CITIZENS GUIDE

to the

UNITED STATES DEPARTMENT OF ENERGY'S

IDAHO NATIONAL LABORATORY

Compiled for

Environmental Defense Institute

By
Chuck Broscious

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Dedicated in Memory of
Jeanne McClenahen Broscious
and
Gertrude Hanson

Every gun that is made, every warship launched, every rocket fired, signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone; it is spending the sweat of its laborers, the genius of its scientists, the hopes of its children.

Dwight David Eisenhower

Along with the possibility of the extinction of mankind by nuclear war, the central problem of our age has therefore become the contamination of man's total environment with such substances of incredible potential for harm ---substances that accumulate in the tissues of plants and animals and even penetrate the germ cells to shatter or alter the very material of heredity upon which the shape of the future depends.

Rachel Carson

The ultimate test of a moral society is the kind of world it leaves to its children.

Dietrich Bonheoffer

If you love this planet, you are going to have to change the priorities of your life. People from all walks of life, many of whom identify themselves as non-political, have discovered that hopeful action is better than hopeless inaction.

Helen Caldecott

Acknowledgements

Basic to the democratic process is the concept of informed consent. The goal of the *Citizens Guide to Idaho National Laboratory* (INL) formerly called Idaho National Engineering and Environmental Laboratory (INEEL) is to provide the reader with a candid history of INL operations, and the environmental, health, and safety impact that are the legacy of nearly six decades of nuclear activities at this nuclear site. The reader will hopefully be better prepared to make informed decisions on nuclear policy issues, cleanup activities, and new nuclear projects planned for INL by reading this Guide.

The first edition of the *Guide*, released in January 1991, would not have been possible without the ongoing support of hundreds of individual contributions that have sustained the Environmental Defense Institute (EDI) over the years. The Harder Foundation provided funding for the publishing costs of the first edition. Special credit and appreciation also go to the W. Alton Jones Foundation, the Deer Creek Foundation, the Peace Development Fund, the Norman Foundation, the Bridge Builders Foundation, Jeanne M. Broscious, Carol B. Ferry, Russell K. Broscious, P.E., Dr. Allen Benson and Tri-State Distributors for their generous financial support. EDI's Board of Directors has tirelessly worked for over a decade to ensure the organization stays on track and keeps focused on our mission.

Tami Thatcher is a former nuclear safety analyst at INL and is now a nuclear safety consultant for EDI writing our Newsletter added extensively to the *Guide's* content. Also during earlier *Citizens Guide* editions, Patricia Diaz, Ph.D. contributed indispensable editing talent to the first edition of the *Citizens Guide*. Jonathan Stoke, Karen Hallgren, and Lynn Mineur also contributed their essential editing skills through the first seven editions of the *Citizens Guide*. Elaine Broscious Dawson's creative publishing talents on the eighth and ninth editions provided the software building blocks for the tenth edition. Since each new edition builds on previous editions these editors continue to contribute. Margaret Carde contributed the section on EPA waste standards, Daniel Hirsch, Ph.D. contributed the section on breeder reactors, Daniel Horner contributed the section on pyroprocessing, and Daryl Kimball contributed the section on epidemiological research activities. Tim Connor, Keith Stormo, Arjun Makhijani, Ph.D., Philip Deutchman, Ph.D., T. Alan Place, Ph.D., Kate Schalck, Russell Broscious, P.E., Alice Stewart, M.D., Allen Benson, Ph.D., Todd Martin, Don Hancock, Michael Blaine, Ph.D., Duane Allen, Dirk Dunning, William Weida, Ph. D., and Bret Leslie, Ph.D. offered considerable technical assistance. Allan Bowles, J.D., Kellie Youmans, J.D., Kenneth Gallant, J.D., and John Norton, J.D. contributed extensive legal assistance. Daniel Jones' Anyware Computers kept EDI computers literally running. Michael Cawley, Richard Hanson, Gertrude Hanson, Mary Burkett, and Jean Dennis' willingness to share their personnel histories and litigation documents and Alan Lifton's compelling *Faces of Victims* video record ensured the prominence of the victims dominated.

The core documentation cited in this *Citizens Guide* was obtained through Freedom of Information Act (FOIA) requests to the Department of Energy. Robert Alvarez provided the inspiration and principal formulation of these FOIA requests that were first initiated in 1987. His generous guidance in subsequent years was indispensable during the DOE denials and administrative appeals for these FOIA requests. Tom Carpenter, J.D., Daniel Berger, J.D., also assisted in FOIA request formulation. Additionally, the six member organizations of the INL Research Bureau, who were the original FOIA requesters, made it ultimately possible to obtain these Department of Energy (DOE) documents because of the restrictive DOE interpretation of FOIA to meet "in the public interest" and "dissemination" requirements.

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Acronyms

AEC	U.S. Atomic Energy Commission (ERDA and later DOE's predecessor)
AFSR	Argonne Fast Source Reactor
ALARA	As-low-as-achievable
AMWTP	Advanced Mixed Waste Treatment Project at RWMC
ANL-W	Argonne National Laboratory-West on INL site now called Materials and Fuels Complex
ANP	Aircraft Nuclear Propulsion
ANSI	American National Standards Institute
APS	Atmospheric Protection System
ARP	Accelerated Retrieval Project at RWMC
ARA	Auxiliary Reactor Area on INL site
ARFM-1	Advanced Reactivity Measurement Facility No. 1
ARVF	Army Reentry Vehicle Facility
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATR	Advance Test Reactor
ATRC	Advanced Test Reactor Critical
ATSDR	Agency for Toxic Substances and Disease Registry
BAE	Battelle Energy Alliance
BLR	Big Lost River on INL Site
BORAX	Boiling Water Reactor Experiment
BBWI	Bechtel/BWXT Idaho
BWR	Boling Water Reactor
CDC	(National) Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liabilities Act
CERT	Controlled Experimental Release Test
CEQ	Council of Environmental Quality
CFA	Central Facilities Area on INL site
CFRMF	Coupled Fast Reactivity Measurement Facility
CFR	Code of Federal Regulations
CH	Contact Handled
CLOFA	Complete Loss of (coolant) Flow Accident
CLOHS	Complete loss-of coolant sink
CIC	Core Integral Changeout
CITRC	Critical Infrastructure Test Range
CPP	Chemical Processing Plant (now INTEC)
CRR	Carbon Reduction Reformer
CTF	Core Test Facility
CWI	CH2M-WG Idaho, LLC
DEQ	Idaho Department of Environmental Quality - primary state regulator
DEIS	Draft Environmental Impact Statement
DMR	Denitration and Mineralization Reformer
DOB	Daily Operations Brief for Secretary of Energy
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/ID	U.S. Department of Energy Idaho Operations Office
EBR-I	Experimental Breeder Reactor Number 1
EBR-II	Experimental Breeder Reactor Number 2
ECF	Expended Core Facility
EDF	Engineering Design File
EDI	Environmental Defense Institute

EDE	effective dose equivalent
EFIS	emergency firewater injection system
EG&G	Edgerton, Germeshausen & Grier (DOE Contractor)
EIS	Environmental Impact Statement
EMS	Environmental Management System
EOCR	Experimental Organic Cooled Reactor
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration (DOE's predecessor)
ESRPA	Eastern Snake River Plain Aquifer
ESER	Environmental Surveillance, Education and Research (Program)
ETR	Engineering Test Reactor
ETRC	Engineering Test Reactor Critical
ETS	Evaporator Tank System (INTEC Tank Farm)
EXCES	Experimental Cloud Exposure Study
FAST	Flourinel and Fuel Storage Facility
FCF	Fuel Cycle Facility
FECF	Fuel Element Cutting Facility
FEET	Fuel Element Effluent Test
FEIS	Final Environmental Impact Statement
FFCA	Federal Facilities Compliance Act
FOIA	Freedom of Information Act
FONSI	Finding of No Significant Impact
FPFRT	Fission Product Field Release Test
FMF	Fuel Manufacturing Facility
FR	Federal Register
GAO	U. S. Congress General Accounting Office
GCRE	Gas-Cooled Reactor Experiment
GOCO	Government Owned Contractor Operated
GPM	Gallons per minute
GTCC	Greater Than Class-C Low-Level Waste
HEDR	Hanford Environmental Dose Reconstruction Project
HEPA	High efficiency particulate air
HFEF	Hot Fuel Examination Facilities
HTRE	Heat Transfer Reactor Experiment
HWMA	Hazardous Waste Management Act
ICDF	Idaho CERCLA Disposal Facility
ICRP	International Commission on Radiological Protection
ICPP	Idaho Chemical Processing Plant (now called INTEC)
ICP	Idaho Cleanup Project
IDAPA	Idaho Administrative Procedures Act (primary Idaho Laws)
IEMP	Idaho Environmental Monitoring Program
IDHW	Idaho Department of Health and Welfare
LDR	Land Disposal Restrictions
IET	Initial Engine Test (ANP Reactor Program)
IFSF	Irradiated Fuel Storage Facility (CPP-603)
ILWMS	INTEC Liquid Waste Management System
ILTSF	Intermediate-level Transuranic Storage Facility
IHES	INL Health Effects Subcommittee (CDC Dose Reconstruction Study)
INEL	Idaho National Engineering Laboratory (now Idaho National Laboratory)
INEEL	Idaho National Engineering and Environmental Laboratory (now INL)
INTEC	Idaho Nuclear Technology and Engineering Center (formerly ICPP)
IRB	INEL Research Bureau
IFR	Integral Fast Reactor
IWTU	Integrated Waste Treatment Unit at INTEC
LDDT	Long Distance Diffusion Test

LIME	Limited Melt Experiment (Reactor)
LESAT	Lockheed Environmental Services and Technologies (now LMAES)
LITCO	Lockheed Idaho Technologies Company (now LMITCO)
LMITCO	Lockheed Martin Idaho Technologies Company
LMAES	Lockheed Martin Advanced Energy Systems
LOC	Limiting Condition of Operations
LOCA	Loss of coolant accident
LOFT	Loss of Fluid Test (Reactor)
LPT	Low Power Test (Reactor)
LWR	Light Water Reactor
MEI	maximally exposed individual
MCL	maximum contaminate level
M&O	Maintenance and Operations
MFC	Materials and Fuels Complex (formerly ANL-W)
MLLW	Mixed low-level Waste
MPF	Mixed Fission Product (generally now called mixed-transuranic waste)
MTR	Materials Test Reactor (at ATRC)
MW	megawatts
NA	not applicable
NAAQS	National Ambient Air Quality Standard
NCEH	National Center for Environmental Health (Division of CDC)
NDRP	Design Basis Reconstruction
NDPS	National Pollution Discharge Elimination System
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NE-ID	Department of Energy Idaho Operations
NIOSH	National Institute for Occupational Safety and Health (Division of CDC)
NOV/CO	Notice of Violation/Consent Order
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRAD	Neutron Radiography Facility
NRF	Naval Reactors Facility
NRTS	National Reactor Testing Station (Currently called INL)
NWCF	New Waste Calcine Facility
OMRE	Organic-Moderated Reactor Experiment
OTA	U.S. Congress Office of Technical Assistance
PAAA	Price-Anderson Amendment Act
PBF	Power Burst Facility (Reactor)
PCB	polychlorinated biphenyl
PCP	Primary Coolant Pump
PCS	Primary Coolant System
PEL	permissible exposure limit
PEIS	Programmatic Environmental Impact Statement
PSD	Prevention of Significant Deterioration
PGA	Peak Ground Acceleration
PLN	Plan
PM-2A	Portable Medium Nuclear Power Plant
PISA	Potential Inadequacy in Safety Analysis
PRA	Probabilistic Risk Assessment
PREPP	Process Experimental Pilot Plant
PWR	Pressurized Water Reactor
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation Recovery Act

RDT	Relative Diffusion Test
RESL	Radiological and Environmental Sciences Laboratory
RH	Remote Handled
RI/FC	Remedial Investigation/Feasibility Study
RIA	Reactivity Insertion Accident
ROD	Record of Decision
RSS	Reactor Shutdown System
RTC	Reactor Technology Center (formerly Test Reactor Area now Advanced Test Reactor Compex)
RWMC	Radioactive Waste Management Complex on INL site
SAR	safety analysis report
SARA	Superfund Amendments and Reauthorization Act
SCRC	Special Cavity Reactor Critical Experiment
SCS	secondary
SDA	Subsurface Disposal Area at RWMC
SDIO	Strategic Defense Initiative Organization
SER	Safety Evaluation Report
SEIS	Supplemental Environmental Impact Statement
SL-1	Stationary Low-Power Reactor No. 1
SMC	Specific Manufacturing Capability at Test Area North
SMCL	Secondary maximum contaminate level
SMN	Special Nuclear Materials
SNF	Spent Nuclear Fuel
SNAPTRAN	Special Nuclear Auxiliary Power Transient
SPERT	Special Power Excursion Reactor Tests I, II, III, and IV
SWEEP	Stored Waste Examination Pilot Plant
SNF	Spent (used) nuclear reactor fuel
SSC	Structures, systems, and components
SSE	safe shutdown earthquake
SST	stainless steel
SSC	structures, systems and components
STD	standard
STP	Site Treatment Plan
STR	Submarine Thermal Reactor (S1W) at Naval Reactor Facility
TAN	Test Area North on INL site
TBT	to be determined
TEDE	Total Effective Dose Equivalent
TLD	thermaluminescent dosimeter
TRA	Test Reactor Area on INL site (formerly Reactor Test Complex now Advanced Test Reactor)
TREET	Transient Reactor Test Facility
TRU	Transuranic Waste
TRUPACT	Transuranic Package Transorter
TSF	Transuranic Storage Facility at the RWMC
TSR	Technical Safety Requirements
URSF	Upgraded Final Safety Analysis Report
USAEC	U.S. Atomic Energy Commission (preceded DOE)
USGS	United States Geological Survey
USGS-BRD	United States Geological Survey – Biological Resources Division
USQ	Unreviewed Safety Questions
VCO	Voluntary Consent Order
VVE	Vapor Vacuum Extraction
WAG	Waste Are Group
WCF	Waste Calcine Facility at INTEC
WERF	Waste Experimental Reduction Facility
WIPP	Waste Isolation Pilot Plant in New Mexico
WINCO	Westinghouse Idaho Nuclear Company

WM	Waste Management
WMPEIS	Waste Management Programmatic Environmental Impact Statement
WRC	Waste Reductions Operations Complex
WRRTF	Water Reactor Research Test Facility
ZPPR	Zero Power Physics Reactors (I, II, and III)

Introduction

The *Citizens Guide to INL* is intended as a resource tool for individuals and public interest groups seeking information on the U.S. Department of Energy's (DOE) historical, current, and planned operations in Idaho. DOE owns and operates the Idaho National Laboratory (INL) formerly (and hereafter referred interchangeably) as the Idaho National Engineering and Environmental Laboratory (INEEL) 35 miles northeast of Idaho Falls, Idaho as a nuclear weapon materials production and reactor testing site. INL has gone through four name changes. The original site name bestowed by the U.S. Atomic Energy Commission in 1949 was the National Reactor Testing Station (NRTS). In the mid 1970's the site name was changed to the Idaho National Engineering Laboratory, in 1996, the name was changed again to Idaho National Engineering and Environmental Laboratory, and currently the name was changed to INL.

The *Citizens Guide to INL* is published by the Environmental Defense Institute (EDI), a non-profit public interest organization dedicated to promoting responsible public policy concerning Idaho's human and natural environment. EDI was the sponsor and coordinator of a coalition of six organizations called the INL Research Bureau (IRB), which functioned between 1988 and 1995. The IRB coalition focused on accessing documents through the Freedom of Information Act on the operating history of the INL. These INL documents are used by IRB member organizations as part of their on-going analysis of the health and safety impact of INL operations.

Periodically, the *Citizens Guide* is updated to reflect new information, disclosures, and changes in the issues that the *Guide* addresses. Since the last update to the *Citizens Guide*, INL Superfund cleanup activities have been initiated, and additional information has come to light challenging DOE's "no action" decision at some waste sites. Also, public participation initiatives have developed in an attempt to implement substantive public involvement in the health study decision making process.

Initially in the 1940’s Congress established the Atomic Energy Act and the Atomic Energy Commission (AEC) that was involved with the production and testing of nuclear weapons. The AEC was completely shrouded in secrecy accountable only to the President and granted sovereign immunity. In the 1990’s under significant public pressure, Congress passed the Federal Facilities Compliance Act that forced all federal agencies (including DOE) to comply with all applicable environmental regulations. Congress also passed the Nuclear Waste Policy Act, that further provided more detailed regulations to management and disposal of radioactive waste. Former Idaho Governor Andrus to his credit initiated the 1995 INL Settlement Agreement that was formalized in a Federal Court Order and Consent Order that further forced DOE/INL to comply with Federal Facilities Compliance Act, Nuclear Waste Policy Act and CERCLA. Tragically, all the gains these laws and legal efforts produced has been undermined by later and current conservative Presidents, Congress, Governors and Idaho State legislatures.

Citizens of Idaho are facing important choices concerning the DOE’s Idaho operations. For over seventy years, INL operations were conducted in secret. The public had no choice but to accept decisions made by the federal government. Today, the public has the opportunity to participate in current policy decisions concerning the INL that include:

* Expansion of INL pyro-processing of reactor fuel to recover plutonium and highly enriched uranium;
* Expansion of INL as a national radioactive waste storage and treatment center;
* Expansion of INL burial grounds for permanent disposal of radioactive wastes;
* Superfund cleanup of radioactive and chemical wastes from past and present nuclear programs;
* Health studies of affected populations to determine impact of INL releases on workers and off-site residents;
* Development, promotion and construction of new nuclear reactor designs.

Due to safety and environmental violations at many DOE sites across the country, the government has been forced to close some facilities. In an effort to revive its breeder reactor program, DOE is funding Materials Fuels Complex (formerly called Argonne National Laboratory-West) spent nuclear fuel pyro-processing plant. This process recovers plutonium and enriched uranium that is then refabricated into new reactor fuel. This fissile material can also be used for nuclear weapons posing significant issues related to the proliferation and violation of nuclear proliferation treaty agreements.

This planned expansion of INL will increase the already significant negative impact on Idaho’s environment and the health and safety of its residents. The fall of the Soviet Union and Nuclear Weapons Treaties has significantly changed the arsenal requirements. However, U.S. government recent funding for development and production of new nuclear weapon systems is increasing by $1 Trillion over the next decade. Despite a surplus of plutonium and highly enriched uranium that are the primary components of nuclear bombs, the nuclear alchemists still want to build reserve production capacity in case it is needed in the future.

INL's expansion proposal says Idaho is best because it "provides added safety by virtue of a distance shield to protect the public in case of a low probability, high consequence event."[NWCRS/INL @ 1-6] In plain English, this means that DOE still believes that; when another accident releases radiation, there will be no “significant” impact on Idahoans. DOE assesses risk to public as low because Idaho is a state with a low population density. Population growth in Idaho and surrounding states (Utah, Wyoming and Montana) now challenge the “low population density” determination.

Resistance to addressing INL’s environmental contamination problems are rooted in protecting the site’s image and ability to attract new nuclear projects. Resistance to owning up to decades of mismanagement of the INL site’s nuclear waste streams is another factor not to mention the government’s reluctance to pay the $6-7 billion/yr. INL Superfund cleanup bill for 2020 is $553,225,000; total between 2003-2020 is $10,995,412,000. (See Section IV.A)

Former INL site manager John Wilcynski believed that a site mission composed largely of environmental cleanup work is a certain road to shut-down. The nuclear culture has sunk deep roots into the socioeconomic consciousness of southeastern Idaho. As the single largest employer in the State, INL’s political clout cannot be underestimated.

In order for the *Guide* reader to be able to make informed decisions concerning INL’s present and future activities, it is essential to have an understanding of the site’s operating history. Section I of this *Guide* offers as candid a view of INL’s history as current publicly available information allows. Unfortunately, much of INL’s operating history still remains secret and documentation classified. Hundreds of thousands of pages of DOE and other government source documents gained through Freedom of Information Act requests were reviewed to provide a fully referenced *Guide*. Citations are placed in [brackets] in abbreviated form that are also listed in alphabetical order in the Reference Section at the end of the *Guide*. The reason for this unconventional reference format is to facilitate the updating process with each new edition of the *Guide*. Additionally, footnotes have been added as further references.

With this understanding of the site, the reader will be better able to evaluate the cumulative impacts of nuclear activities as opposed to a snap shot of a new project taken out of the context of existing contamination. As of this printing, the reader must understand that this is only what we know now about INL, and that new revelations occur on a daily basis. Even other government agencies such as the Centers for Disease Control with a Congressional mandate to study the INL radioactive releases, is blocked from using classified documents that DOE and the Department of Defense refuse to declassify. This classified information is nearly seven decades old and has no credible national security implication. Rather, it represents an embarrassment to the government’s mismanagement of its operations in Idaho.

DOE's internal documents record massive radioactive and chemical contamination resulting from releasing tens of millions of curies of radioactive material into the atmosphere and dumping of millions of cubic feet of solid hazardous/radioactive waste containing millions of curies into Idaho's soil that eventually migrate into the underlying Snake River Aquifer used by hundreds of thousands of Idahoans. To put these releases of radioactivity into perspective, the Environmental Protection Agency (EPA) sets maximum concentration standards for radionuclides in drinking water. See Section IV.A for details. These standards are expressed in pico curie units, or one trillionth of one curie, or one part per trillion. In short, radionuclides are biologically extremely hazardous so that the regulations only allow minuscule amounts in the environment. INL, operating in secret and without outside regulatory oversight, used Idaho’s southeastern desert as a dumping ground for the most hazardous materials known to humankind.

Public pressure and previous Congressional mandates gave EPA and the host of states jurisdiction over some of DOE cleanup activities, but has not generated the needed change in recent years due to the conservative political climate. Because of the federal government’s dumping of radioactive and chemical wastes, the EPA put INL on its Superfund cleanup National Priority List. Concern over the health effects from these radioactive releases spurred the Congressional General Accounting Office (GAO) to conduct an investigation of INL's emissions and accidents. The GAO report (discussed in Section I.I) was released in February 1992 by then Senator John Glenn who concluded that an independent health study was needed, "These [GAO] results raise key questions about the health effects of radiation exposure on both the workers and residents near the facility at INL. I certainly hope this report will open some eyes and get such a study underway."[Glenn (b)] This *Citizens Guide* discusses in some detail the short comings of the INL health studies for which Senator Glenn was instrumental in gaining Congressional research funding. Centers for Disease Control initiated a full scale INL Environmental Dose Reconstruction Health Study in 1992. Section VI of the *Guide* offers an analysis of this health study’s Phase II of a four phase process.

The Congressional Office of Technology Assessment (OTA) released a report in February 1993 that declared that DOE was unprepared to protect tens of thousands of workers involved in hazardous activities at its production sites. "The DOE and its contractors continue to operate under an organizational structure that presents serious obstacles to progress in safeguarding worker health and safety," the report said. OTA further found that DOE's managers, employees and contractors were not convinced that occupational health and safety is truly a top priority. [OTA-BP-O-85] DOE's lack of protection for its workforce extends past the site boundary to affected populations living in INL's shadow. A September

1997 Notice of Violation for Work Deficiencies under the Price Anderson Act leveled at INL primary contractor Lockheed Martin for six Severity Level III violations by workers suggests that the problems OTA identified in 1993, still persist. Regular turnover of INL contractors ensures that accountability is never applied.

Cleanup of DOE's whole Complex is the most expensive single public works effort in the history of the United States. Cleanup costs for the DOE Complex in over 20 states is at between $6 and $7 billion/yr. These cleanup estimates are not for complete environmental restoration (return to original condition); but rather for designation of nuclear sacrifice zones that will require institutional control to prevent public access for perpetuity. DOE's declaration of fenced off sacrifice zones is a deliberate ploy to excuse them from cleanup obligations. This literally shifts the costs and hazards on to future generations and away from the perpetrators. In view of the fact that these wastes will be lethal for tens of thousands of years, the reliance on fences to keep people and animals out is ludicrous at best. This *Guide* reviews ten waste area group remediation decisions in Section IV made by DOE, the State, and the Environmental Protection Agency (EPA) under the Federal Facility Agreement and Consent Order. Generally speaking, there is more cover-up than cleanup in these remediation decisions. A typical decision is to put a soil cap over the waste dump to reduce the radiation field at the surface, put a fence around it, and call it "cleaned up". The government simply will not pay the cost of exhuming the waste and vitrifying it to create a stable waste form that will not pose an environmental hazard. This vitrified waste could then be safely stored on-site until a safe permanent geologic repository is built for its final internment. Unfortunately, the State and EPA as regulatory agencies are acquiescing to DOE's cleanup shortcuts.

Bob Alvarez's DOE 2017 Budget Assessment notes**; "**Military nuclear activities take up about 58% of the DOE's budget, with nuclear weapons activities having the single largest proposed expenditure ($9.243B or 28%). The Weapons Activities budget is increased by 5% from FY 2016 - and is larger on an annual basis then spent during the cold war 30 years ago.

- Between FY 2015 and 2025 the U.S. Government Accountability Office estimates that spending on the nuclear stockpile and the weapons complex is $103.5 Billion.
- Nuclear weapons dismantlement receives a low priority. The Obama Administration plans to refrain from dismantling weapons retired under the New Start Treaty until the nuclear weapons complex is refurbished sometime in the 2030s.
- Funding for the Mixed Oxide fuel plant to blend plutonium from weapons into reactor fuel is being cut by 20%.
- Nuclear site cleanup takes up ~$6.2 billion for FY 2017- with a total estimated life-cycle cost spanning the next several decades of $341.5 billion.

"The nuclear weapons complex is over-sized and antiquated. The costs of "keeping the lights on" in terms of Infrastructure and indirect costs consistently take up 40% of the Weapons Activities budget. Approximately $961 million is to be spent in FY 2017 on repair and maintenance. The National Security Administration within DOE as of 2011 had about 86% of all the DOE's excess facilities with an estimated liability for decontamination and decommissioning of $8.6 billion. It now appears that the price for the New START Treaty to pay for modernization of the U.S. nuclear arsenal is greater than the treaty itself. " [1]

Congressional appropriations for DOE's FY-2017 nuclear energy programs are twice what previous Administrations requested. These programs include a broad range of commercial and military nuclear reactor development and construction - many of which are slated for INL. Congressional intransigence in perpetuating these questionable projects while cutting environmental restoration is a testament to DOE nuclear reactor development contractors' ability to influence the purse strings. This funding brings into question this nation's commitment to the nuclear weapon reduction treaties. Additionally, more nuclear waste will be generated at a time when we have no permanent internment site.

Funding for Superfund cleanup at DOE sites is found in the Department's environmental management budget category. The relative degree of commitment to environmental restoration and paying off the nuclear mortgage legacy can be best seen in the budget. The Clinton Administration's DOE FY-94 budget for INL showed a temporary shift from defense production programs to environmental management. DOE's Complex-wide FY-94 nuclear weapons activity budget request was only 17.5% lower than that appropriated for 1993. For FY-95 and 96 however, the nuclear weapons appropriations increased 10% each year while environmental restoration decreased. In 1997 DOE launched a five year program to reduce environmental restoration by 4.4 billion over five years while increasing nuclear weapon development by over $10 billion. Considerable uncertainty exists in the budget primarily due to DOE's creative accounting shifts of defense program allocations to environmental management accounts. Hundreds of millions of dollars in INL projects that support defense programs have turned up in environmental management accounts. The net effect of this creative

[1] Robert Alvarez slides prepared analyzing the U.S. Department of Energy's Atomic Defense budget for FY 2017.

accounting is to make the defense budgets appear artificially lower and the environmental restoration budgets appear artificially higher. It's important that we understand the historical issues in order to understand how we got here.

DOE's commitment to move ahead with its Materials Fuel Complex - reactor fuel pyro-processing capability may contain a hidden agenda. Nuclear weapons materials are produced by processing reactor spent fuel rods and extracting highly enriched uranium and plutonium. Currently, DOE's old production facilities including the Idaho Chemical Processing Plant (ICPP) – now called INTEC - violate environmental laws and must be either shut-down or extensively upgraded. DOE's hidden agenda in this Plan is to rebuild its nuclear weapons materials production capacity under the guise of waste processing for final disposal. Yet, reactor fuel rods do not require processing prior to internment in a repository other than in some cases re-canning (putting the fuel into stainless canisters).

Spent (used) Nuclear Fuel Pyroprocessing

DOE has enlisted University of Idaho Nuclear Energy Program based at UI Idaho Falls Center for Advanced Energy Studies a collaboration that includes UI and Idaho National Laboratory. The project intends to "ensure that plutonium used in future pyroprocessing facilities never falls into the wrong hands. Pyroprocessing is a way to recycle nuclear reactor waste into fuel. It's not yet happening on a commercial scale, but is developing globally. UI's Barretlli and Tolman are writing computer code that would track the amount and location of plutonium in pyroprocessing facility, ensuring that nuclear material can't be diverted for non-fuel purposes – like bomb-making. The code will be customizable so it can be incorporated into the design process of the facility. Around the world, safeguards are really strong. No one has built a nuclear weapon from nuclear civilian nuclear power plant program." [2]

This is an old refrain DOE and nuclear enthusiasts use to justify reprocessing despite being a clear violation of the Non-proliferation Treaty. The small foot-print of these pyroprocessing facilities make it extremely difficult to detect and claims that "No one has built a nuclear weapon from nuclear civilian nuclear power plant program" is ludicrous given the proliferation of nuclear power reactors owned/operated by non-compliant rogue countries that simply will use the technology without the tracking codes.

Former Idaho Governor Andrus challenged DOE's erroneous assumption of the need to process spent nuclear fuel to meet waste repository acceptance criteria. Andrus' concerns are well founded due to the significant radioactive emissions that result from fuel processing. Congressional funding and public acceptance will be radically different if DOE is candid about its true mission for the INL/MFC pyro-processing of spent nuclear fuel. Therefore, DOE's subterfuge may be a well-planned ploy to build new nuclear materials production capacity that involves reactor fuel processing, while publicly the Department claims it is a waste management project. Former President Obama announced DOE will spend $1 trillion on "upgrading its nuclear weapon arsenal in the next decade."

DOE's 1996 State air pollution permit application for the ICPP (INTEC) describes the assigned objectives as "the safe and economical receipt, storage, and recovery of highly enriched uranium from fuel elements discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic as well as from other unique fuels) that cannot be processed elsewhere." This State permit is prima-fascia evidence that the Department's public rhetoric about discontinuing nuclear weapons material production is therefore inaccurate.

DOE's abuse of Idaho's open spaces and relatively sparse population is a continuation of the misguided notion that "dilution is the solution to pollution." The hundreds of billions of gallons of radioactive waste dumped via injection wells directly into the Snake River Plain Aquifer and dumped into unlined percolation ponds may never be cleaned up.

According to sweetheart deals between DOE, the State, and EPA, groundwater contamination exceeding 176,000 times the regulatory limits for radionuclide's in drinking water is not bad enough to warrant a pump and treat cleanup action. DOE stubbornly contends that: "The large size and remote nature of the INL enables the Super-Site to be several miles from existing INL facilities, thus lowering the risk to the public of combined radionuclide emissions."

This is yet another example of DOE's disregard for radioactive contamination in the Snake River Plain Aquifer that underlies the INL site. This sole source aquifer provides water to more than 270,000 Idahoans. The previous use of radioactive waste injection wells and continued use of unlined percolation ponds for INL process wastes contaminates the aquifer at a staggering rate.

Radioactive and hazardous chemical wastes are dumped in unpermitted, unlined pits/trenches at the Radioactive Waste Management Complex that would not even meet current municipal garbage landfill standards. This illegal dumping continues today violating the Recourse Conservation Recovery Act (RCRA). The Environmental Protection Agency (EPA), as early as 1987, identified these waste ponds among the 368 sites at INL that are to be reviewed for cleanup under Superfund. Unfortunately, EPA and the State are reluctant to force INL to comply with environmental laws because INL is the single largest employer in the state; thus using its lobbying effectively in the Legislature.

The public is demanding that the State of Idaho take a more critical oversight role of INL. However, changing

[2] "Keeping an Eye on Plutonium," by Tara Roberts, www.uidsaho.edu/idahofalls/cares, Fall 2016.

decades of laissez-faire oversight of DOE will require continued public involvement and pressure. The Environmental Defense Institute (EDI) supported former Governor Andrus's ban on additional nuclear waste shipments to INL. The ban is based upon decades of broken DOE promises on waste disposal that has turned INL into a defacto nuclear dump. According to Andrus, "It's pretty clear they [DOE] never intended to keep their word. You just can't do business with those lying so-and-so's." Idaho's then Governor Batt pressured by public opposition to more radioactive waste shipments to the state, initially appeared to take a hard stand against DOE and the Navy. Unfortunately, the agreement signed by Batt on October 1995, will eventually increase waste shipments because it allows INL to be a national radioactive waste treatment center. Emissions from these waste incinerators are a crucial issue to Idahoans, and the Department's refusal to conduct the legally required Environmental Impact Statements on these plants demonstrates the government's lack of commitment to full disclosure.

Of particular concern today is the nearly 900,000 gallons of high-level radioactive liquid waste currently stored in three tanks at INTEC formerly called Idaho Chemical Processing Plant (ICPP) tank farm at INL. Three-fourths of this volume was generated in the 1950s and 60s; the original 11 (now reduced to 3) volume stored in tanks that have since corroded and that do not meet current RCRA earthquake, structural, or containment standards. Though DOE is required under a court order to solidify the liquid portion in the tanks (which it has only solidified/incinerated ~ 1 million of the original 2 million gallons produced), the Department has left the seven equally radioactive tank sediments permanently using grout dumped on top of the sediments. This grout/sediment will eventually deteriorate and migrate into the aquifer before the nuclide half-life is over. Additionally, numerous reactors spent fuel storage facilities at INL are old and too decrepit to safely store this hazardous material. Nuclear reactors operating at INL do not meet current containment and safety regulations imposed on commercial nuclear plants by the Nuclear Regulatory Commission because DOE is exempt from Nuclear Regulatory Commission regulations.

Continued public pressure is needed to convince the State of Idaho and the Environmental Protection Agency to exercise their full enforcement authority to ensure that DOE complies with all applicable environmental laws. Environmental Defense Institute, together with other public interest groups, was instrumental in the creation of two INL "Citizen Advisory Boards," [3] one for INL Superfund cleanup and one for Centers for Disease Control's INL health studies. [4] Originally it was thought that these advisory bodies had the potential to expand public participation and to hold all agencies accountable. Unfortunately, these advisory boards were packed with INL boosters that are more interested in preserving INL's good name so that the site will continue to attract new nuclear missions.

The citizen advisory board concept evolved out of intense frustration with the lack of response by the enforcement agencies to address critical compliance issues. Sites where advisory boards are working are those where it is in an undeniable shutdown mode – like Hanford. Production sites, like INL, Oak Ridge and Savannah River, that still vie for new nuclear missions remain in denial of the massive environmental contamination at the site. DOE continues to obfuscate this nation's environmental, health, and safety laws. Only an active and involved citizenry will change decades of intransigence to outside oversight and regulation.

The INL radiation release data offered in this *Citizens Guide*, though fully documented, must be interpreted as extensively understated. The reason for these understatements is that the DOE (and its predecessors) often created the illusion to successive Presidents that their operations were safe and functioning within guidelines in force at the time. Therefore, publicly available summary documentation is less than accurate about radioactive releases and the impacts of those releases. These inconsistencies in federal documents and regulatory agency documents are reflected in this *Citizens Guide*. The intent is not to confuse the reader, but to give the reader the opportunity to decide for themselves which data is more reliable.

The reader must never conclude that information herein offered is conclusive nor anywhere near what was actually released to Idaho's environment. Considerable analysis of INL's operating history, industrial processes, emission system efficiencies (or lack thereof), reactor meltdown experiments, etc. must be conducted before the whole truth will be known. Significant political will is needed to force declassification of currently secret operating history documents and financial resources will be required to uncover these past activities. Due to the liability implications of such revelations, resistance continues for a full disclosure to the citizens of Idaho. It is a sad commentary on the state of democracy here in the United States when the federal government refuses to declassify seventy-year old environmental, health, and safety information on the grounds of national security.

The US District Court Ordered DOE to conduct a site specific INL Environmental Restoration Waste Management Environmental Impact Statement (EIS). Even this 4,200 page document lacks the waste stream characterization required by the National Environmental Policy Act. Also the INL High-level Waste EIS shares the same

[3] See Section IV.O for details on INL Environmental Management Citizens Board.
[4] See Section VI.A for details on CDC's Citizens Board

flaws. One of many fundamental flaws of these EIS's is there lack of consideration of where DOE intends to put all its waste that has been piling up over the past seventy years. Reliance on the Waste Isolation Pilot Project in New Mexico to solve INL's transuranic waste constipation problem is unrealistic due to the limited capacity of WIPP. Recent accidents at WIPP are putting new INL waste shipments in jeopardy. The only deep geologic high-level waste (HLW) that was attempted at Yucca Mt, Nevada in the 1980's responding to the Nuclear Waste Policy Act never opened because of flaws in the site selection process that did not take into account groundwater contamination. Since Congress has failed to appropriate finding for a new permanent HLW repository, means the crisis has ballooned as commercial nuclear reactors are forced to close because they have aged far beyond their design life, DOE has opted to enter into private interim HLW storage sites for commercial HLW and leaving the DOE's accumulating HLW at DOE sites like INL. Most knowable observers believe these "interim" sites will – by default – become permanent. DOE's INL planning reflects this recognition of the waste staying on site even though they will not state it outright.

DOE has changed the definition of transuranic and HLW so it can leave more of it dumped on its sites. [5] EPA and the Nuclear Regulatory Commission are - as faithful executive branch agencies - gone along with DOE. [6] The commitment of former Idaho Governor Cecil Andrus to prevent DOE from turning Idaho into another nuclear sacrifice zone is not shared by current leadership. Andrus and his successor Governor Batt were able to convince the Idaho Federal District Court to issue a Consent Order forcing DOE to agree to milestones to remove the waste out of the state. DOE appealed this ruling to the Federal Court of Appeals that failed to rule because the case was not "ripe" enough because DOE lied about its intensions.

This *Citizens Guide* discusses national policy issues such as cleanup standards, radiation exposure standards, regulatory oversight, secrecy, transportation of waste, and budget priorities because these policy issues directly affect if and how problems at INL will be addressed. The issues at INL must be seen within the greater context of the national agenda so that the reader will have a more accurate understanding of the scope of these problems. Through this understanding, the reader will hopefully be able to interact more effectively with their elected officials and enforcement agency representatives. The *Guide* also chronologically lists INL accidents and unusual occurrences as a graphic portrait for individuals needing to correlate their own experiences with incidents on the site.

This nation cannot afford to continue to operate its nuclear weapons complex as it has in the past seventy+ years. Already huge areas of our country are now nuclear sacrifice zones for perpetuity. Large segments of our population have been exposed to intentional radioactive emissions that have caused serious health effects and death. These populations were not informed nor were they given the opportunity to give informed consent. Remember, INL's original name was National Reactor Testing Station whose mission was to test new reactor designs. [7] This is not the democratic process that we agreed to in our Constitution. If we as a country are to meet the challenges before us on nuclear issues, we must immediately reevaluate how public policy is formulated and start developing a truly equitable and democratic process free of secrecy and deploying appropriate accountability. Public interest groups can only advocate for change. Real substantive change will only occur if everyday citizens make the commitment to be activists on these issues of health and safety. This we must collectively do this for the sake of our children and future generations.

The victims are acknowledged in this *Citizens Guide* because ultimately, they are the real issue. [8] Millions of curies of radiation released to Idaho's environment are just another statistic and relatively meaningless without being in the context of the impact on the biosphere. To their credit these individuals were willing to come forward and share their experiences out of their own personal commitment to setting the record straight. The human element to this tragedy will likely take decades to be fully revealed as it was for the Cold War American human radiation experiments to finally surface. "Only the truth can make us free."

Current information about Guide updates and DOE's operations at INL can be found at EDI monthly newsletter available at: http://environmental-defense-institute.org

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[5] See Section IV.B for more discussion on DOE's changes to waste definitions.
[6] See Section IV.A for more discussion on EPA's changes to exposure and waste disposal standards.
[7] See Section I.A & B & C Experimental Reactors and Atmosphere Releases for more details.
[8] See Section VIII.B for more details on INL Radiation Victims. Also see Section V.A for details on independent health studies.

Section I. INL Operating History

A. Site History

The Idaho National Laboratory was originally a 173,000 acre Naval Proving Ground used mainly as a gunnery range. In 1948 the Atomic Energy Commission (AEC) made the decision to expand reactor development and spent fuel chemical processing for nuclear weapons materials. Initially, the AEC decided to expand the Argonne National Laboratory near Chicago, yet, "Any accident releasing the fission products built up in the fuel elements could be hazardous to the [then] 4 million people of the nations' second largest urban center." [Hewlett and Duncan, 1969 @187] The AEC's safety committee established citing criteria that, "Simply stated, the higher the power level the greater the area over which control was needed. Ideally a reactor location should meet three criteria: complete Commission control over the immediate area; a population of less than 10,000 in the surrounding country; and no installations vital to the nation's defense in the region." [Ibid @ 196]

Ironically, the Montana Congressional delegation was pressing the Joint Committee on Atomic Energy of Congress for designation of Fort Peck in their state as the best site for the new reactor testing station. At Congressional hearings held April 14 and May 10, 1948, Montana Congressmen challenged the AEC's decision to build the reactor site in Idaho citing that the Snake River would be more likely to be contaminated than the Missouri River. Fort Peck had solid rock under the site as opposed to Idaho's porous soil and fractured basaltic rock. The Montanans further cited evidence of coliform contamination of the Thousand Springs area that was the result of farm wastes on the Snake River Plain. Clearly, the Congressmen argued, this was an indication that water flows quickly through the Snake River Plain Aquifer. The AEC's choice of Idaho, however, prevailed.

Originally the AEC named the new Idaho reactor site the National Reactor Testing Station (NRTS), and 141,000 additional acres were acquired north and east of the NRTS (for a total of 570,000 acres) as further environmental safeguard and buffer zone for expanded operations. In 1974 the AEC split into two separate agencies because of intense criticism for its lack of concern for nuclear safety practices and overzealous promotion of nuclear power development. These two new nuclear agencies were the Energy Research Development Administration (ERDA), predecessor to DOE and the Nuclear Regulatory Commission (NRC). At this time the AEC was also terminated because of the public pressure to divide military and civilian nuclear activities into two separate agencies. Thus, the ERDA (military) and the Nuclear Regulatory Commission (civilian) were created to replace the old AEC. Also in 1974 ERDA changed the NRTS name to the Idaho National Engineering Laboratory (INEL). DOE in 1996 changed the name a third time to the Idaho National Engineering and Environmental Laboratory (INL).

INL is now 890 square miles in size and located in the north eastern section of the Snake River Plain Aquifer in southeastern Idaho. Idaho Falls lies approximately 29 miles southeast of the nearest site boundary. INL is 23 miles northwest of Blackfoot, 44 miles northwest of Pocatello, and 7 miles east of Arco. (See map in Figures) In 1977 approximately 144,000 people lived within a 50 mile radius of the site. The region of influence for the INL is a seven-county area comprising Bingham, Butte, Bonneville, Clark, Jefferson, Bannock, and Madison counties. This region had a 1990 population of 219,713. [ANL-EA@ 67] Projections based on current demographic trends indicate that about 240,000 people will live within the 50 mile radius by the year 2000. [ERDA-1552@I-2]

Under annual permits from the Bureau of Land Management, 63,600 sheep and 3,300 cattle raised for human consumption are pastured on the INL site. [ERDA-1536@III-43] In the winter as many as 4,500-6,000 pronghorn (antelope) are on the INL site. [Blain, p.35] The pronghorn is a game animal hunted off-site for human consumption. In 1992 the site employed nearly 12,000 workers that directly supported a population of 38,000 people on an annual budget of $1.2 million. In 1997, about 6,000 contract people and about 400 DOE people are employed at the site that operates on an annual budget of about $ 784 million.

INL is a government-owned, contractor-operated (GOCO) site with the exception of the recently defrocked contractor- owned Pit-9 treatment plant and the Advanced Mixed Waste Treatment Facility. Since the beginning of the Manhattan Project, the government has contracted with private industry to operate its nuclear facilities. INL is geographically the largest of the DOE production sites. In 1994, Lockheed Martin Idaho Technologies Company[1] (LITCO) became the primary maintenance and operations (M&O) contractor on the site and assumed duties previously conducted by Westinghouse Idaho Nuclear Company (WINCO), EG&G Idaho, B&W Idaho, MK-Ferguson, and PTI. After a merger between Lockheed and Martin Marietta, the LITCO name was changed to Lockheed Martin Idaho Technologies Company (LMITCO). WINCO previously operated the Idaho Chemical Processing Plant. The Argonne National Laboratory, then owned by the University of Chicago, operates Argonne West. The Naval Reactors Facility was operated for the US Navy by Westinghouse Electric under separate but current jurisdiction of DOE's Pittsburgh Naval Reactors Office. Lockheed Martin Advanced Energy Systems previously owned and operated (new privatized operation) the waste treatment plant at RWMC Pit-9. The Advanced Mixed Waste Treatment Facility (also new privatized) was owned by British Nuclear Fuels Limited (BNFL) that subcontracts to BNFL Engineering, GTS Duratek, Manufacturing Sciences, Morrison Knudsen, Rocky Mountain Remediation Services, and Science Applications. Currently, Battelle Energy Alliance (BEA) is the current INL site-wide contractor to present;

Former ICPP contractors include:
- Phillips Petroleum Co, Atomic Energy Division 1950-1966;
- American Cyanamid Co. 1966-1971
- Allied Chemical Corp. 1971 to 1980
- Exxon Nuclear Idaho Company 1980 to 1984
- Westinghouse Idaho Nuclear Co. 1984-1994;

Former Naval Reactor Facility contractors:
- Combustion Engineering Inc., Nuclear Division 1959 to 1965
- Westinghouse Electric 1965

Miscellaneous former facility contractors:
- Aerojet General Corp. and Aerojet General Nucleonics, 1959 to 1965
- Aerojet General, 1965 to 1966
- General Electric Company, 1959 to 1968
- Idaho Nuclear Corp., (a subsidiary of Aerojet General Corp. 1966-1971
- Allied Chemical Corp.1966 - 1971
- Phillips Petroleum Co., 1969 - 1971;
- Aerojet Nuclear Co., (a wholly owned subsidiary of Aerojet General Corp., 1971 - 1976
- EG&G Idaho Inc., 1984 to 1994;
- Special Manufacturing Capability (SMC) for M1-A1/A2 tank armor
- Rockwell International Corp. 1986 to 1991
- Babcock and Wilcox 1991 to 1994. [Schwartz]
- CH2M.WG Idaho, LLC. Idaho Cleanup Program

Current INL Contractors

Three federal government contractors primarily operate facilities at the INL Site.
- Bechtel Bettis operates the Naval Reactors Facility;
- Flour Idaho manages AMWTF, Idaho Cleanup Project Core, or ICP Core, 2016 to present; the contract is valued at $1.4 billion.[2] See below for details.

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[1] Lockheed Martin Idaho Technologies Company (LMITCO) is a subsidiary of Lockheed Martin Corporation. LMITCO is a consortium including Babcock & Wilcox Idaho, Coleman Research, Duke Engineering and Services, Parsons Environmental Services, Rust International, and the Thermo Electron Corporation.

[2] LUKE RAMSETH ~1/11/17, lramseth@postregister.com

> Battelle Energy Alliance, LLC (BEA) operates Materials and Fuels Complex [MFC] (formally Argonne-West), Advanced Test Reactor (ATR), Transient Reactor Test Facility (TREAT), to develop and deploy the next generation of nuclear reactors including small modular reactors (SMRs), cyber security capabilities and expertise, biofuels research, and manages national laboratory functions and operates as general manager of the INL Site services.

"The U.S. Department of Energy (DOE) announced the award of a contract to Fluor Idaho, LLC, for the performance of ongoing Advanced Mixed Waste Treatment Project (AMWTP) and Idaho Clean-up Project (ICP) work scopes in support of the DOE Office of Environmental Management's cleanup mission at the Idaho Site. The value of the contract is $1.4 billion (including options), and the contract term five years.

"In an effort to align contractor and taxpayer interests, the ICP Core contract is a performance based contract type that is primarily Cost-Plus-Incentive-Fee (CPIF) with some scope set up as Cost-Plus-Fixed-Fee (CPFF). The contract includes Cost Incentive, Schedule Milestone, Annual Milestone, and Performance Incentive fees, and will allow DOE to incentivize the contractor for meeting the contract requirements.

"At the conclusion of this contract it is anticipated that all Idaho Settlement Agreement (ISA) transuranic (TRU) waste will be dispositioned out of Idaho and all Agreement to Implement/CERCLA Record of Decision buried waste will be exhumed from the Subsurface Disposal Area.

"The base scope to be performed under this contract includes: stabilizing and storage of spent nuclear fuel and high-level waste; dispositioning transuranic waste; retrieving targeted buried waste; closing the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm; maintaining Comprehensive Environmental Response Compensation and Liability Act (CERCLA) remedial actions; and operating and maintaining the INTEC, Radioactive Waste Management Complex (RWMC), and the Materials Fuels Complex (MFC) Radioactive Scrap and Waste Facility (RSWF) facility infrastructure. Option scope to be performed under this contract includes: Integrated Waste Treatment Unit (IWTU) operations. The IWTU option scope will be exercised at contract award.

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"The mission of the Office of Environmental Management is to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research." [3]

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[3] DOE Office of Environmental Management Awards Contract for Idaho Clean-up Project (ICP) Core, 4/4/16

environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research." [DOE Office of Environmental Management Awards Contract for Idaho Clean-up Project (ICP) Core, 2/4/16]

DOE's own internal "Tiger Team" report on INL concluded: "that the Field Office had not been effectively carrying out its management responsibilities over the INL. Many deficiencies were identified including; a general lack of [DOE] Idaho leadership; lack of a comprehensive, cohesive management approach; virtually no independent environmental, safety, and health oversight program; lack of an arms-length relationship with the contractors; and ineffective management of the award fee process. [Tiger @ES-2] Award fees are bonuses granted to contractors beyond cost plus contracts. INL contractors received $14.35 million in bonuses in 1995[AP (d)] and $7.96 million for 1997. Between 1994 and 1997 LMITCO received $40 million in bonuses. These bonuses are offered at the same time that the State of Idaho charged DOE with 135 hazardous waste management violations and fines of $892,725. Additionally, EPA and the State fined DOE a million dollars for missing the Pit-9 cleanup milestone.

The Government-Owned-Contractor-Operated (GOCO) system provides for an artificial oversight structure where, theoretically, the DOE is the federal regulator over private contractors who operate various areas at the INL. In practice, however, there is little or no distinction between the DOE and its contractors, and consequently, little regulation. This breakdown in oversight between the DOE and the INL contractors has resulted in massive abuse and mismanagement of nuclear materials. Additionally, as the above list shows, the frequent contractor turnover provides for abuses to be blamed on previous contractors.

The GOCO operating system at INL has resulted in a strangle hold by on-site contractors. Exorbitant administrative charges beyond actual operating expenses are routine. With respect to Superfund cleanup, what money does finally make it to Idaho is eaten up by these site contractors who charge 60% overhead for their management functions. Cleanup contractors at private (non-government owned) Superfund sites allow less than 20% overhead charges, and consequently get twice the work accomplished. Taxpayers are justifiably outraged by the systematic milking of the cleanup cow by the very polluters who caused the contamination in the first place. Additionally, multi-million dollar bonuses are granted each contractor annually without any real basis, according to the General Accounting Office.

There is a difference in how long-term the planning is carried out because of the stability of the funding at INL. There is a difference in the accountability. At a place like the INL, it's always been this shuffle. The new contractor and DOE blame the bad old contractor for "legacy problems." Then the new contractor begins to learn about all the skeletons in the closet and snakes in the basement, screws up a few times, can't get the money needed to fix problems and leave in disgrace, and the cycle begins anew. DOE usually pins the blame on the contractor as opposed to taking responsibility for its flawed contractor management.

Responding to this problem, Congress passed in 1993 the Federal Facility Compliance Act (FFCA) that removed many sovereign immunity exemptions that the DOE and its predecessors functioned under. Prior to this law, the DOE operated in a virtual self-regulated environment. FFCA, however, only applies to Resource Conservation Recovery Act (RCRA) listed hazardous wastes. Radioactive materials are not RCRA listed however, when mixed with RCRA listed hazardous wastes, FFCA applies. The State of Idaho and EPA do not agree with this legal mixed radioactive-hazardous distinction.

"The National Nuclear Security Administration (NNSA) was established by Congress in 2000 as a separately organized agency within the U.S. Department of Energy, responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. In 2002 NNSA reorganized, removing a layer of management by eliminating its regional operations offices in New Mexico, California and Nevada. NNSA headquarters retained responsibility for strategic and program planning, budgeting and oversight of research, development and nonproliferation activities.

"NNSA is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security.

"In 2002 NNSA reorganized, removing a layer of management by eliminating its regional operations offices in New Mexico, California and Nevada. Contract and project management oversight responsibility for NNSA's labs, plants and special facilities was given to the site offices. NNSA headquarters retained responsibility for strategic and program planning, budgeting and oversight of research, development and nonproliferation activities.

"NNSA's mission is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security including:

* Managing the Stockpile: Maintaining the safety, security and effectiveness of the nuclear deterrent without nuclear testing – especially at lower numbers – requires increased investments across the nuclear security enterprise;

* "Preventing proliferation: Keeping weapons of mass destruction (WMD) out of the hands of state and non-state actors requires a coordinated effort on the part of suppliers of proliferation-sensitive materials, equipment, and technologies;

* "Powering the Nuclear Navy: The Naval Nuclear Propulsion Program provides militarily effective nuclear propulsion plants and ensures their safe, reliable and long-lived operation. This mission requires the combination of fully trained U.S. Navy men and women with ships that excel in endurance, stealth, speed, and independence from supply chains;

* "Emergency Response: NNSA ensures that capabilities are in place to respond to any NNSA and Department of Energy facility emergency. It is also the nation's premier responder to any nuclear or radiological incident within the United States or abroad and provides operational planning and training to counter both domestic and international nuclear terrorism;

* "Recapitalizing Our Infrastructure: The FY2011 Budget Request increase represents the investment need to transform a Cold War nuclear weapons complex into a 21st century Nuclear Security Enterprise;

* "Continuing Management Reform: NNSA is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security." [4]

So, is the difference that NNSA just needs a way for DOE safety regulations to go away, because the smoke screen is too troublesome to bother with? The intent of 10 CFR 830 was to force DOE to come into a higher level of safety – yet, it was ambiguous on back-fit. DOE retains tons of wiggle room and the ability to formally ask the DOE secretary permission to be excluded from any requirement deemed too onerous. Yet, even this is not enough for the NNSA facilities. But, is the charade to act like 10 CFR 830 is being met actually accomplishing anything at those facilities? Basically, NNSA only adds another ineffective layer of bureaucracy much the same as Home Land Security provided ineffective coordination with the many national security and emergency response agencies.

Over its 60+ year history, 52 nuclear reactors were built at INL – as of 2017, 2 (ATR, ATRC) are operating and another 3 (NRF, IFR, TREAT) are shutdown but operable. This represents the largest concentration of reactors in the world. [DOE/EH/OEV-22-P,p,2-8] In addition to these reactors are facilities that process large quantities of radioactive and chemical materials. The INL is also the birthplace of the Nuclear Navy Propulsion Program (NNPP) initiated under Admiral Hymand Rickover. The Navy, single largest radioactive dumper at INL, passes its responsibilities on to DOE as its nuclear garbage collector.

Primary operation areas include the Idaho Chemical Processing Plant (ICPP) that (up until 1993) reprocessed spent reactor fuel from around the country and the world to extract isotopes and enriched

[4] http://NNSA.energy.gov/

uranium for the US nuclear military programs. DOE announced termination of reprocessing at the ICPP.

The Naval Reactor Facility (NRF) has three (non-operating) reactors for its nuclear navy training, and also spent reactor fuel testing facility. The Navy has not announced what it intends to do with its training reactors at NRF.

The Advanced Test Reactor Complex (ATRC) formerly called Test Reactor Area (TRA), had 4 experimental reactors and process facilities. At this time only the Advanced Test Reactor and Advanced Test Reactor Critical is operating.

Material Fuels Complex formerly called Argonne National Laboratory - West (ANL-W) has several experimental breeder reactors including the Integral Fast Reactor (IFR) (EBR-II, ZPPR , TREAT and fuel reprocessing reactor fuel manufacturing facilities. Currently only TREAT is operational.

Auxiliary Reactor Area (ARA) has had several Army experimental reactors but currently only the Power Burst Reactor is operable.

Test Area North (TAN) formally conducted open air reactor tests, but currently only has Abrams tank uranium armor and radioactive materials process facilities.

Radioactive Waste Management Complex (RWMC) is INL's main radioactive dump site and where Advanced Mixed Waste Treatment Project for packaging waste for shipment to WIPP in NM is located. For a complete listing of facilities by area, and operational status see Appendix B.

Most of INL's airborne radioactive releases occurred during the early reactor testing years. Between 1952 and 1989 contained 18,564,868 curies were released. [DOE-ID-12119@A-190] Total discharge to the environment for the period 1952 to 1992 was 39,597,934 curies. See Section I(E)(2). [ID-10054-81@12][DOE/ID-10087-85@5][DOE/RW-0006,rev 7][RWMIS]

A curie (Ci) is a unit of measurement of radioactivity in a given material. Safe drinking water standards for radioactive contaminates are expressed in pico curies (pCi), or one trillionth of one curie. Because radioactive contaminate standards are in pCi's it is the best way to explain how extremely toxic and biologically damaging these pollutants are to the human body. This environmental insult from the radioactive dumping at INL is of enormous proportions.

Additionally, 35,550 cubic meters containing 371,200,000 curies of high-level liquid wastes have been generated over the ICPP's operating history. This waste is stored in old corroded underground tanks, or calcined in INL's ICPP high-level calcine waste incinerator. The Calciner is an incinerator that volatilizes the liquid portion of the waste and mixes the residue with a granular calcine. The calcine in storage as of 1981 accounted for 64,120,000 Ci. [IDO-10054-81 @ 19] What distinguishes INL from other DOE production sites is its calcine incineration of liquid high-level wastes. The Integral Waste Treatment Unit (IWTU) is the new incinerator intended for the remaining high-level liquid waste at INTEC tank farm. The IWTU - if DOE can ever get it to operate - however will not produce a waste form that can be sent to a permanent repository. Consequently, INL had only 11 high-level liquid waste tanks (currently reduced to 3 tanks) containing ~900,000 gal. Hanford by contrast put all its waste in 177 underground tanks.

One of many unanswered questions is the mass balance discrepancy between the number of curies that went into the incinerator and the number of curies that DOE acknowledges in the calcine ash after incineration and INTEC/ICPP stack monitoring of curies that were released to the atmosphere. Radioactive material does not lose its activity during incineration - only by gradual decay. Radioactive elements are basic elements as opposed to compounds that are made up of two or more elements.

Emissions to the environment from the totality of the nuclear operations at INL significantly impact the health of the surrounding human and wildlife populations. The long-term impacts are not fully characterized. The Dose Reconstruction study of INL started in 1992 by the Centers for Disease Control never offed an accurate assessment of how much radiation was released, and what the probable radiation dose was to affected populations around INL. However, the commitment to adequately clean up the massive contamination generated over seven decades remains an open question. Recently, "no action" decisions on major INL cleanup sites by DOE are an indication that the government's commitment to environmental restoration continues to be in name only. Only continued public pressure will force the federal government to own up to its responsibilities.

It is important to keep in mind that INL nor the INL Naval Reactor Facility is not an anomaly when viewed within the context of US military nuclear operations contamination resulting from gross miss-management of radioactive/hazardous waste. Robert Alvarez reports the following in *A primer: Military nuclear wastes in the United States:*

"Research, development, testing, and production of US nuclear weapons occurred at thousands of sites in nearly every state, as well as Puerto Rico, the Marshall Islands, Johnston Atoll, and Christmas Island in the Pacific. Between 1940 and 1996, the United States spent approximately $5.8 trillion dollars to develop and deploy nuclear weapons. [5] As a result, the nuclear weapons program created one of the largest radioactive waste legacies in the world—rivaling the former Soviet Union's.

"US nuclear weapons sites—many of them under the aegis of the Energy Department—constitute some of the most contaminated zones in the Western hemisphere, and attempts to remediate those sites are now approaching their fifth decade. It is the most costly, complex, and risky environmental cleanup effort ever undertaken, dwarfing the cleanup of Defense Department sites and the Environmental Protection Agency's Superfund program. Long-term liability estimates range from approximately $300 billion to $1 trillion. Site remediation and disposition of radioactive detritus are expected to continue well into this century. After that, long-term stewardship of profoundly contaminated areas will pose a challenge spanning hundreds of centuries.

"A CLEANUP: TREASURE ISLAND [6]

"Research, development, testing and production of nuclear weapons by the United States created:

- More than 3 billion metric tons of uranium mining and milling wastes.
- More than 1 million cubic meters of transuranic radioactive wastes.
- Approximately 6 million cubic meters of low-level radioactive wastes.
- Approximately 4.7 billion cubic meters of contaminated soil and groundwater (according to an Energy Department document unavailable online).
- More than 10,000 radiation-contaminated structures such as uranium processing and enrichment plants, radiochemical processing and storage facilities and laboratories.
- About 100 million gallons of high-level radioactive wastes, considered among the most dangerous, left in aging tanks larger that most state capitol domes. More than a third of some 200 tanks have leaked and threaten groundwater and waterways such as the Columbia River.
- Areas contaminated by more than 1,054 nuclear weapons tests, 219 of which involved aboveground detonations. As of 1992, underground shots released about 300 million curies of radioactive materials at the Nevada Test Site—making it the most radioactively contaminated area in the United States. Areas in the Republic of the Marshall Islands remain uninhabitable from US aboveground tests in the 1940s and 1950s. [7]
- More than 700,000 metric tons of excess nuclear weapons production materials, in addition to hundreds of tons of weapons-usable plutonium and highly enriched uranium.

"The human health legacy of the US nuclear weapons program is also quite significant. As of February 2014, more than 100,000 sick nuclear weapons workers have received more than $10 billion in compensation following exposure to ionizing radiation and other hazardous materials.

"Even today, the radioactive waste from the dawn of the nuclear age remains a significant challenge to public health in highly populated areas. For instance, in 1973 a large amount of uranium processing wastes, generated to make the first nuclear weapons at the Mallinckrodt Chemical Works in St. Louis, was illegally dumped in a municipal landfill in a nearby suburb. The landfill is experiencing the latest of

5 President Obama and Trump have added an additional $10 trillion (over 10 years) to the nuclear weapons budget.

6 https://thebulletin.org/2014/02/treasure-island-cleanup-exposes-navys-mishandling-of-its-nuclear-past/

7 According to the American Academy of Sciences study on the Nevada bomb test releases, many of the highest downwind areas were in southern Idaho and Montana.

at least two subsurface fires over the past 21 years and lies on a floodplain approximately 1.2 miles from the Missouri River.

"The dump contains the largest single amount of thorium 230 in the country and possibly the world. With a half-life of more than 75,000 years, it is comparable in toxicity to plutonium. Even though these concerns were repeatedly raised with the US Environmental Protection Agency, the agency issued a Record of Decision in 2008 that allows for "in place disposal" of these wastes, subject to institutional controls and with a cap over radiologically contaminated areas. Lost in this process is an important warning by a panel of the National Academy of Sciences in 2000 that "engineered barriers and institutional controls—are inherently failure prone.

"The radiological legacy of nuclear weapons will be with us for a very long time." [8]

[8] Robert Alvarez, A primer: Military nuclear wastes in the United States and is a senior scholar at the Institute for Policy Studies, Robert Alvarez served as senior policy adviser to the Energy Department's secretary and deputy assistant secretary for national security and an EDI Board member.

Section I.B. INL Accident History

Of the 52 reactors built and operated at INL, forty-two (42) reactors melted downed so far in its history of operations. Sixteen (16) of these meltdowns were accidents. The remaining twenty-six (26) were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation releases. These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Below is a partial listing of the more notable meltdowns and criticality releases. (See IX Appendix (A)) for a listing of acknowledged melt-downs, accidents, and experimental radioactive releases. The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-rodding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

According to Boyd Norton, manager of the **SPERT tests** in the early 1960s notes, "These reactors are, essentially, stripped-down “hot-rodders,” [sic] they had no radiation shielding and no elaborate safety systems. Sitting as they were, in the middle of more than nine hundred square miles of desert, there wasn't much concern over such things. Not back then." [Norton] See discussion below on SPERT Tests.

An **ICPP/INTEC criticality accident** on October 16, 1959 required evacuation of the facility. "Outside the building and for 130 yards west to the area entrance the radiation field was 5 R/hr or greater." [IDO-10035 @ 4] Thankfully, it was a night shift and less than 10% of the normal work-force was on the site. Twenty-one workers were considered at immediate risk from exposure. Film badge dosimetry and calculations on internal radiation exposure found the highest skin exposure was 50 rem and the highest penetrating exposure was 8 rem. Highest internal dose was 29 mrem. [IDO-10035 @ 5 & 38] This accident followed a Rala run the previous day. [see Section I.D] Over the course of the accident 337,717 Ci of long-lived fission product was released to the atmosphere. [DOE/ID-12119@A-99] See RaLa Run Discussion below.

Another ICPP/INTEC criticality accident on January 25, 1961 released 5,200 Ci [ERDA-1536 @ C-5] and required full evacuation of the plant. Two hundred fifty-one workers were on-site at the time. The highest exposure as determined from film badge readings did not exceed 55 mrem of penetrating radiation. The maximum thermal neutron exposure detected in the 65 badges analyzed was less than 10 mrem. Excessive cesium-138 was detected at the Central Facilities Area three miles south of the INTEC/ICPP after the accident. [IDO-10036@5&6] "Highest personnel exposure received for the four-week period of January 20 through February 16, 1961 by any Phillips' employee in the ICPP at the time of the incident was 240 mrem gamma, 310 mrem beta." [Ibid.@37] Considerable uncertainty exists in relying on the badge reading due to variability in isotope exposure, and the distance the badge is from the worker's hands. More often than not, the badges are considerable understatements of exposure.

For more detailed information see Tami Thatcher’s SL-1 report at: http://environmental-defense-institute.org/publications/SL-1Article%20Rev5.pdf

Stationary Low-Power Reactor -1 (SL-1)

The Army and Air Force wanted the Atomic Energy Commission (AEC) to develop a simple reactor that anyone could operate for use in remote areas. They were competing with the Navy dominance over reactor development; how-ever the Navy applied more stringent design/safety/ operating policies for reactors. The early Navy reactors were for submarines, so safety issues were a priority. [1]

The Atomic Energy Commission established the Government Owned/Contractor Operated (GOCO) process for developing nuclear power system. [2] In the case of the Stationary Low-Power Reactor Number One (SL-1), Combustion Engineering located in Windsor, CT, got the contract to build and operate the reactor for the Army at INL.

[1] Admiral Richover managed the development of the first Naval Nuclear Power Propulsion program at INL’s Naval Reactor Facility. See Guide Section I.V.K for NRF details.

[2] See Section I for more info on GOCO

The SL-1 was the Army's attempt to compete with the Navy's dominance over nuclear power reactors. Located at the INL's Auxiliary Reactor Area, the SL-1 was a small compact nuclear power plant designed to generate electricity at remote military locations such as the Arctic or Antarctic.

The reactor served both as an experimental prototype and as a training facility for military personnel. Reactor containment consisted of a grain silo/like building around the reactor vessel; and gravel filled the space between the exterior silo and the reactor vessel that provided some radiation shielding. Access to the top of the reactor was up exterior stairs connected to an operations building connected to the silo containment building.

There are several interpretations of the SL-1 steam explosion accident occurred on January 3, 1961 that will be discuss below. [3] On this bitterly cold afternoon of January 3rd, three Army technicians arrived at the facility for the four to midnight shift. The SL-1 reactor had been shut down for routine maintenance, and the task of the three men that evening was to complete certain preparations for nuclear startup. Since there were no survivors, there are no first-hand testimonies as to what exactly happed that night; and due to the extreme radiation spread around the whole site, forensic evidence is limited.

During the process of attaching control rods to drive motors, one of the men apparently raised the central control rod too far and/or too fast. Evidence indicates that the rod might have stuck momentarily. In the past, there had been significant sticking problems with these rods. When it came unstuck, it moved upward much higher than anticipated and triggered a supercritical power excursion in the reactor core. In a fraction of a second the power reached a magnitude of an estimated several billion watts, melting and perhaps even vaporizing a large part of the core. The water in the core region was vaporized, creating a devastating steam explosion. The remaining water in the reactor vessel was hurled upward at high velocity, striking the underside of the reactor's pressure lid and lifting the whole nine-ton vessel upward, shearing cooling pipes in the process.

The author interviewed Owen Gailar [4] (now 93) who worked at Combustion Engineering Physics Division located in Windsor, CT - where he was in charge of the Reactor Statics Division. The Combustion Engineering (CE) Windsor Engineering Division had control of the SL-1 design, operations, including the SL-1 Physics Group. The CE Windsor Reactor Statics Group (where Gailar worked) had no part in the original SL-1 design and no control over SL-1 operations. Gailar said:

> "Combustion Engineering (CE) that had control of the SL-1 wanted to continue reactor operations. Only Gailar and one other wanted to shut down the reactor" but had no control over SL-1 operations. These significant problems with aluminum clad rods swelling and sticking produced a risk in controlling the reactor and implementing a controlled shutdown."
>
> Gailar said he would "often get 'unofficial calls' from the CE SL-1 Physics Group reporting on loss of boron, critical rod positions and sticking control rods. In this capacity I could 'cross the aisle' and recommend to friends and supervisors in the Engineering Division that the SL-1 be shut down. They in turn did NOT push for SL-1 shutdown! 'You geeks worry about everything, nothing is going to happen,' was the response of mid-level supervisor in the Engineering Department. He [supervisor] was right…for a few months, then 4 were… and not for bureaucratic money grabbing, a fifth would have been killed in the first nuclear power related accident in the United States."
>
> "Combustion Engineering management wanted to continue operations and disregarded its CE Windsor Reactor Statics Group engineer's warnings. These engineers became extremely concerned after they heard that the Army operators were conducting "bumping experiments" or "burp tests" to see how much "steam bubbles" were generated during shutdowns to evaluate the reactor's stability. Also when Reactor Statics Group engineers heard that Combustion Engineering/Army reactor operators were instructed to use a sledge hammer to drive the rods into the core, this raised Gailar and a local physics' concerns. To no avail. Then later when operators tried to remove the rods, they could not manually lift the rods out because they

[3] "SL-1 Accident Atomic Energy Commission Investigation Board Report Joint Committee on Atomic Energy Congress of the United in States June 1961," now also find it on the INL digital library: https://inldigitallibrary.inl.gov/PRR/70116.pdf or Stanford https://purl.stanford.edu/wx089sc1780

[4] Owen Gailar phone call to Broscious July 2019

> had been hammered into place. The operators ask the Army for a jack to lift the rods out far enough (13") to reach the motorized rod lift; but were refused because "it might damage the reactor." [5]

This stability test apparently would be useful to convince the Army that the SL-1 design could be used in remote locations as a power source far away from the usual skilled nuclear reactor engineers. These "bumping experiments" tests are extremely dangerous procedures because the reactor can go out of control in nano-seconds. When reactor operators tried to remove the rods, they could not manually lift the rods out because they had been hammered into place.

The Army SL-1 operators were concerned enough that "they wanted the night supervisor present but were turned down because there were no funds for a night supervisor." One can only speculate that if the night supervisor (normal practice) was also refused; the way the Army and Combustion Engineering were playing loose with an extremely dangerous nuclear reactor operation. Also, this loose safety culture was typical at INL (then known as the National Reactor Testing Station) along most of the other non-Navy reactor operators that ran reactors to deliberate meltdowns to evaluate the various reactor design operating parameters. [6]

> "I worked in the CE Windsor physics division, where I was in charge of Reactor Statics. I would often! Get phone calls (Un-official) from SL-1 physics, reporting on loss of Boron, Critical rod positions, and sticking control rods. In this capacity I would "cross the aisle" and recommend to friends and supervisors in the Engineering division that the SL-1 be shut down…They in turn did NOT push for SL-1 SHUTDOWN!"

This is informative and helps explain the motive for continuing to blame the crew for the SL-1 accident, to protect Combustion Engineering as well as the AEC which was in charge of safety. Of the three crewmen at SL-1, it is agreed that there were probably two crewmen on top and a third on the floor. Crewman McKinley was the one man on the main floor when the accident happened and another was thrown from near the reactor top. They both died of blunt force trauma. The third man was eviscerated and impaled to the ceiling. According to Tami Thatcher's investigation;

> "According to Todd Tucker in his book Atomic America about the SL1 accident, Clarence Lushbaugh from Los Alamos National Laboratory was the pathologist brought in to examine the SL1 crewmen. The bodies of the men had been quite mutilated and this has caused problems in identifying the men. Crewman McKinley had been on the reactor main floor and he is the one who was still alive for a few hours. There are different opinions about exactly where each man was when the accident happened, but Lushbaugh's reconstruction of their positions was based on his examination of the bodies. Lushbaugh placed crewman Legg on the reactor top with his hands-on Rod 9, with crewman Byrnes standing nearby to assist with reassembly of the control rod drive. Crewman Legg's hands were greatly injured; crewman Byrnes' hands were not. Crewman Legg was impaled to the ceiling by the Rod 7 shield plug. But the early blame was on crewman Byrnes, who was having marital problems, as having deliberately pulled the rod and the evidence to the contrary was available to few. The men died of blunt force trauma (page 176 of Atomic America), although they would have died of neutron exposure or radiation dose had they not died of blunt force trauma.
>
> "In William McKeown's book Idaho Falls *The Untold Story of America's First Nuclear Accident*, on page 128, he provides a figure showing the radiation survey of the three crewman, after decontamination efforts. But the identities corresponding to the three figures gets misidentified in the book.
>
> "So, in addition to the immediate deaths of two crewmen, and the death of a third crewman about two hours after the accident, this comment adds a fourth person as the nurse, Hele Lesien, who was in the ambulance that the crewman was put in, while still alive. The nurse was not wearing a radiation badge but the door of the ambulance was surveyed at 400 R/hr., [page 87], *Atomic America*. So, the radiation level inside the ambulance with the crewman was higher and the nurse was in the ambulance with the crewman, McKinley, for a period of time between 10:35 when the victim was heard moaning on the reactor floor and

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[5] Owen Gailar written comments to Broscious on EDI Guide to INL excerpts

[6] Owen Gailar written comments to Broscious on EDI Guide to INL excerpts

> 11:14 pm when this victim, McKinley was declared dead while inside the ambulance. There is no doubt that the nurse received a life-shortening radiation dose and she died of cancer a few years later.
>
> "But, many of the SL-1 responders died of cancer. The difficulty is in documentation of the number of years after the accident that they died and in their diagnosis. So, we continue to distinguish the three deaths the evening of the SL1 accident from deaths that occurred years later of emergency responders. And we maintain that many cleanup workers obtained early deaths from the inadequate radiation monitoring during cleanup.
>
> "It is correct, based on Energy Employee Occupational Illness Compensation which has paid out billions of dollars. There are many more claims denied than compensated and so the number of workers having disease from radiation is disputed. I also found that 1200 workers participated with SL1 cleanup.
>
> "Operators ask for a jack to lift the rods out far enough (13 in.) to reach motorized rod lift, which although refused by the Army because they felt it might damage the reactor, was an indication of serious rod sticking at the SL-1 reactor.
>
> "See the AEC Investigation Review Board report, p. 7 that describes that Combustion Engineering requested written confirmation that a Combustion Engineering shift supervisor would not be required for routine supervision of night shifts. Thus, three crewmen were to work alone at the facility during the evening shift, which would leave no one at the control room to monitor instruments and no one to observe the work being conducted." [7]

Four workers (3 reactor operators and 1 nurse that transported one of the fatally injured operators) were the initial causalities in the SL-1 explosion. In addition to the nurse's death from radiation exposure, about a dozen other emergency responders that night may have died of cancer years later; this is described somewhat in books about SL-1.

According to Boyd Norton; "The three men, who had been standing atop or near the reactor vessel, were killed by the explosion that lifted the vessel 8 ft. before the huge vessel dropped back into place. One of the men remained impaled on the ceiling by a piece of control rod rammed through his groin. 'It all happened in a second or so.'"

"It [SL-1] was a terrible accident, made even more grisly because the intensely radioactive fission products scattered inside the building by the accident hampered the work of recovering the bodies. Staying in the building for mere seconds resulted in a year's allowable dose of radiation for rescue workers. And it took six days to remove the body that was impaled on the ceiling by use of a remotely operated crane and a closed-circuit television. The bodies were so badly contaminated, the heads and hands of the victims had to be severed and buried with other radioactive wastes at the Radioactive Waste Management Complex." [Norton] The Oil Chemical and Atomic Workers Union protested vigorously that the government refused to provide a proper Christian burial for the workers." [8]

The SL-1 reactor explosion not only resulted in three operator deaths but also serious exposure of 0.1-0.5 roentgens [rem] to nearly 100 personnel. Over 12 workers received exposure greater than 10 roentgens [rem]. [IDO-19301@138] The maximum acknowledged personnel exposure was 1,000 R/hr. (Rad per hour). [ERDA-1536, p.II-243] The exposed reactor was still emitting 22,000 R/hr. five months after the accident. Readings above the reactor one month after the accident were 410 R/hr. [IDO-19301, p.109] 1,128 Ci including 80 Curies of radioactive Iodine were also released during the SL-1 accident. [ERDA-1536, p.II-243] [DOE/ID-12119@A-53] A temperature inversion kept the radiation plume close to the ground and at 25 miles the radioactive iodine levels were 10 times above background. At 100 miles the radiation levels were above background.

The author interviewed the widow of James Dennis who was a member of the SL-1 **in-**voluntary Army demolition crew brought in to dismantle the reactor after the accident. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia, which his medical documents confirm, was

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[7] Tami Thatcher review of Owen Gailar's comments on SL-1 October 2019.

[8] Norton; "Supercritical", Boyd Norton, Manager of SPERT Reactor tests during 1960s, Audubon Magazine May 1980, p. 89-105]

caused by exposure to 50 rem/hr. for nine hours and ten minutes at the SL-1 site. [Dennis, p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1, CAB] as grossly understated. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis, p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Dennis is only one of thousands of individuals who are victims of the health effects of radiation exposure caused by radioactive releases from DOE facilities.

Tami Thatcher's extensive SL-1 document review relating to the reactor rod prompt critical height found:

> "The reading the IDO 19311b, page III-107, shows that this later prediction puts prompt critical at 17.6 inches. Not 20 inches, as the first Combustion Engineering report states. Also page III-51: "For shroud No. 1, the control blade for No. 1 extended 4 inches below the bottom of the shroud." [Note that for the center blade, it extended much further] Anyway, it says "prominent rub marks can be plainly seen on the lower section of the exposed part of the blade . . . and these marks are of pre-incident origin." 9
>
> "And in this IDO 19311b report, they mention finding on the center blade "many scouring marks that appears to be of pre-incident origin..." [p. III-62] Now, this is significant --- the lower end of the control rods would exit the shroud. And would apparently warp as it sat during shutdown – so this solves a problem for me – It seemed to unlikely that it would glide, not sticking – and then have debris and be stuck. Sticking as the lower end entered the shroud! And not much discussion of where the scouring marks is exactly despite the importance. But I can't see the black and white pictures very well.
>
> "The center control rod had to be moved 2 inches and could have been moved 3 inches with the c-clamp, then needed to be lifted, slightly – it stuck. They concede that a man can over lift by 10 inches. So this is 10 + 3 = 13 inches. And now we're saying prompt critical at 17.6 inches. An extra 4.6 inches! Jerking free a rod!
>
> "The rods were sticking in this low position, as the lower end was coming in the shroud. This matters! In this town – it matters! Because of how "Proving the Principle" is written – and the DOE films ---- Proving the Principle says the rod was withdrawn 26 ¼ inches (p. 148)! IT WAS NOT! So insinuate that it had to be a deliberate act. Most folks around here think that --- and the Idaho Falls – the untold story is so excellent is some ways but it really leaves it as a mystery.
>
> "Like the scratches on the control rod that happened after the explosion – that some folks concluded meant that the control rod had been yanked out. At least "Proving the Principle" concedes the scratches happened after the rod hit the ceiling." Below is a list of Tami Thatcher's extensive published reviews of the available declassified reports on the SL-1 explosion.
>
> Tami Thatcher, Environmental Defense Institute, The SL-1 Accident Consequences, September 2019. http://environmental-defense-institute.org/publications/SL-1Consequences.pdf
>
> Tami Thatcher, Environmental Defense Institute, The Truth about the SL-1 Accident – Understanding the Reactor Excursion and Safety Problems at SL-1, Updated September 2019.
> http://environmental-defense-institute.org/publications/SL-1Accident.pdf
>
> Tami Thatcher, Environmental Defense Institute, A Brief History of Radiation Exposures to Idaho National Laboratory Workers, Updated January 5, 2016.
> http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf
>
> Tami Thatcher, Environmental Defense Institute January 2015 Newsletter article, America's only Nuclear Reactor Operator Deaths.
> http://www.environmental-defense-institute.org/publications/News.15.Jan.Final.pdf
>
> Tami Thatcher, Environmental Defense Institute April 2018 Newsletter article, "An Editorial About the

9 Atomic Energy Commission report, Idaho Field Office IDO-19300, "SL-1 Reactor Accident on January 3, 1961: Interim Report." Combustion Engineering, May15, 1961 and Atomic Energy Commission report, Idaho Field Office, IDO-19311, "Final Report of the SL-1 Recovery Operation, General Electric Co., June 27, 1962 partial center rod withdrawal of 20 inches, p. 146.

1961 SL-1Accident History in Response to a February Guest Editorial in the Post Register." http://environmental-defense-institute.org/publications/News.18.April.pdf

INL Managers Deny Any Responsibility for ZPPR Accident (By Tami Thatcher)

"A recent article in the Boise Weekly about the 2011 Zero Power Physics Reactor (ZPPR) accident at the Idaho National Laboratory's Materials and Fuels Complex (MFC) included interviews of INL managers.[10]

"The ZPPR accident contaminated workers with plutonium when damaged fuel plates were exposed. The DOE accident investigation report[11] concluded that the accident was preventable and that the safety chairman for MFC had twice given written information about his concerns about the continued use of the hood and the higher likelihood of finding damaged ZPPR plates.

"The Department of Energy accident investigation report stated that "Battelle Energy Alliance (BEA) continued operation of the ZPPR Facility with known safety basis deficiencies and without adequately analyzing the hazard to the worker."

"Interviewed for the Boise Weekly, Phil Breidenbach recalls the meeting with the safety oversight chair as cordial and soft-spoken. "This letter, when it's looked at outside the context of what goes on here every day, creates the image that someone ran in here and said, 'No, stop, danger, danger, danger.'" John Grossenbacher said. "That's not the case."

"DOE and its contractors should take note: all safety issues of *actual* importance require the person describing it to say "Stop" and then say "danger, danger, danger" at least three times.

"Breidenbach said one simple action could have prevented the exposure: Ralph Stanton and others could have stopped the work once they found the plastic-wrapped plate. "I'm not a rocket scientist or a Ph.D.," Grossenbacher added, "but if I'm a rad-con tech and I think, 'Well, what happens to this stuff after 30 years of being wrapped in plastic, anybody know?' And if the answer is no, I would say, 'You know what, let's stop.'"

"These two INL managers have forgotten the DOE accident investigation report that describes Stanton and others who questioned several times whether to proceed and it describes the operations personnel including the facility manager – who confidently directed that the work proceed. They have also forgotten the finding that BEA management failed to report the Safety Chair's findings as an Unreviewed Safety Question." [12] [13]

"Breidenbach said, "the stars aligned in such a way that too much equipment was out of service." But, BEA had problems far beyond the work room's ventilation and inadequate alpha alarm placement.

"For INL managers who had been briefed on the safety problem but never acted on it, never bothered to find out if operations people understood the increased risk, never questioned whether the controls were adequate – for them to state that it was the fault of the rad-con techs reflects an uncorrectable mentality.

"Grossenbacher also said that when it comes to the health effects of plutonium inhalation: "We know what kind of radiation exposures will result in physical impacts on a person's health, and none of these exposures came anywhere near that."

"The problem is that estimated doses have are large uncertainties and questionable cancer risk

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[10] Article by Jessica Murri, "Half-Life: How an Accident at the Idaho National Laboratory Changed a Family," *Boise Weekly*, April 2014. http://www.boiseweekly.com/boise/half-life-how-an-accident-at-the-idaho-national-laboratory-changed-a-family/Content?oid=3094301&showFullText=true

[11] Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, "Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory" accident 11/8/11 at the Materials and Fuels Complex (MFC). http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor.

[12] DOE Occurrence Report NE-ID-BEA-ZPPR-2011-0001 https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Etjz%5D%91

[13] See the October 2013 EDI newsletter article about ZPPR: http://www.environmental-defense-institute.org/publications/News.13.Oct.-Final.2.pdf

prediction adequacy.[14]

"I would also like to remind Grossenbacher that the Energy worker compensation act (EEOICPA) points out that "studies indicate than 98 percent of radiation-induced cancers within the nuclear weapons complex have occurred at dose levels below existing maximum safe thresholds." [15]

Accident at INL Leads to MFC Worker Complaint

Alex Stuckey reports 8/11/13 in the Idaho Falls Post Register: "Ralph Stanton slowly sliced through the plastic and electrical tape wrapped around a plutonium fuel plate.

From above the hood, he watched his gloved hands work over the plate, found in a box -- called a clamshell -- atypically labeled with warnings about radioactive contents and abnormalities in the fuel plate's conditions.

Just minutes before, he and his co-workers conferred with their immediate supervisor about opening this and another atypical clamshell. Their supervisor gave them the go-ahead to cut through the plastic. An operator also asked what to do in the event of a fire or powder sighting. The operator said he was told that was "not a valid question," but the supervisor does not recall this, according to the January 2012 Department of Energy Accident Investigation report.

Stanton slowly turned the plate over. Black powder, plutonium, spilled out. No respirator protection was worn, the report stated.

At 11:04 a.m. Nov. 8, 2011 -- in the building that once housed the Zero Power Physics Reactor on the Department of Energy's desert site -- Stanton and 15 others were exposed to the plutonium.

The aftermath of the accident -- and the decisions made by Battelle Energy Alliance leading up to it -- led Stanton and a colleague, Brian Simmons, to file a whistle-blower complaint against the contractor in charge of Idaho National Laboratory.

The DOE report concluded the seeds of the accident were planted years before it occurred. They included: On June 23, 2011: A safety official presented a document to management containing recommendations for safe handling of fuel plates stored at the reactor building, the second time since 2009. Both times, the document's "significance was not recognized and no action was taken," according to the report.

On Around 2004-2005 -- about the time BEA was awarded the 10-year contract to manage INL -- information containing the condition of the fuel plates -- some of which were stored for 30 years in the reactor building -- was lost.

But at 11:04 a.m., Stanton was not aware of these issues. He was only aware of the hand- and foot-monitor alarm and the jittery feeling forming a lump in his throat.

At 11:07, the Vault Continuous Air Monitor, which measures near real-time gross radioactivity levels, went off. The workers evacuated the room and were ushered into the reactor control room, the report stated. Later, the DOE would find that the location of the monitor was not optimal for work performed in the hood.

Nearly 20 people sat in the control room in total silence as a worker read off the escalating monitor numbers, Stanton said. Scanning the room, he said he could see the worry on everyone's face.

That's when the severity hit him. Stanton's new life of uncertainty started that day, but he was hopeful for assistance from BEA or the DOE. He said it hasn't come. BEA officials declined to comment.

He hopes his whistle-blower complaint filed in April will change that. He and Simmons allege the contractor created an unsafe work environment and then retaliated against them after they raised health and safety concerns regarding the incident. Simmons did not wish to speak on the record.

In previous Post Register reporting, BEA has said it disagrees with the filed complaint and "will be strongly defending."

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[14] December 2013 EDI Newsletter article, "How Believable are Estimated Radiological Doses Following Plutonium Inhalation?" by Tami Thatcher. http://www.environmental-defense-institute.org/publications/News.13.Dec.Final..pdf

[15] 42 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended.

On two occasions in 2011, BEA allegedly refused to allow Stanton and Simmons to use lead shielding to protect themselves when handling plutonium, according to the complaint. The two workers "exercised their rights to stop the jobs," according to the complaint.

In October 2011, Stanton and Simmons allegedly were asked to "falsify 25 Type 1 safety procedures on a job that was done the day before." They refused, the complaint said.

In retaliation for the two workers' actions, the complaint alleges, BEA sent them to a psychologist for evaluation, gave them negative performance evaluations and withheld radiation dosage information.

The Department of Labor has a year to investigate the case and report a resolution. "I know it costs a little money to keep us safe, but let's do it," Stanton said.

Section I.C. Experimental Reactors and Atmospheric Releases

The original name for INL was the National Reactor Testing Station (NRTS). The name more accurately characterizes the activities undertaken at the site. Idaho was the proving ground for military and commercial reactor designs. Reactors were deliberately run to high power levels (excursioned [sic] or melted down) to establish operating limit parameters and component durability under accident scenarios (loss-of-coolant). The power stability of different types of fuel, coolant (water, heavy water, nitrogen gas, molten metal sodium, the organic compound terphenl [sic] and their configuration inside the core were also the subject of many tests. "One set of reactors is devoted to finding out how much abuse a reactor can take. The chain reactor is deliberately allowed to get out of control, to see if the reactor will blow up. (One reactor was deliberately blown up , in a chemical, not an atomic explosion several years ago." 1

During INL's six decade + history, experimental nuclear projects contributed significantly to the site's radioactive emissions to the environment. Detailed information about these projects is still largely classified as secret and unavailable to the public. Therefore, the complete history of INL may await an executive order from the President. To his credit, former President Clinton released more information than the previous Presidents; however, the Defense Department (DOD) remains intransigent. Because most of the reactor and fuel reprocessing programs at INL were military related, DOD has claimed jurisdiction over DOE in the declassification decisions. The Air Force has claimed jurisdiction over some of the intentional radioactive releases from the Idaho Chemical Processing Plant (ICPP) now called INTEC during operation Bluenose. The Navy has also blocked information about its Naval Reactors Facility reactor operations, accidents, and environmental contamination. The Navy also claims jurisdiction over the Advanced Test Reactor (ATR) operations to include blocking Defense Nuclear Safety Board's safety reviews.

Attorney Mark Sullivan representing EDI petitioned the Defense Nuclear Facility Safety Board (DFNSB) to conduct a safety analysis of DOE's 60+ year old Advanced Test Reactor at the INL. DFNSB chairman Winokur's reply states: "It is the Board understands that currently the primary defense-related mission of ATR is research and testing of components in support of Naval Nuclear Propulsion Program. Navy nuclear propulsion activities are excluded from the Board's jurisdiction by 42 U.S.C. ss 2286g (1) (A)." 2 The DFNSB is the product of the Federal Facilities Compliance Act passed by Congress to end federal agencies immunity from compliance with environmental laws. Unfortunately, Congress granted the Nuclear Navy an exemption, even from the DFNSB review.

I.C.1 Aircraft Nuclear Propulsion Program

The US Air Force's Aircraft Nuclear Propulsion (ANP) program in the 1950's designed built, and flight tested a nuclear jet powered bomber which employed more than 10,000 workers. The plane was a modified B-36 (called NB-36) built by Convair and flight tested at Carswell Air Force Base in Fort Worth, Texas. Between 1955 and 1957, the NB-36 made 47 test flights. In 21 of these flights, the nuclear jets were operating. This particular prototype was powered by six conventional propeller engines and two nuclear jets powered by a reactor in the fuselage of the bomber. Considerable radiation was released by the unshielded reactor and by the exhaust resulting from the reactor driven jet engine nozzles, which meant the plane was radioactive after each flight. To protect the flight crew from radiation from the reactor, up to 2.5 inches of lead and 17 inches of special rubber were used to line the crew compartment. WFAA-TV's American Portrait program on the "History of the Nuclear Jet Engine" offers original Air Force footage of the NB-36 and related ANP programs including why INL was chosen. The INL hanger built at Test Area North is now used to manufacture depleted armor for tanks. The planed

1 *iNews*, November 7, 2000, pg. 9, a publication of DOE Idaho Operations Office, citing "This is a reprint from the January 1961 issue of Modern Montana, published by Adrian Allen of Missoula Montana. It offers a glimpse of the news media coverage of the INEEL from nearly 40 years ago."

2. Defense Nuclear Facility Safety Board (DNFSB) Chair, Peter Winokur letter to Mark Sullivan, 9/23/10. Also see EDI's Unacceptable Risk at INL's Advanced Test Reactor.

runway at TAN was never built because the program was abruptly canceled because it was considered too dangerous for crew and the region over which it flew in case of the high probability of accidents discussed below.

The Air Force was intent on building a bigger long-range nuclear powered bomber that could stay aloft indefinitely over the North Pole and deliver a nuclear attack on the Soviet Union. Pratt and Whitney, General Electric, and Lockheed were competing for contracts on reactor designs on this next generation of nuclear powered bombers. GE won the contract and proceeded to build and ground test the 44,000 horsepower nuclear jet engines at INL where a 20,000 foot runway was also slated to be built for the plane. The 8-foot concrete shielded hanger for the plane was built at INL's Test Area North where the runway was also to be built. This test program was called the Initial Engine Tests (IET), and it lasted from 1955 through 1961 when it was canceled by President Kennedy. By 1961, the ANP program consumed $4.6 billion. 3 Another analysis in 1995 included all related ANP activities and found the price tag to be over $6 billion. [Wald(b)] Other space related reactor testing programs at INL, however, continued with the SPERT, SNAPTRAN, and NASA's Light-bulb reactor tests.

"The power plant design concept selected for development by the General Electric Company was the direct air cycle turbojet. Air is the only working fluid in this type of system. The reactor receives air from the jet engine compressor, heats it directly, and delivers it to the turbine. The high-temperature air then generates the forward thrust as it exhausts through the engine nozzle." [Wilks]

One Initial Engine Test (IET) series at INL released from April to June of 1956 over 1.9 million curies of activity including significant amounts (453,350 Ci) of Iodides. 4 Between 1956 and 1970, fifty-nine ANP tests released an estimated 4,635,724 curies of radiation. 5 By comparison, the Three Mile Island reactor accident, generally considered this nation's worst nuclear incident, released 15 curies (Ci) of radioactive iodine to the environment. The Centers for Disease Control (CDC) years later years later found that the DOE's Historical Dose Evaluation dose in DOE/ID-12119 had underestimated several IET releases (and others) by a factor of 7, and inadequacies of the radiological release estimates continue to be discovered**.** 6

"The ANP Reactors were direct, open cycled air cooled. This means that air was driven into the jet engine, compressed, passed through the reactor fuel element where heat energy was extracted, and then discharged through the turbine and jet engine nozzle." ... "Any radioactivity leaking from the fuel elements was also discharged to the air stream." 7

Many deliberate fuel element failure tests that block reactor coolant, were conducted to test a full scale aircraft reactor accident. One of these tests went awry resulting in significant portions of reactor core to melt and considerable additional radiation to be released to the environment. [Ibid.] DOE publicly denies that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). 8 The SDA does not meet the Environmental Protection Agency's Subtitle D garbage landfill standards let alone Nuclear Regulatory Commission greater than class C radioactive waste disposal standards. The IET series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." 9 Though two ANP nuclear jet engine shells are on display at the Experimental Breeder Reactor-I, the disposition of the other engines and reactor cores for these engines was to the RWMC. The HTRE experiments included the following:

"HTRE-1. The HTRE-1 reactor operated a modified J47 turbojet engine exclusively on nuclear

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3 . American Portrait, produced by Dallas, TX WFAA-TV's. *American Portrait* program on the "*History of the Nuclear Jet Engine 1993.*

4. DOE-ID-12119@A-114.

5. DOE/ID-12119 @A55

6. See CDC.gov SCA-TR-TASK1-0005 and related documents

7. ERDA-1536@II-239

8. PR-W-79-001 @ 4-1

9. DOE/ID-12119@A-87

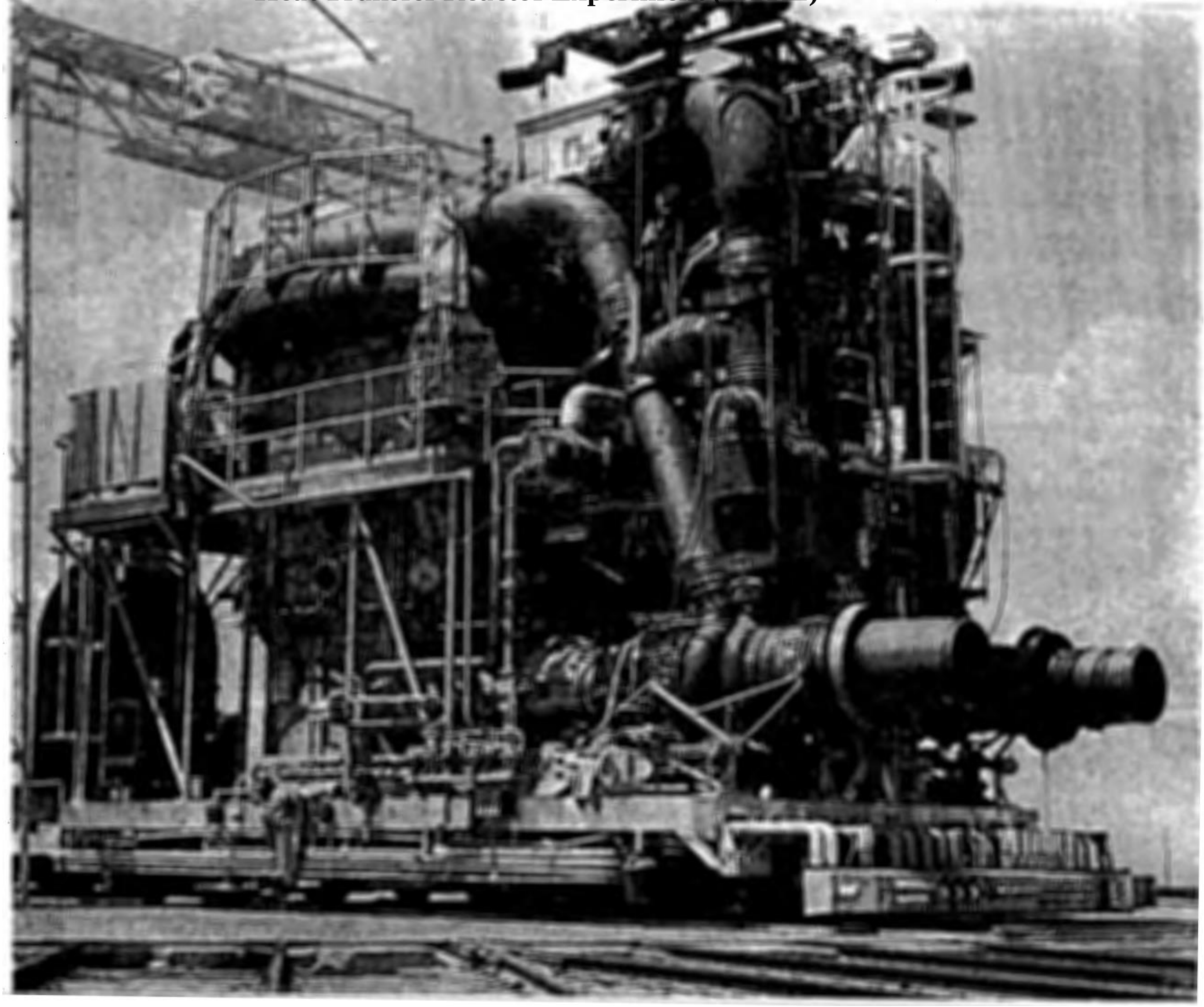
power in January 1956. It accumulated a total of 150.8 hours of operation at high nuclear power levels."

"HTRE-2. The HTRE-2 reactor was a modification of HTRE-1. Testing began in July 1957. The reactor accumulated 1,299 hours of high-power nuclear operation."

"HTRE-3. The HTRE-3 reactor was built in a full-scale aircraft reactor configuration. Two modified J47 turbo jets engines were operated by this reactor. Full nuclear power was achieved in 1959 and the system operated for a total of 126 hours." 10

Aircraft Nuclear Propulsion

Heat Transfer Reactor Experiment (HTRE)



Plane reactor tester. This core test facility at the National Reactor Testing Station, Idaho, was used to carry out the United States first successful ground operation of an airplane jet, engine on power from a nuclear· reactor. At right in picture are modified jet engines which are connected by ducts to the direct-cycle reactor located in the large central tank. Air is passed through the compressor of the jet engine, then to the reactor where it is hented directly by the reactor fuel elements. The heated air then is passed through the engine turbines and out through the engine nozzles at extreme right. The ground test; equipment, is mounted on a dual fln.t car so that, it can be drawn between test and maintenance areas by a shielded locomotive, shown at the extreme left . [USAEC-July-December 1958]

10. RE-P-82-053 p.2 See Reference for full citation.

Knowing full well how hazardous the emissions from these reactors would be, the IET managers built a remote test site called the IET Core Test Facility some distance north of TAN's Technical Support Facility. The two sites were connected by a 4-rail track on which the reactors were moved on rail dollies between test series. The Technical Support Facility Hot Shop assembled and disassembled the reactors. The Core Test Facility (CTF) is where the reactors actually operated. CTF consisted of an underground bunker control building where personnel ran the reactors, and a 214 foot-exhaust duct connected to a 150-foot exhaust stack. The reactors were rolled up to the exhaust duct using a shielded locomotive. When the reactors were operating, a plume rose from the exhaust stack to a height of over 1,200 feet. Jackrabbit thyroids sampled downwind from the IET in March 1958 showed radioactivity at 293,700 disintegrations per minute per gram (d/m/g). 11

The HTRE-2 and 3 were disassembled in the IET Hot Shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350-ton transporter was moved under for shipment to the RWMC burial grounds at INL. Bridges between TAN and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. 12 The 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 and considerable volumes of related radioactive parts were dumped at the RWMC. [See below Section IV(D)] These dumping practices are another reason why the RWMC is a Superfund cleanup site today.

2. Timberwind INL Nuclear Jet Engines

The Strategic Defense Initiative Organization (SDIO) revived the nuclear jet engine project for use in the space program. This new Black Budget program's (code name Timberwind) purpose is to develop the technology and demonstrate the feasibility of a high-temperature particle bed reactor propulsion system to be used to power an advanced nuclear rocket engine. The Strategic Defense Initiative involves orbiting space platforms that theoretically will have the capacity to shoot down missiles launched at the USA. To build these platforms, heavy payloads would have to be launched - requiring powerful rockets. SDIO believes that the nuclear rocket offers a greater thrust to weight ratio than conventional rocket designs.

SDIO generated a secret Environmental Impact Statement (EIS) on Timberwind in 1990. When the existence of this EIS was discovered by the Federation of American Scientists, they demanded that it be released. A declassified Environmental Impact Statement (EIS) was released in 1991, however most substantive (classified) sections have been blacked out (redacted). This violates the intent of the National Environmental Policy Act which requires full disclosure of the environmental impacts of proposed federal activities. The Environmental Defense Institute received a copy of the EIS and commented on it. 13

The Timberwind program was later officially transferred to the Air Force and a new EIS was released in 1992. The 103rd Congress, however, eliminated funding for nuclear rocket program in the FY-1994 budget after spending $464 million. Black Budget projects rarely survive the light of day. The 104th Congress revived the SDI program so Timberwind may also be revived under programs called "Prometheus." Since INL was originally selected as the Timberwind ground test site, it is possible that Idahoans will again be subjected to massive radioactive emissions if the nuclear propulsion part of

11. IDO-12082(58)@74
12. PR-W-79-001 @4-3
13. Comments on Space Nuclear Propulsion Program Environmental Impact Submitted on Behalf of Environmental Defense Institute By Chuck Broscious September 21, 1992 Updated November 2012

SDIO's program is built and tested. The Draft EIS EDI received from SDIO was nearly completely blacked out (redacted). For a more detailed assessment of Timberwind, the Environmental Defense Institute's written comments upon the EIS are available on request.

In other nuclear aircraft related tests, General Electric conducted two open air burning tests on March 20, 1957 of reactor fuel rods to see how much radiation would be released in a nuclear powered plane crash. These tests, called Operation Wiener Roast because of the live animals used to test radiation exposure, also released over 78.3 curies of radiation to the air. [DOE/ID-12119 p. A-55]

US still has plans for nuclear powered planes

According to the *Guardian and The Turkish Weekly* the US still has plans for nuclear powered planes. "The United States is planning to build nuclear-powered drones, which will allow an increase in flying time from days to months without refueling, leaving more power available for operating equipment. The project, developed by the U.S. government's principal nuclear research and development agency Sandia National Laboratories along with defense contractor Northrop Grumman, has not yet reached the building or testing phase, the Guardian has reported."

"The report said the work had been temporarily halted, due to worries that public opinion would not accept the idea. Such a potentially hazardous technology would have the potential hazard of effectively turning into a so-called dirty bomb in the event of a crash, or of its nuclear propulsion system falling into the hands of militants or unfriendly powers. According to a summary of the research published by the Federation of American Scientists, an independent think-tank, computer-based projections were used to test the concepts.

"The summary also stated that the results "were to be used in the next generation of unmanned air vehicles used for military and intelligence applications. It added that "none of the results will be used in the near-term or mid-term future," due to political constraints. The report also compared the future drones with the existing aircraft such as the MQ-9 Reaper, which is used extensively in Afghanistan and Pakistan in operations against insurgents. The Reaper can presently carry nearly two tons of fuel in addition a similar weight of munitions and other equipment and can stay airborne for around 42 hours, or just 14 hours when fully loaded with munitions. Using nuclear power would enable drones not only to remain airborne for far longer, but also to carry more missiles or surveillance equipment, and to dispense with the need for ground crews based in remote and dangerous areas." 14

2. Fission Products Field Release Tests at INL

The US Air Force conducted the Fission Products Field Release Tests (FPFRT) between July and September 1958. "The tests were performed to obtain information for evaluating the release of radioactivity from potential accidents involving nuclear powered aircraft using metallic reactor fuel." 15 These open air, furnace induced hot burns of reactor fuel rods released 502.7 curies of radiation to the atmosphere. 16 [Ibid. p. A-54] "The experiments at Idaho using 'fresh' fuel elements were cooled from 21 days before meltdown, thus losing essentially all of the short lived isotopes of iodine." [Dunning (b)] The Atomic Energy Commission put a limit on the ANP individual releases of iodine at 1500 rads. [Dunning (b)] See ANP Test Table.

3. Special Power Excursion Reactor Tests (SPERT)

The Special Power Excursion Reactor Test (SPERT) reactor test series were "planned integral core destructive tests to investigate the consequences of reactor accidents." [DOE/ID-12119@79] 17 "The accident scenarios tested included reactors suddenly being made greatly supercritical and undergoing a severe power excursion or transient. In just hundredths of a second the power, or fission rate, could leap from zero to billions of watts, with the potential for severe core damage." [Norton]

SPERT-I: Each of the four SPERT reactors was different. "SPERT-I, built in 1954 was the simplest

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14. *US Plans Long Flights with Nuclear-Powered Drones*, Wednesday, 4 April 2012 Turkish Weekly reporting on UK's The Guardian.

15 . DOE-ID-12119 @A-176. See reference at Guide end.

16 . DOE-ID-12119 @ p. A-54.

17. DOE/ID-12119@79

of the four, with a large open tank containing the core and moderator. Before it [SPERT-I] was shut down in 1967, seven different cores had been used in it and more than two thousand power excursions conducted."... "In 1962, it was decided to conduct the ultimate test on SPERT-I. Blow it up, deliberately. It would be an answer to ... how far could you push a highly enriched core in a power excursion?" [Norton] The November 15, 1962 SPERT-I experimental reactor "destruct" test resulted in a release of 240,000 Curies including Iodine. 18 The reactor was placed in an open tank 16 feet deep and 5 feet in diameter. Coolant water was spewed 100 feet in the air in less than one hundredth of a second after the 2 and a half billion watt power surge. Gross reactor damage occurred. Wind direction and the arrival of a monitoring airplane were factors in the timing of the meltdown. [Norton] SPERT-I site would later be used for the Power Burst Facility at INL Auxiliary Reactor Area.

SPERT-II was a scale prototype of a modern nuclear power plant except that it used low pressure and heavy water as a moderator. SPERT-II first went critical in 1959, performed tests for five years, and was retired in 1964. The reactor was remotely controlled from a control center one half mile away. The SPERT-II reactor "destruct test" experiment on November 10, 1963 produced 24,000,000 curies; 530 curies were released including iodine. This was a pressurized heavy water reactor.

SPERT-III was a high temperature; pressurized (2,500 psi) light water reactor built in the late 1950's, went critical in 1958, and was placed on standby in 1968. The April 14, 1964, SPERT-III test released 1900 Ci. to the atmosphere producing a radioactive cloud that was tracked for 2.5 miles. The reactor surged in one hundredth of a second from zero to thirty billion watts. [Norton] Using different cores the reactor continued to run until an accidental melt-down in 1968. [Norton] The SPERT-III site was later to be used for the WERF incinerator.

SPERT-IV, constructed in 1960, and was called a swimming pool reactor; was immersed in a 30 foot diameter tank and was placed on standby in 1970. These tests demonstrated reactor instability and power oscillations. SPERT project manager Boyd Norton acknowledges "...that it got pretty scary in the control room when the power began oscillating out of control and threatened to blow the thing apart. Being at the reactor console was ... a total exercise in sphincter control. SPERT-IV was later converted to the Capsule Drive Core, forerunner of the Power Burst Facility, which was built a few years later." [Norton] What was left of the SPERT reactors and components were buried at the RWMC. [ERDA-1536,p.II-244-246]

4. Space Nuclear Auxiliary Power Transient Tests

SNAPTRAN, The Space Nuclear Auxiliary Power Transient destructive reactor tests were part of the space nuclear power program. A SNAPTRAN reactor was actually launched in 1965. It operated just 43 days before an electrical failure caused it fail and crash in Canada spreading radioactive contamination over a large area. Three SNAPTRAN tests were conducted at Test Area North's IET site. These reactors lacked shielding because of the added weight limitations. 19 The tests were "designed to provide information on the radiological consequences of accidental immersion of a SNAP 2/10A reactor in water or wet earth such as could occur during assembly, transport, or a launch abort." The tests also assessed the "dynamic response fuel behavior, and inherent shutdown mechanisms in an open air environment." [ERDA-1536,@II-247] The SNAPTRAN series in Idaho involved the following tests:

- "A series of tests aimed at providing information about beryllium-replicated reactor performance under atmospheric conditions and assessing hazards during reactor assembly and launch;
- "Nuclear excursions resulting from immersion of the reactor in water or wet earth;
- "Non-destructive tests including static tests and those kinetic tests in which minor damage to the reactor occurred, and
- "Destructive tests in which the reactor was destroyed". [RE-P-82-053,p.3]

The first April 1, 1964 SNAPTRAN destructive reactor test had an energy release of 45 MW-sec. "More than 99% of the fission products were retained in the environmental water and reactor fuel remains" according to ERDA's EIS. 20 [ERDA -1536, p. II-248]. Iodine was assumed to be retained in the

18 . DOE/ID-12119 @ p.79
19 Tami Thatcher, SNAPTRAN research notes 3/12/16.
20 ERDA -1536, p. II-248

water and "only 3% the noble gases" were released, 24,000 curies. Of the 10,000 gallons of water originally in the tank, 9,500 gallons of the highly contaminated water blew out of the test tank when the operators intentionally allowed the reactor to blowup during this underwater test. The radioactive cloud was followed by an airplane for 21 miles before it dissipated. Estimated dose at INL boundary was 10 mRem. Reactor debris was buried at RWMC. [ERDA-1536, .@II-248] The prompt critical, complete destructive test conducted April 1, 1965 with most of the water ejected must have released more radioactivity than stated.

The SNAPTRAN open air destructive test on January 11, 1966 released an energy of 54 MW-sec and exploded spreading reactor fuel 700 feet around the site and released 600,000 curies (Ci) of noble gases including 0.1 Ci I-131. It also created widespread heavy contamination of beryllium on the surrounding ground. The radioactive cloud was followed by aircraft for 19 miles before it was no longer visible. Estimated radiation dose at INL boundary was 10 mRem. Again, reactor debris and 300 cubic yards of contaminated soil were buried at RWMC. [Ibid@II-249] The reported activity of the noble gases included the reduction of assumed radioactive decay during transport from the point of release to the INEL site boundary, thus yielding a reported 4800 curies of release rather than the 600,000 curies of noble gases released. [DOE/ID-12119, p. A-55]

Sometime between the two full destructive SNAPTRAN tests of April 1, 1964 and January 11, 1966, a partial destructive of a third SNAPTRAN core occurred in open-air and unshielded and releases unaccounted for. In the Human Radiation Experiments collection for the SNAPTRAN tests, there is an unsigned draft press release for the middle test which is dated July 1965. The SNAPTRAN tests were conducted at Test Area North (TAN) only a few miles downwind of the Monteview and Mud Lake communities. The SNAPTRAN releases as are other INL releases included in the Human Radiation Experiments collection of documents because of public exposure to radiation without their knowledge or consent.

Former DOE Idaho Operations manager John Horan later worked as a consultant to the site contractor in the 1990s and authored a report of external radiation exposures. In the report he claims he thinks it was an error that so many workers got over 5 rem in the 1960s but then on closer examination can't find an error. He was in charge of safety in the 60s, including keeping tabs on worker radiation doses. So his claimed surprise at the high recorded doses is "incredible." [EGG-CS-11143, 1993] 21

So worker exposure from the SNAPTRAN tests (and other tests) is an issue which the CDC's organization charged with the radiation compensation for DOE Energy Employees, NIOSH, tries to approach from looking at the INEL HDE created for offsite dose evaluation. But the INEL HDE hides much of the problem.

Tami Thatcher reports, following the January 11, 1966 SNAPTRAN-2 test, the reactor dolly was dismantled and the reactor structure and components were removed to the burial ground. "Forty-seven truck-loads of contaminated soil were removed from around the IET area to the CFA burial ground." If you understand how DOE is really not that particular about soil contamination, you know that the soil contamination had to be extraordinarily high even by the monitoring standards of the time. After all, around the BORAX I reactor debris from intentionally blowing it up, later, a few rocks were scattered over the top of it. Decade's later CERCLA reviews found unacceptably high soil contamination problems persisting at TAN where the SNAPTRAN and initial engine tests took place, among others. Coincidentally, the US Geological Survey stopped well water monitoring for the entire north end of the INL from NRF to TAN after 1963 for about a decade**.**" [22]

"The discrepancy between the 2000 curies and the 600,000 curies is said to be due to the decay of

21 J. R. Horan, 'Occupational Radiation Exposure History of the Idaho Field Office Operations at INEL", EGG-CS-1143, October 1993.

22 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. See Table E-5 on p. E-36 for mystery milk and see Table C-21 for the public annual dose summary. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html, reported by Tami Thatcher.

very short-lived noble gases. The INEL [Historical Dose Evaluation] (HDE) (p. A-64) for SNAPTRAN, says they predicted the release of 75 percent of the noble gases, 70 percent of the iodine, 45 percent of the tellurium, 4 percent of the "solids" this being alpha emitters like uranium and plutonium that they would not have monitored and only 21 percent of the fission product inventory**."** 23

While a large fraction of the curies are short-lived. How reliable were the release fraction estimates? And how reliable was the monitoring in the 1960s given the extensive contamination?

ERDA EIS says "only slight ground contamination" plume followed 21 miles but no iodine, only noble gases with only 10 mrem 6 miles at boundary of INL was recorded. [ERDA-1536 p. II-248] 24If the ground contamination was only "slight" then why the multiple truckloads of soil hauled away? And excessive soil contamination found years later in CERCLA reports?

There's the mystery milk in SE Idaho in the 1965 and 1966 documented in Table E-5 of the INEL HDE. But the elevated concentrations of iodine-131 in milk that were not found to be caused by INL or global fallout from nuclear weapons testing may actually be due to weapons testing at the Nevada Test Site that continued despite the 1963 partial weapons testing ban. 25

"There is reporting of fuel processing at the "chem. plant" for two SNAPTRAN tests, but we know there were three. A report of fuel reprocessed at ICPP, later called INTEC, lists the fuel processed at ICPP. In addition to MTR fuel, Hanford fuel, "Zirconium" [likely naval propulsion fuel], Borax, EBR-I, EBR-II, ATR, ETR, Borax IV, SL-1 scrap, SL-1 (fuel not in the reactor at the time of the accident), SPERT, SNAPTRAN 2/10A-3 core debris, SNAPTRAN 2/10-2, and many others. 26

But nothing about the whereabouts of SNAPTRAN 2/10-1 reactor, which operated in the 1964 to 1966 timeframe but was supposedly only slightly damaged but radioactive. In the book "Atomic Accidents" by James Mahaffey, he says he could not find any record of the whereabouts of the 2/10-1 reactor. Confirming its whereabouts would be somewhat helpful but may not help know the extent of understatement of worker and public exposures. 27

Tami Thatcher found in "Susan Stacey's "Proving the Principle," she describes the fact the Idaho tested three SNAP reactors. So there are multiple issues:

- "There is the likely underestimation of the amount of fission products actually released from the two SNAPTRAN destructive tests and the third fuel damage test. Worker and public exposures have likely been underestimated. The 2000 curie vs 600,000 curies is explained by DOE's using only the long-lived noble gases they say blew offsite. But the assumed release fractions are subject to question and the extensive soil contamination decades after the tests speak volumes about DOE's radiation monitoring.
- The worker external as well as internal exposures, especially alpha and beta exposures were likely to have been inadequately monitored and likely not well represented by NIOSH feeble attempts to argue, as they have in person in Idaho Falls, that all radioactivity was timed to blow offsite, so that workers were not exposed.
- The amount of soil contamination that had to be trucked away for disposal points to the

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23 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991, pg. A-64. Reported by Tami Thatcher.

24 ERDA-1536 p. II-248

25 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. See Table E-5 on p. E-36 for mystery milk and see Table C-21 for the public annual dose summary. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html, reported by Tami Thatcher.

26 INEEL Site Report on the Production and Use of Recycled Uranium, L.C.Lewis, D.C.Barg C.L.Bendixsen J.P.Henscheid D.R.Wenzel B.L.Denning, INEEL/EXT-2000-00959, September 2000 http://www.osti.gov/scitech/servlets/purl/768760, reported by Tami Thatcher.

27 Tami Thatcher SNAPTRAN notes 3/12/16

mess and overall monitoring problems. I say this because later CERCLA investigations required hauling more contaminated soil away from TAN. Where was the soil trucked to? DOE's 1960s report says to a CFA landfill. But was it actually trucked to CFA or to RWMC? Some later soil cleanup was hauled to TRA. The soil mess points to lousy overall monitoring especially in those early years which is a public and a worker issue because public roads cross the northern part of the INL near where the SNAPTRAN tests and other ANP tests took place. Soil contamination is also transported by wind to public roads on southern INL site.

 There is also the mystery milk high iodine levels in Idaho Falls in 1965 and 1966 documented in the INL HDE. The elevated iodine-131 levels in milk could be because of the Department of Energy's weapons testing at the Nevada Test Site after the 1963 partial test ban. But the insufficient monitoring and deliberate actions to hide the contamination from the DOE's continued weapons testing may have also hidden excessive radiological releases from the INL fuel testing releases. Theoretical estimates of the radiological releases have generally not been verified by reviews conducted years later." 28

SNAPTRAN Tests

Tami Thatcher writes; "There were three SNAPTRAN tests at INL in the 1960s all conducted at TAN. The INL was given three SNAPTRAN reactors to play with. These were designed as an experimental reactor to launch into space. A SNAPTRAN reactor was actually launched in 1965. It operated just 43 days before an electrical failure caused it (to be shut down?) (Google wiki SNAPTRAN)

These were U-235 cores, 15.6 in. long by 8.8 inches in diameter. (Contrast this to ATR's 4 ft. long, 4 ft. diameter core?) These were thermal power of 30 kW contrast to the Advanced Test Reactor is 250 MW thermal but usually operated at only about 100 MW thermal.

But what matters is the total amount of fissionable material in the core, not the rate at which it was designed to produce power. These had beryllium reflectors and were sodium-potassium Nak cooled.

One of the three did not dismantle or disassemble the reactor core so there's no plume of it mentioned in the ERDA-1536 document or INEL HDE. But apparently it did go critical, become radioactive, and I found somewhere it said "it was only slightly damaged." I can't find where I read that. The thing is that all three would have also been a worker exposure source for TAN workers in the 1960s. And John Horan's report of external radiation exposures in the 1990s, he claims he thinks it was an error that so many workers got over 5 rem but then on closer examination can't find an error. He was in charge of safety in the 60s, including keeping tabs on worker radiation doses. So his claimed surprise at the high recorded doses is "incredible." So one issue is the worker exposure from the SNAPTRAN tests which NIOSH tries to approach from looking at the INEL HDE created for offsite dose evaluation. 29 Thatcher wrote:

> "Following one SNAPTRAN test, the plume was tracked 21 miles by plane. Subsequent monitoring in Monteview, a farming community near TAN at the near end of the INL included cow's milk and alfalfa concluded that the release wasn't above allowable standards but never told residents. The DOE's 1966 report [1] concluded that the release was 20 percent of the total inventory, but it doesn't say what the total inventory was. The INEL Historical Dose Evaluation listed the release on January 11, 1966 as 2000 curies but the DOE's waste document said 600,000 curies. [2] They proceed to say "The SNAPTRAN-2 Reactor Dolly was dismantled and the reactor structure and components were removed to the burial ground. Forty-seven truck-loads of contaminated soil were removed from around the IET area to the CFA burial ground." If you understand how DOE is really not that particular about soil contamination, you know that the soil had to be hotter than hell. Around the BORAX I reactor debris from intentionally blowing it up, later, a few rocks were scattered over the top of it. Decade's later CERCLA reviews found unacceptably high soil contamination problems at TAN where the SNAPTRAN and initial engine tests took place, among others. Coincidentally, the

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28 Tami Thatcher, Nuclear Accident Risks at INL, http://environmental-defense-institute.org/inlrisk.html#Nuclear Accident History at INL.pdf

29 J. R. Horan, "Occupational Radiation Exposure History of the Idaho Field Office Operations at INEL," EGG-CS-11143, October 1993.

US Geological Survey stopped well water monitoring for the entire north end of the INL from NRF to TAN after 1963 for about a decade." 30

The discrepancy between the 2000 curies and the 600,000 curies is said to be because the 2000 curies is the long-lived curies that blew offsite. They are saying that the short-lived curies stayed on-site. And p. A-64 SNAPTRAN, they say released 75 percent of the noble gases, 70 percent of the iodine, 45 percent of the tellurium, 4 percent of the "solids" this being alpha emitters like uranium and plutonium that they would not have monitored for, likely, and only 21 percent of the fission product inventory." Yes, a large fraction of the curies are short-lived. But the longer-lived fission product inventory – how reliable is the 21 percent estimate? How reliable is the solid's 4 percent estimate? Well, these questions take more research and are harder to answer, especially without the environmental monitoring data.

ERDA-1536 p. II-248 says "only slight ground contamination" plume followed 21 miles but no iodine, only noble gases. 10 mrem 6 miles at boundary of INL. If the ground contamination was only "slight" then why the multiple truckloads of soil hauled away? And excessive soil contamination found years later?

4/1/1964 SNAPTRAN-3 Underwater, but steam ejected. 45 MW-sec of nuclear fission. Said to be a fireball. Prompt critical. "Blew up."

1/11/1966 SNAPTRAN-2 54 MW-sec of nuclear fission. Open air test, so no chance of iodine scrubbing from water. But DOE says "once again, the total integrated rad exposure at the nearest boundary was less than 10 mrem."

So, there is an issue about what was actually released by the two destructive SNAPTRAN tests. There's the mystery milk in SE Idaho in the 1965 and 1966 documented in Table E-5 of the INEL HDE. 31

There is an unsigned press release that is part of the DOE's Human Radiation Experiments collection dated July 20, 1965 of a destructive SNAPTRAN test. Why was this press release part of the Human Radiation Experiments collection, since acknowledged tests were not on this date? 32

There is reporting of fuel processing at the "chem. plant" for two SNAPTRAN tests, but we know there were three. This report below has Table V that lists all the fuel processed at ICPP.
In addition to MTR fuel, Hanford fuel, "Zirconium" which is naval propulsion fuel I think, it lists Borax, EBR-I, EBR-II, ATR, ETR, Borax IV, SL-1 scrap, SL-1 (fuel not in the reactor at the time of the accident, I suppose) SPERT, SNAPTRAN 2/10A-3 core debris, SNAPTRAN 2/10-2, and many others. 33

But nothing about the where-abouts of SNAPTRAN 2/10-1, which operated in the 1964 to 1966 timeframe but was supposedly only slightly damaged but radioactive. It makes sense for them to have reprocessed it. In an interesting but unreliable book "Atomic Accidents" by James Mahaffey, he says he could not find any record of the whereabouts of the 2/10-1 reactor. But it is

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30 EDI's website here: http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf

31 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. See Table E-5 on p. E-36 for mystery milk and see Table C-21 for the public annual dose summary. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html

32 See the Department of Energy Human Radiation Experiments documents collection (of the small subset publicly accessible) including J. R. Horan, "Annual Progress Report 1963, Idaho Operations Office of the US Atomic Energy Commission," 1964, and INEL-HRE-TO70228 and the SNAPTRAN collection; http://www4vip.inl.gov/library/searchreadingroom2.shtml

33 INEEL Site Report on the Production and Use of Recycled Uranium, L.C.Lewis, D.C.Barg C.L.Bendixsen J.P.Henscheid D.R.Wenzel B.L.Denning, INEEL/EXT-2000-00959, September 2000 http://www.osti.gov/scitech/servlets/purl/768760

not impossible for them to have shipped it in a shielded cask to another NASA research facility. But unless that facility had a hot cell or spent fuel pool, its seems very unlikely. Confirming its whereabouts would be somewhat helpful but may not help know the extent of understatement of worker and public exposures.

There was an ans.org dinner meeting presentation about SNAP 10A by Schmidt. He says "test shutdown at 10,000 hours in 1966." Was he talking about SNAPTRAN 10A-1, the reactor not blown to smithereens?

Susan Stacey's "Proving the Principle" describes the fact the Idaho tested three SNAP reactors. So, there are multiple issues:

- There's the likely underestimation of the amount of fission products actually released from the two SNAPTRAN destructive tests that exposed the public. I say this because of the mystery milk high iodine levels in Idaho Falls in 1965 and 1966 and because of the likely underestimation of the fraction of inventory released from the fuel by the tests. The 2000 curie vs 600,000 curies are explained by DOE's using only the long-lived fission products they say blew offsite. But the assumed release fractions are subject to question.

- The worker external as well as internal exposures, especially alpha and beta exposures were likely to have not been adequately monitored and likely not well represented by NIOSH feeble attempts to argue, as they have in person in Idaho Falls, that all radioactivity was timed to blow offsite, so that workers were not exposed.

- The amount of soil contamination that had to be trucked away for disposal points to the mess and overall monitoring problems. I say this because later CERCLA investigations required hauling more contaminated soil away from TAN. Where was the soil trucked to? DOE's 1960s report says to a Central Facilities Area (CFA) landfill. But was it actually trucked to CFA or to RWMC? Some later soil cleanup was hauled to TRA. The soil mess points to lousy overall monitoring especially in those early years which is a public and a worker issue.

- Where did the third SNAPTRAN reactor (INL had three of these reactors to play with), where did it end up? My conjecture is that at least one of the destructive tests resulted in no core to reprocess. So it is only conjecture on my part to wonder if the missing SNAPTRAN-10A-1 was actually reprocessed even though the official records say that -2 and -3 were reprocessed."

5. Summary Aircraft Nuclear Propulsion Program and Experimental Reactor INL Tests 1956 to 1969

ANP/Experimental Reactor Test Number	Test Date	Release Quantity (Curies)	Source
IET # 3 HTRE-1	2/11 – 2/24/56	132,000.00	D @ ES-11
IET # 4			
# 4-A-1	5/1 – 5/23/56	7,264.00	D @ ES-13
# 4-B-2	5-24 – 6/29/56	205,772.00	D @ ES-13
# 4-C-3	6/29/56	689,886.00	D @ ES-13
IET # 6	12/18/56	9,000.00	B @ A-202
IET # 8 HTRE-2	7/31 – 8/28/57	1,700.00	B @ A-121
IET # 10-A			
# 10-B	12/20/57 – 2/25/58	2,220,000.00	D @ ES-16
# 10-C	3/1 - 3/6/58	2,740,000.00	D @ ES-16

IET # 11	3/20/58 to 4/14/58	4,635.00	B @ A-128
IET # 12 "Boot"	4/21/58 to 5/7/58	29,070.00	B @ A-132
FPFRT-1	7/25/58	9.80	B @ A-201
FPFRT-2	8/4/58	9.30	B @ A-201
FPFRT-3	8/6/58	9.90	B @ A-200
FPFRT-4	8/14/58	9.60	B @ A-200
FPFRT-5	8/27/58	140.00	B @ A-200
FPFRT-6	9/4/58	115.28	B @ A-200
FPFRT-7	9/17/58	90.79	B @ A-200
FPFRT-8	9/18/58	102.48	B @ A-200
FPFRT-9	9/26/58	10.08	B @ A-200
IET # 13	10/8/58 to 11/18/58	9,730.00	B @ A-137
IET # 14	4/24/59 to 5/19/59	13,456.00	B @ A-139
IET # 15	5/27/59 to 6/24/59	3,178.34	B @ A-199
IET # 16	7/28/59 to 10/28/59	294.42	B @ A-199
IET # 17	11/2/59 to 12/12/59	6,202.00	B @ A-147
IET # 18 "HTRE-3"	12/23/59 to 2/8/60	14,157.30	B @ A-153
IET # 19	2/9/60 to 4/30/60	11,381.00	B @ A-153
IET # 20	5/1/60 to 6/13/60	10,249.00	B @ A-155
IET # 21 "Feet # 1"	6/20/60 to 8/8/60	3,752.00	B @ A-158
IET # 22	8/12/60 to 8/25/60	10,526.80	B @ A-160
IET # 23 "Feet #2"	9/1/60 to 10/14/60	2,890.00	B @ A-163
IET # 24 "Lime"	10/17/60 to 10/26/60	7,725.90	B @ A-165
IET # 25	11/15/60 to 12/16/60	10,171.26	B @ A-197
IET # 26	12/22/61 to 3/31/61	12,110.00	B @A-173
SPERT-1	11/5/62	240,000.00	B @ A-79
SPERT-2	11/10/63	530.00	A @ II-246
SPERT-3	4/14/64	1,900.00	A @ II-244
SNAPTRAN-2-10-3	4/1/64	24,000.00	A @ II-248
SNAPTRAN-10A-1	7/20/65?	?	?
SNAPTRAN-2-10-2	1/11/66	600,000.00	A @ II-249
7 Module # 1168 to # 1183	1967 to 1968	?	C @ 29 to 116
3 Module # 1185 to # 1192	1969	?	C @ 165 to 179
Total # Tests > 59		**Total Curies* 7,021,878.25**	
Total Uranium Released		**1,635.82 grams**	

Acronyms: IET = Initial Engine Test; FPFRT = Fission Product Field Release Test; SPERT- Special Power Excursion Reactor Test; SNAPTRAN = Special Nuclear Auxiliary Power Transient; Modular - NASA's Modular Cavity or "Light Bulb" Reactor.

* Only hot run tests are listed in the table above, therefore, missing test numbers indicate cold runs. Curie content of uranium released is not included in the total curies released. Releases for the 7 &3 Module are not yet fully

analyzed. Between 1956 and 1966 the ANP reactors operated in excess of 3,064.24 hours. During this time the reactors were operated at high power for 1,575.8 hours.
Resources for above table: [DOE/ID-12119] [PG-WM-85-008 @2-3] Table sources: [A - ERDA-1536]; [B - DOE/ID-12219]; [C - IN-1376]; [D - Critical Review of Source Terms for Select Initial Engine Tests Associated with the Aircraft Nuclear Propulsion Program at INEL, CDC, 7/03.

Other nuclear jet engine projects that impacted INL were ground tested in Nevada. [Times News10/15/90] The nation's first nuclear-powered rocket engine, Kiwi-A, first fired for five minutes in July 1959 at the Nuclear Rocket Development Station about 100 miles northwest of Los Vegas. Several Kiwi-A's were test fired throwing smoke and dust hundreds of feet into the air. In a 2012 news article about *US Plans Long Flights with Nuclear-Powered Drones* it states*:*

> "Hoping to keep drones in the air for a longer period of time in order to leave more power available for operating equipment, the US plans to build nuclear-powered drones that can fly for months.
>
> "The United States is planning to build nuclear-powered drones, which will allow an increase in flying time from days to months without refueling, leaving more power available for operating equipment. The project, developed by the U.S. government's principal nuclear research and development agency Sandia National Laboratories along with defense contractor Northrop Grumman, has not yet reached the building or testing phase, the Guardian has reported.
>
> "According to the report, the project sets out to solve three problems associated with drones: insufficient "hang time" over a potential target, lack of power for running sophisticated surveillance and weapons systems, and lack of communications capacity. The research team found that nuclear drones were able to provide far more surveillance time and intelligence information per mission compared to other technologies, and also to reduce the considerable costs of support systems, eliminating the need for forward bases and fuel supplies in remote and possibly hostile areas." 34

6. **ROVER Reactor Tests at** Nevada Nuclear Rocket Development Station; "The remains of the reactors from the development project collectively called the ROVER project are among the highly radioactive wastes stored at the INL's ICPP." [Ibid.] ICPP also had a ROVER fuel reprocessing building that has been identified in DOE's Highly Enriched Uranium vulnerability report as having criticality problems. Also see Section I.D.2 Post RaLa ICPP Releases pg. 12 for more Rover discussion.

In 1972, after the ROVER program had shut down, 26,000 fuel elements were shipped from Jackass Flats, Nevada to INL. About 18,000 rods of ROVER program fuel were eventually processed at the ICPP between April 1983 and June 1984 removing about 3,200 kilograms of highly enriched uranium.[Times News10/15/90]

The reprocessing of ROVER fuel was discontinued because burning the graphite off the fuel plugged up the off-gas systems and dissolved fuel raffinate plugged up process lines. These plugged lines remain today as they were left at the end of the program. "For the contractor slated to deactivate the ROVER Facility...criticality risks are of paramount concern. The ROVER Facility which was shut down in 1984, houses a substantial amount of uranium in its processing lines, vessels, and related equipment." [EM Progress, Winter 1996]

Workers attempting to decontaminate the ICPP ROVER fuel burn cells in 1984 received significant exposures because the graphite plugged face masks and seeped into protective suits. Management refused to provide workers with pressurized air lines and suits so the workers refused to reenter the ROVER cells. After a dozen years and a belated commitment of over $23 million, DOE is finally willing to address this lingering criticality hazard.

The NERVA (Nuclear Engine for Rocket Vehicle Application) - engine, later developed by Aerojet-General and Westinghouse Electric, was designed to propel a rocket or space vehicle once it escapes the earth's atmosphere. The heart of the engine is a little reactor that uses small ceramic-coated fuel pellets imbedded in graphite. The reactor heated liquid hydrogen, causing it to expand and turn to

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34 *US Plans Long Flights with Nuclear-Powered Drones*, Wednesday, 4 April 2012 Turkish Weekly

gas. The rapid expansion provided the propelling force of the engine. [Times News10/15/90] [Also see Timberwind]

Centaurus Program: Budget disputes in 1991 over the Strategic Defense Initiative revealed a secret program called Centaurus at INL. Bill Thielbahr, director of DOE Idaho's energy technology division, acknowledged the difficulties of gaining continued Congressional funding for the $3 million annual requirements of the project. Thielbahr described the Centaurus as a "nuclear-pumped laser" testing program. The work could include studying methods to recover safely some space debris and new systems to produce electrical power. This INL research team consisted of about 20 workers. The $4 million total proposed for INL research is uncertain, since both chambers of Congress have voted to cut the 1991 SDI budget by at least $1 billion. [AP (k)]

The basic SDI concept is a space-based network of nuclear powered lasers that could shoot down missiles launched at the United States. This secret program has never had any publicly available environmental monitoring data, which is a repetition of decades of non-accountability fostered by classified Black Budget projects.

7. Atmospheric Release Experiments

OMRE Solvent Burning Experiment on November 16, 1960 was conducted to "determine the feasibility of open-air burning of contaminated solvents accumulated at the Organic Moderated Reactor Experiment (OMRE) facility. 400 gallons of radioactive solvents were placed in an open vessel and ignited." [DOE/ID-12119 @A-173]

CERT Tests: Other "human guinea pig" experiments were carried out just to see how Iodine-131 is absorbed in humans and disperses in the surrounding ground. Twenty-nine Controlled Environmental Radio-iodine Test (CERT) between May 1963 and December 1977 released over 32.72 Ci including 26 Curies of Iodine-131 to the environment. [ERDA-1536@II-250]& [DOE/ID-12119]

"On three of these CERT releases, human subjects were deliberately exposed. The general design was that radioactive iodine was released in gaseous form, and prevailing winds took the iodine over an area designated the 'hot pasture.' Monitoring devices in the pasture determined the radioactivity deposited. A herd of cows was then led to the pasture to graze for several days. The cows were milked and the milk monitored for Radio iodine. Humans were exposed either by drinking the milk or by direct exposure to the released iodine gas. During CERT-1, conducted in May 1963, one curie of radioactive iodine was released into the hot pasture. Six cows were placed in the contaminated pasture. Cows were milked twice a day and the milk from one cow saved for human ingestion. Seven human subjects each drank 0.5 liter of radioactive milk over a period of 18 days. Radioactive iodine uptake was determined by counting the radioactivity absorbed in the thyroid of each subject." [IDO-12053]

CERT-2 was conducted in September 1964. Approximately one curie of radioactive iodine was again released over the hot pasture. Milk samples were again tested, but were not consumed by humans. Instead, three human subjects were placed on the pasture during iodine release, and the radiation accumulated in their thyroids was counted after exposure. This was not a food chain experiment, but was designed to measure the direct iodine dose from inhalation. During CERT-6 conducted in the summer of 1965, several vials of Radio iodine were broken and the contents (2-6 curies) released to the environment. [IDO-12053, 8/66 @2] "Several individuals were inadvertently exposed to airborne Radio iodine from the leaking and broken containers, and efforts were made to obtain data on the retention of this form of iodine in humans." [Ibid. @2]

These CERT exposures occurred over a four-day period, and a few people received multiple exposures; radiation accumulation in the thyroids of these individuals was counted. CERT-7 was conducted in November 1965; 1 curie of I-131 in the gaseous molecular form was released over the pasture at the INL Experimental Dairy Farm. Six cows grazed, and milk samples were counted. In addition, seven human 'volunteers' were placed seated on the pasture area. Uptake of radioactive material was determined by counting the subject's thyroids. "DOE reported to the Subcommittee that no medical follow up of the experimental subjects in the CERT tests was performed." Through the course of the CERT tests, twenty one individuals were exposed. [Congressional Research Service, 5-156 @ 22- 24]

8. Human Radiation Experiments

"From 1963 to 1965, at the Atomic Energy Commission National Reactor Testing Station in Idaho, [now called Idaho National Laboratory] radioactive iodine was purposely released on seven separate occasions. In one of these experiments, seven human subjects drank milk from cows which had grazed on iodine-contaminated land. This experiment was designed to measure the passage of iodine through the food chain into the thyroids of human subjects. In a second experiment, three human subjects were placed on the pasture during iodine release, and seven subjects were placed on the pasture in a third experiment. In addition, 'several' individuals were contaminated during yet another experiment when vials of radio-active iodine accidentally broke. Cows grazed on contaminated land and their milk was counted in four of the experiments; in the remaining three, radiation measurements were made only in the pasture." 35

"Between 1965 and 1972, 8 individuals were involved in 13 different human experiments. All eight were employees of the Idaho Division of the Atomic Energy Commission. In four experiments, subjects inhaled Argon-41; in nine experiments, subjects swallowed capsules containing micro curie amounts of radioactivity. These experiments were funded and carried out by the Atomic Energy Commission. The objective of this experiment was to calibrate instruments that measure radioactive substances inside the human body; such instruments are usually used to examine workers accidentally exposed or hospital patients receiving radioactive material for diagnostic purposes. A second objective of the experiments was to examine the metabolism of radionuclides ingested or inhaled by humans. In the first set of experiments, one subject was fed one micro curie of Manganese-54; another subject was fed an unspecified amount of Iodine-131. In a second set of experiments, individual subjects were fed 3.5 micro curie of Cesium-132, 1.9 micro curie of Potassium-42, or 1.1 micro curie of Manganese-54. In addition, 4 subjects inhaled Argon-41 in amounts of 1.3 to 2.2 micro curie. In a third experiment, one subject was fed 1.5 micro curie of Cobalt-60 and Cesium-137. The Department of Energy reported there was no medical follow up of any of these experimental subjects." [Congressional Research Service, 5-156 @ 35-36]

Intentional releases of Iodine-129 into the environment referred to as the Iodine-129 Technology Studies took place in August 1964. The studies were a collaborative effort of the US Weather Bureau Research Station at the INL and the Nuclear Science and Engineering Corporation of Pittsburgh, PA. The Iodine-129 Technology Studies were conducted to examine the atmospheric mixing and dilution of gases and particles containing small amounts of Iodine-129. There were a total of five tests: two with particles, one with gases, and two more with particles and gases combined. The first three tests were sampled to distances of about 10 miles over a densely instrumented grid located in the center of the INL site. The last two tests were sampled at distances of 25 to 35 miles in off-site areas to the north-east of the point of release. One mill curie of iodine-129 was released during the experiment. [DOE News, 7/31/95]

The 17-million year half-life of Iodine-129 plus its ability to enter the food chain and subsequently concentrate in the thyroid makes this isotope especially toxic for perpetuity.

The Atomic Energy Commission (AEC) also collected human body parts that were used in radiation experiments from hospitals in the Idaho Falls area. Between 1954 and 1955, five samples of human bone obtained at surgery or autopsy from local hospitals were analytically compared with measurements of radioactivity in animals located at the INL.

According to the US General Accounting Office report titled "*Information on DOE's Human Tissue Analysis Work*", the human bone samples appear to have been analyzed for two radioactive elements, strontium and yttrium. In other studies between 1968 and 1970 skin from amputated limbs and other surgical procedures was obtained from various hospitals in the Idaho Falls area. The study's ultimate objectives were to apply radioactive iodine to the human skin to evaluate the hazards caused by iodine permeation. The principal goals of the program were to establish procedures for making accurate predictions of the thyroid dose that would result from an accidental iodine exposure. Other goals were to help in selecting iodine impermeable materials for protective clothing and to develop improved decontamination procedures. In both of these studies informed consent was **not** obtained from the

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35 Congressional Hearings On Radiation Experiments**.** For Briefing Book Volume 1, February 10, 1994. http://www2.gwu.edu/~nsarchiv/radiation/dir/mstreet/commeet/meet1/brief1/br1n.txt

patients and/or family by the researchers. [GAO/RCED-95-109FS@39]

Long Distance Diffusion Tests (LDDT) included three between March 1971 and August 1972 were conducted by the National Oceanic and Atmospheric Administration and the Health Services Lab at INL. These tests released 1000 Ci of Krypton-85 and 12.3 Ci of Iodine-131 into the atmosphere. The stated purpose of these tests was to see how these radionuclides disperse in the atmosphere. [DOE/ID-12119@A-59] For perspective, the Three Mile Island nuclear accident released more than 15 curies of Iodine-131.

Experimental Cloud Exposure Study included 9 tests, appropriately named EXCES, released between May 1968 and April 1970, 987 Ci of Xenon-133 and Sodium-24.[DOE/ID-12119.@A-61]

Relative Diffusion Tests: Another air dispersion testing series called Relative Diffusion Tests (RDT) released 10.4 Ci of Iodine-131 between November 1967 to October 1969. [Ibid]

Army Gas Cooled Reactor Experiment: The U.S. Army built support structures and reactors at the INL Auxiliary Reactor Area (ARA) between 1957 and 1965 when the program was phased out. ARA was divided into four areas (I through IV). ARA-I acted as support facility for the other ARA sites. ARA-III originally housed the Army Gas Cooled Reactor Experiment (AGCRE), water moderated, nitrogen-cooled reactor that generated heat but no electricity and was finally placed on standby on April 6, 1961. After the Army vacated ARA, the buildings were used for various INL projects such as sensor fabrication, experimental instrumentation, and a metallurgical laboratory for nuclear reactor experiments. In 1965, the U.S. Army built the ARVF in the center of INL. "The facility consisted of a test pit, an underground bunker, and a system of pulleys and cables. The steel-lined, open-top test pit was filled with water into which nuclear fuel elements were placed." [DOE/EH/OEV-22-P @2-39]

Presumably, the tests were done to create an accident scenario of a nuclear plane or satellite crash and the resulting radioactive releases to the crash site. In 1974, "four drums of radioactively contaminated NaK from ERB-1 were placed in the bunker, where they remain today. In 1980, a protective shed and crane were built above the pit, and in 1980-81 a series of explosive tests were conducted in the pit." [DOE/EH/OEV-22-P @2-39]

Loss-of Fluid Tests (LOFT): INL has a long history of intentional reactor melt-downs that were conducted to test the operating parameters of military and civilian reactor designs. The Loss-of Fluid Tests (LOFT) were conducted at INL's Test Area North (TAN) beginning in late 1977 and ending in 1985 costing over $350 million.[Norton] As the name suggests, the purpose of LOFT was to test the effects of loss of coolant to a reactor, damage to fuel, and related reactor systems. DOE acknowledges eight LOFT test series over this period. [DOE-ID-12119@A-57]

The main components of the LOFT facility were the Mobile Test Assembly that was a large four rail dolly capable of moving the reactor between the TAN Technical Support Facility (TSF) Hot Cell and the test pad containment vessel. The Hot Cell assembled the reactor on the rail dolly, which then transported it to the test pad.

The LOFT test pad containment structure is 70 feet wide and 129 feet high with huge doors to allow the reactor and rail dolly to move in and out. As with the ANP, the tests were conducted at a site removed from the main TAN support area because of the known hazards. After the test run, the rail dolly was moved by a shielded locomotive back to the TSF Hot Cell for disassembly and inspection. After the reactor components were inspected, they were transported to INL's RWMC burial ground for shallow disposal. [ERDA-1536 @II-123]

A "blow-down emission suppression system" in the LOFT containment structure was intended to catch steam and water ejected during the intentional melt-downs resulting from loss of coolant. A 150-foot stack was used to exhaust the effluent into the atmosphere. ERDA's "conservatively estimated airborne radioactivity releases from LOFT experiments" were 941,912 Ci per year which includes stack emissions and containment structure leakage. [ERDA-1536 @II-118] Annual solid radioactive waste generated by LOFT contained 27,000 Ci. [Ibid @ II-124] The last LOFT experiment (LP-FP-2) on July 9, 1985 released 8,800 Ci plus 0.09 Ci of Iodine. [DOE/ID-12119 @A-52]

These releases were done with full knowledge of the implicit hazards of radioactive emissions. "In 1950 the 'destructive force of the atom and the harmful effects of radiation' were basically understood." [DOE-ID-12119@A-50] Yet, no public announcements or warnings were ever given to the public so that they could take some measure of precaution.

Indeed, INL operations were shrouded in absolute secrecy. Only recently have public interest groups had some limited success in gaining access to historical records through the Freedom of Information Act. Today, the vast majority of the most revealing documentation is still classified, technically unavailable in contractor files, or intentionally destroyed. DOE and Department of Defense's (DOD) claims of national security concerning the declassification of fifty-year old radiation release documents is not justified. DOE and DOD have yet to offer guarantees to agencies of the US Health and Human Services conducting health studies at INL that all operating history documents will be declassified. Moreover, DOE delayed for two years granting security clearances to CDC/NIOSH public health agency researchers after destroying documentation needed to assess the radiation effects in the INL Dose Reconstruction Study.

Bluenose Releases

In the late 1940s and 1950s a U. S. Atomic Energy Commission (AEC) and U.S. Air Force secret program code named Operation Bluenose attempted to determine Soviet plutonium production levels by analysis of fission product gases released during the reprocessing of reactor fuel. To test the instruments in their U-2 spy planes, the Air Force requested that large amounts of radiation be released from the Hanford, Washington and Oak Ridge, Tennessee process facilities. The Hanford Education Action League (HEAL) received a DOE document through the Freedom of Information Act (FOIA) describing the releases. "The April 1949 report obtained by HEAL recommends that another test be conducted at Hanford that would release more radiation and also suggests that the plant filters be disconnected. This was done for the Green Run experiment." [HEAL (d)]

The CDC managed Hanford Environmental Dose Reconstruction Health Study determined that the Green Runs released 740,000 curies of Iodine-131. The Richland Washington Tri-City Herald offered the following interpretation:

"In the 1940s Walt Singlevich headed a classified program known as Operation Bluenose whose object was to determine soviet plutonium production by analysis of fission product gases given off during the reprocessing of reactor fuel." "The 340,000 curies intentionally released [from Hanford] in 1949 were part of this test program. This release was achieved by hauling 'green' irradiated fuel from the 100 area over to the 200-B Plant were it was dissolved in nitric acid and 'some purple iodine was vented up the stack'. It was later found that I-131 was not an accurate indicator of plutonium processing through-put. The noble gas Krypton-85 was found to be the only isotope which could not be removed from the off-gases and that is what Francis Gary Powers was sampling in 1960 when he was downed by the Soviets. His U-2 spy plane had a Cold Finger sampler in-take on its wingtip to sample air at 100,000 feet over the USSR for its Kr-85 content." [Tri-City Herald]

Michael D' Antonio's book *Atomic Harvest* notes a series of articles in the Portland Oregonian newspaper that interviewed Carl Gamertsfelder, a retired Hanford radiation control manager who was at the site during the infamous "Green Runs." Gamertsfelder seems to corroborate the above *Tri-City Harold* article. According to D' Antonio, Gamertsfelder's characterization of the "Green Runs" in the following way.

"It had related to the intrigue and espionage of the Cold War. The United States had been trying to spy on Soviet weapons factories from the stratospheric perspective of exotic surveillance aircraft. The aircraft, and monitoring stations at sites bordering the Soviet Union, could be equipped with devices that would measure the pollution coming out of Russian plutonium plants. But in order to know how the emissions related to the volume of uranium being processed, the Americans needed to simulate Soviet manufacturing methods. To do this, they ran the [Hanford] T-Plant Soviet style, shortening the cooling period and allowing higher levels of pollution. They then measured off-site radiation and worked out a formula that would turn readings from monitoring devices into estimates of the enemy's bomb-production rate. Since the Soviets processed green uranium, in order to stay competitive in the arms race, Hanford had to conduct a Green Run too. Of course, without documentation, no one could be sure that this explanation was accurate. Years later, HEAL would continue to suggest that there was more to the story. Jim Thomas theorized that the US scientists have to perform the Green Run in the way they did because their instruments were not sensitive enough to detect the small emissions." [D' Antonio@125]

Secret document titles obtained during the Hanford Environmental Dose Reconstruction suggest that the INL's ICPP was involved in this Bluenose program in the 1950s. The focus on Kr-85 is confirmed in a United States Government Office Memorandum titled Bluenose and Other Matters that was the transmittal document conveying the attached "Critique of Possible Methods of Computing the Amount of American Kr-85 in the Atmosphere." [HAN-40477]

The INL Research Bureau (IRB) submitted a Freedom of Information Act (FOIA) request to both Hanford and INL for release of these documents. 36 Though Hanford did send copies of some of the formerly secret documents, INL refuses to declassify these forty-year-old documents because of "national security." In a formerly secret memorandum from Paul G. Holsted, Chief of Planning and Reports Branch, Hanford Operations Division, titled "Review of Bluenose Program" dated May 26, 1955, Holsted notes the following:

> "General Electric Company has been requested by the [AEC] Division of Research to make release calculations to cover operations of the ICPP at Arco. This work has not yet started although many Kgs of U-235 have been recovered. GE had indicated that it would be willing to do the calculations but that further information would be necessary before it could start. This program was discussed briefly and GE is now ready to start the work." [HAN-59174@4]

The Bluenose program precisely irradiated U-235 slugs under highly controlled reactor conditions by AEC prime contractor General Electric Hanford Atomic Products Operation. [HAN-58767] The slugs were shipped from Hanford to other sites where the slugs were dissolved in nitric acid and the gases allowed to escape. These other sites identified are Savannah River, Oak Ridge, Argonne National Laboratory, Knolls Atomic Power Laboratory, Brookhaven National Laboratory, and National Reactor Testing Station (now INL). [HAN-59174@][HAN-401931

Hanford has the INL release data related to the Bluenose program but refuses to release the documents, referring the Environmental Defense Institute (EDI) to INL who also refuses to release the documents. Dr. Charles Miller, Centers for Disease Control, Environmental Health Physicist, has a Q-security clearance and was shown a secret Bluenose document at INL. Dr. Miller's security cleared characterization of the document is that it had nothing to do with releases but was related to shipping of nuclear materials between sites. Verbatim transcript of the May 25, 1994 meeting of a CDC INL Health Advisory Board meeting states the following exchange between CDC's Charles Miller and the author:

> "Mr. Miller: Let me tell you what I can tell you legally, I'm reading my notes very carefully because they have been approved. Bluenose was a measurement program, measurement of analytical samples. It did involve the shipment of what are called limited quantities. Now that is not a judgment [sic] on the part of anybody, that's a legal definition as defined by the U.S. Department of Transportation, a limited quantity of radioactive material. And it did involve the shipment of these limited quantities between DOE sites. There were no releases associated with the project. It was not a release project. INEL has been involved since 1970 and everything else was classified."
>
> "Mr. Broscious: Was it [Bluenose] the Air Force that was involved in it?"
>
> "Mr. Miller: I can't answer that."
>
> "Mr. Broscious: so are they going to declassify that information?"
>
> "Mr. Miller: I would say absolutely no way."
>
> "Mr. Broscious: No way?"
>
> "Mr. Miller: No way." [CDC (d)@175]

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36 The INL Research Bureau (IRB) was a coalition of 12 environmental groups formed by EDI to challenge DOE, DOT and the Air Force refusal to release environmental, health and safety documents on the grounds that "It was not in the public interest." IRB appealed and DOE was ordered to release the documents. Having lost their appeal, DOE then tried to charge the IRB over $2 million for copy/costs but again lost IRB's appeal were forced to deliver the documents.

Dr. Miller concluded that the Bluenose program was not a relevant issue to the INL Dose Reconstruction Study because he was convinced no releases occurred. It is entirely possible that the Bluenose document Dr. Miller was shown only dealt with transporting the Hanford irradiated U-235 slugs to INL. However other declassified documents released under FOIA to EDI clearly show the Bluenose program objectives for releases at numerous chemical processing sites around the country including INL. For instance a document titled "Reporting Bluenose Releases" from S. G. English, Chief, Chemistry Branch, Division of Research, and Washington to G. Victor Board, Director, Health and Safety Division, Idaho Operations Office, Idaho Falls states: "Enclosed for your information are the November reports on the dissolving at the ICPP." [HAN-64357]

Another declassified March 18, 1955 memo between AEC Washington, D.C. and Hanford titled Preparation of ICPP Release Data states: "Your wire of January 27, 1955, requested a review of the feasibility of having General Electric perform calculations on krypton releases from the ICPP plant at Arco." [HA-58488]

Jim Thomas, then with a law firm involved in a Hanford Downwinders class action suit against DOE still believes that the U.S. efforts to determine Soviet plutonium production rates first tried iodine releases and switched to Krypton-85 because it was more reliable. They used atmospheric inventories of Kr-85 through known U.S. and Allied releases and subtracted that sum from the global total to determine the Soviet production levels.

It appears that through ineptitude or conspiracy, CDC has allowed DOE to hide relevant information needed to establish radioactive releases from INL. These Bluenose revelations strike at the very core of public confidence in CDC's political will to conduct good science. Before a scientific finding can have any credibility in the real world the methodology and supporting data must be reviewed and the method replicated by other independent scientists. As long as information remains classified, independent researchers cannot review the source information that CDC relied on to do the INL Dose Reconstruction health study, and therefore cannot replicate the science. The public will remain justifiably skeptical as long as fundamental scientific method is not followed.

The INL Research Bureau (IRB), a coalition sponsored by the Environmental Defense Institute, filed a Freedom of Information Act (FOIA) request to DOE Richland Operations Office in September for copies of documents identified during the Hanford Dose Reconstruction. The Department's October 24th response was: "We have conducted a thorough search of the Department of Energy's Richland Operations Office (RL) and contractor offices and the following documents were not located." "Therefore, this portion of your request must be denied." Twenty seven documents were listed as lost.

The IRB's appeal to DOE's Office of Hearings and Appeals in Washington, DC notes that "if indeed the requested documents are no longer in existence, the more serious implications of document destruction raises issues of Department non-compliance with United States Code, Title 44 Chapter 31 "Records Management by Federal Agencies"; Chapter 33, "Disposal of Records"; Code of Federal Regulations, 36 CFR, Chapter XII, Subchapter B, "Records Management"; 41 CFR Chapter 201, "Agency Programs"; DOE Order 200.1; and Secretary of Energy memorandums dated March 26, 1990, and January 13, 1994 mandating the retention of epidemiological and other related health study records. The IRB requested that DOE stipulate the fate of these 'not located' records."

The reason these INL documents were at Hanford is both sites were involved in Operation Bluenose. In the 1950's, the Air Force 's U-2 spy plane would fly over the Soviet nuclear production sites, take pictures and take air monitoring samples. In order for the air samples to be useful, the instruments had to be calibrated. As previously noted, intentionally large amounts of fission products including Iodine-131 and later Krypton-85 were released from Hanford, INL and other US production sites and over flown by the U-2 planes. Since The US throughput (production rate) was known, the air sample instruments could be calibrated.

Hanford, being the older AEC sibling, was also involved in INL's start up. INL's original name was the National Reactor Testing Station which more accurately characterizes its five decade mission. No other site has had a more diverse range of reactor operations. Because of this diversity, documents needed for a dose reconstruction study are spread out over the country at different sites and archives. Preservation of these records is essential until after the dose reconstruction studies are completed and all challenges resolved.

Missing documents are not the only problem researchers face. DOE's response to a June INL Research Bureau Freedom of Information Act request was to black out the important parts of the report. These documents quantified the amount of krypton-85 that was released from INL in support of the 1956 Bluenose project. DOE justified deleting the amount of krypton that was released by stating that:

"The Atomic Energy Act of 1954 prohibits the disclosure of information concerning atomic energy defense programs that is classified as Restricted Data pursuant to the Atomic Energy Act. The portions deleted from the subject documents pursuant to exemption 3 contain information about nuclear weapons design that has been classified as Restricted Data. Disclosure of the exempt data could jeopardize the common defense and the security of the nation." [DOE-9/23/97]

The only credible aspect of national security in jeopardy is the American public's confidence in its government to tell the truth. It is ludicrous to suggest that a person could figure out how to make a bomb from knowing how much iodine and krypton INL released over forty years ago. People living downwind or downstream have a right to know the truth about how these government activities affected their lives.

9. Incomplete Summary of INL Radioactive Releases to Atmosphere

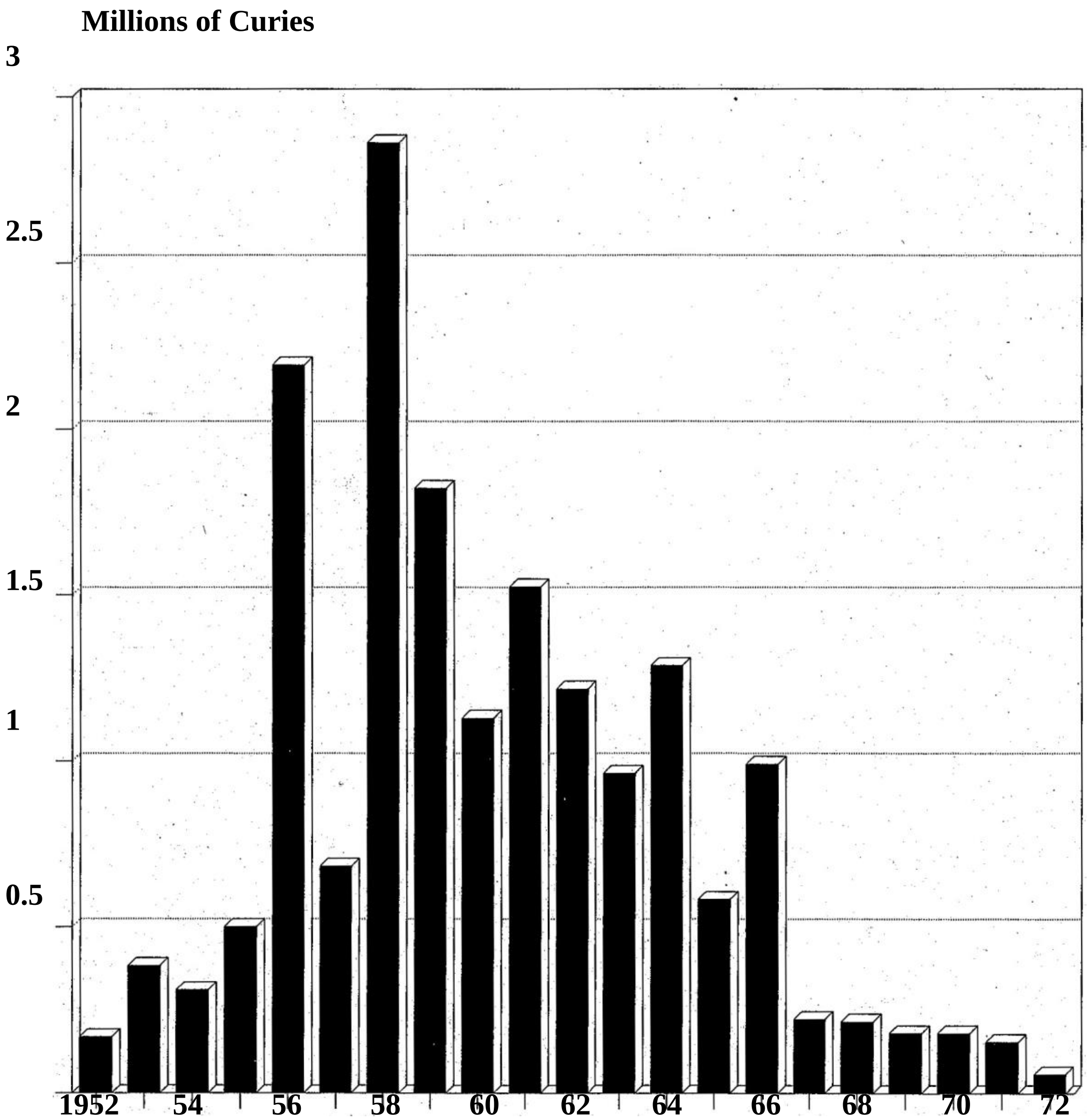
Facility	Date	Curies Released	Source
Naval Reactor Facility*	6/18/55	305	A @ A-203
ERB-1	11/29/55	single excursion	LA-13638
INTEC/ICPP*	10/58	1,200	B @ C-3
INTEC/ICPP*	10/16/59	367,717	A @ A-99
INTEC/ICPP*	1/25/61	5,200	B @ C-5
SL-1*	1/3/61	1,128	A @ A-196
BORAX-1*	7/22/54	714	A @ A-203
Aircraft Nuclear Propulsion*	1956-66	4,635,724	see ANP table
Other INL Operational Release	1952-89	13,552,880	A @ A-189
Total Air Release	1952-98	18,564,868	

Sources: (A) DOE/ID-12119; (B) ERDA-1536; Los Alamos National Laboratory, LANL LA-13638

* ICPP is now called INTEC. Significant episodic releases not included in general INL operational releases to the atmosphere. Curie releases less than 0.1 were not added in this summary and are considered understated due to lack of information.

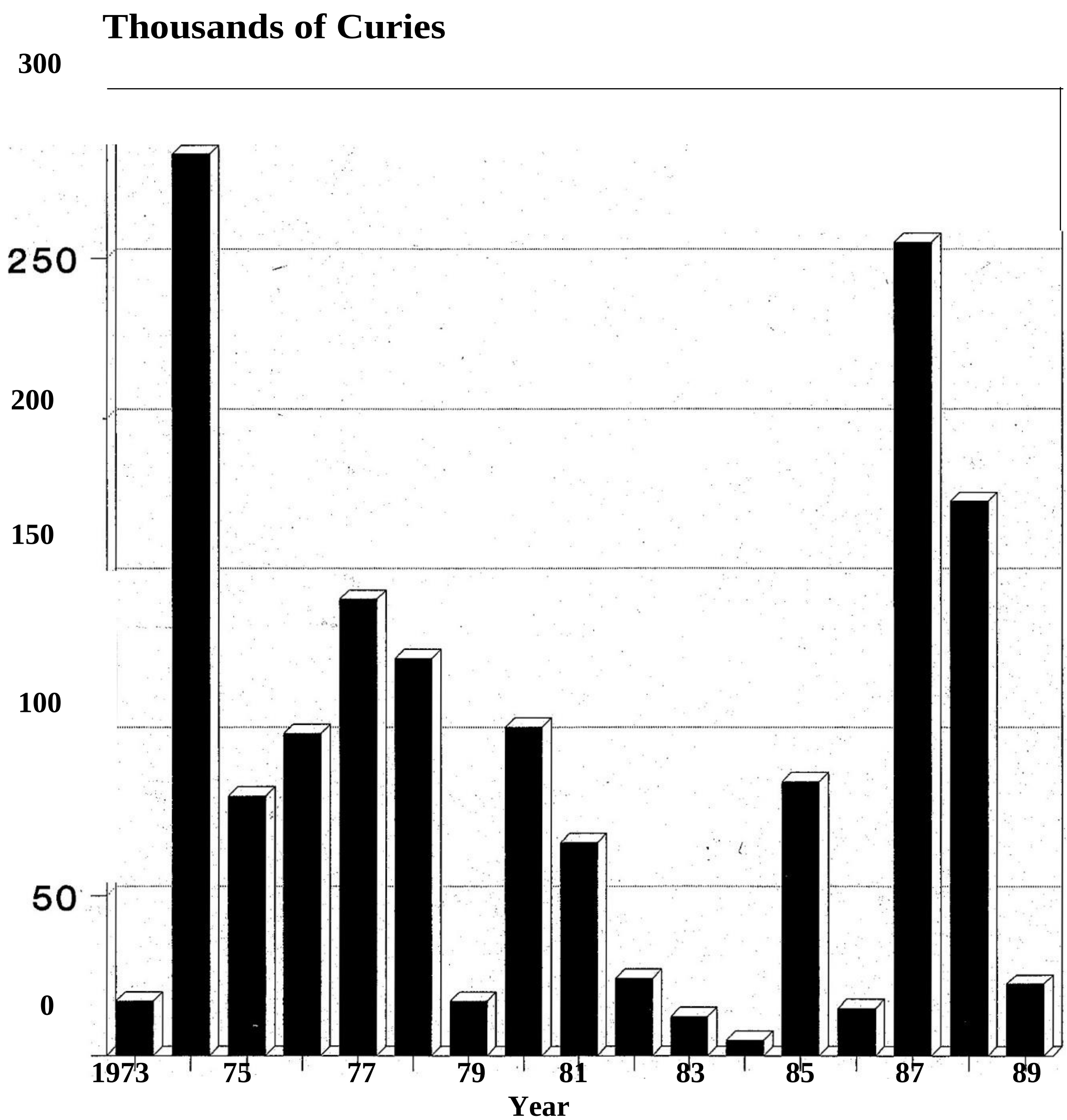
See Section I.D below for more details on INTEC/ICPP spent nuclear fuel reprocessing called RaLa Runs.

INL Air Releases
1952 to 1972



Sources: DOE/ID-12119 and ERDA-1536

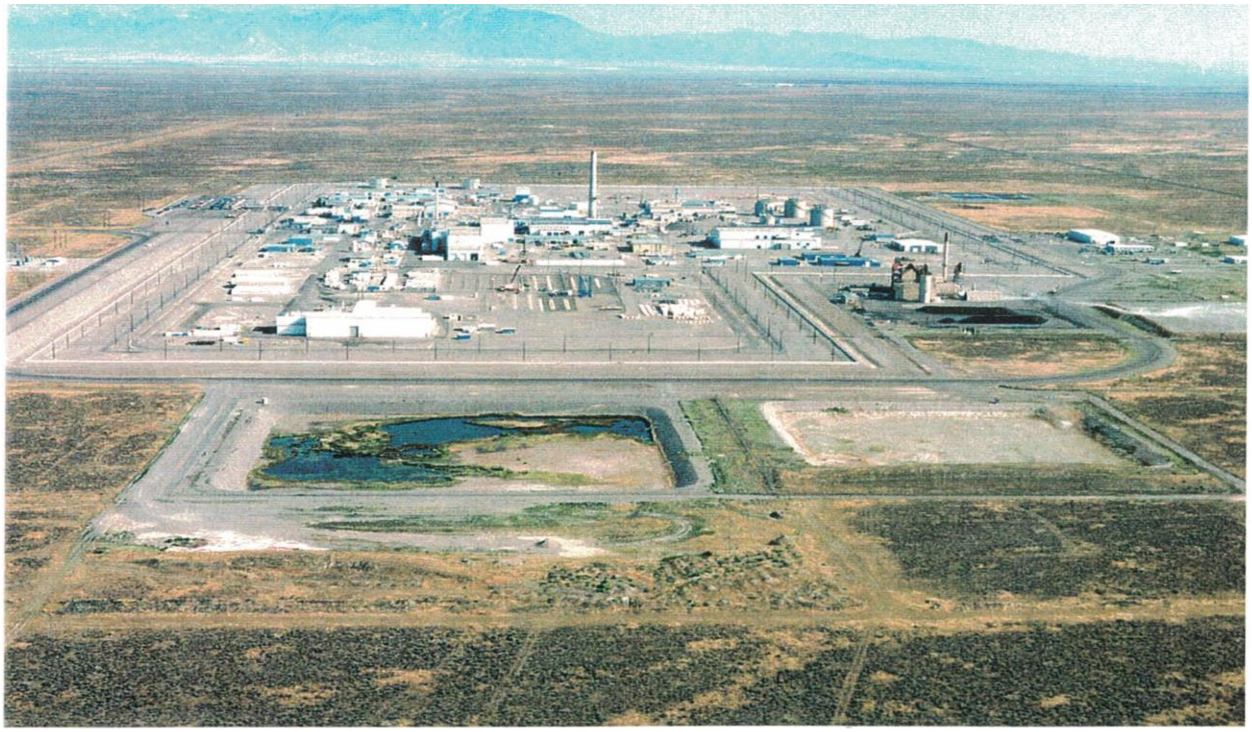
INEL Air Releases
1973 to 1989



Sources: DOE/ID-12119 ERDA-1536

I.D. INTEC Reactor Fuel Processing

Idaho Nuclear Technology and Engineering Center



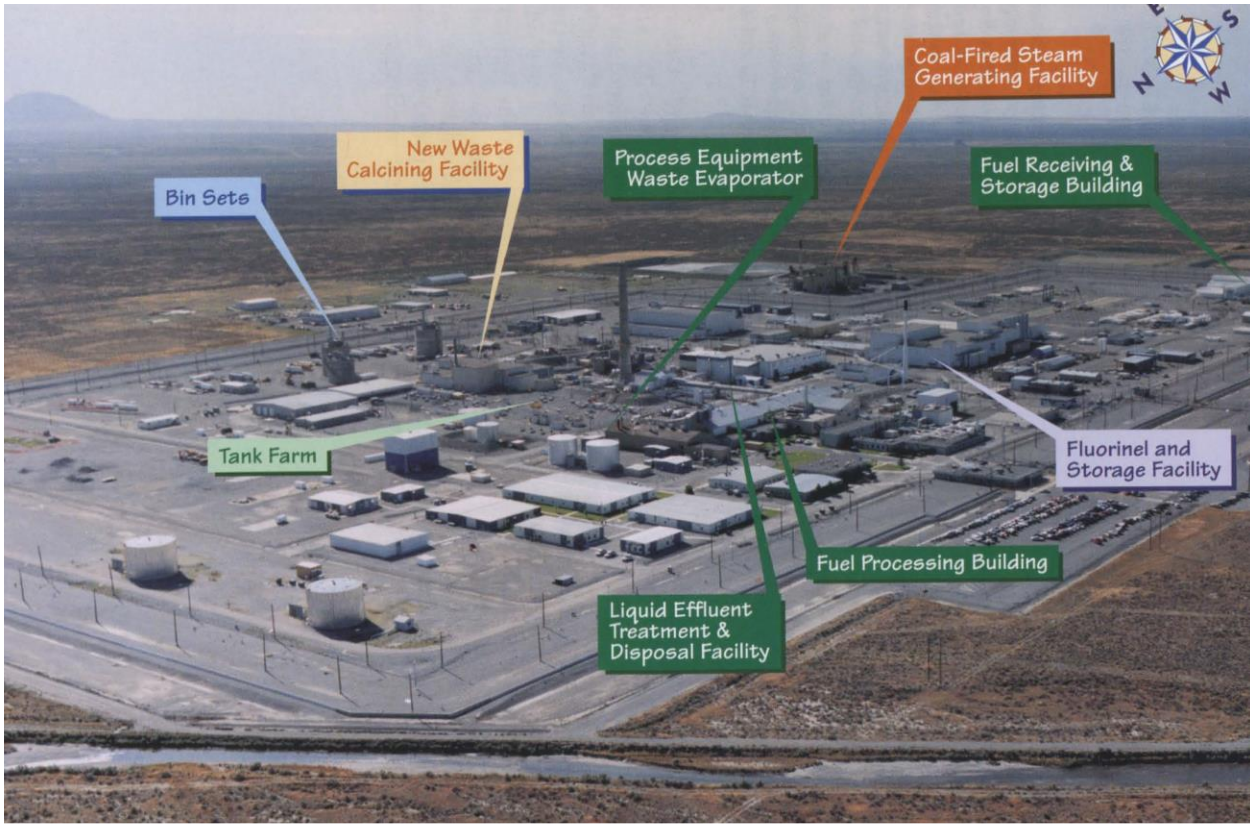
The Idaho Chemical Processing Plant (ICPP) (now called Idaho Nuclear Technology and Environmental Center [INTEC]) opened in 1953 served (until 1993 when reprocessing was temporarily stopped) as the principal facility for storage and reprocessing of spent nuclear fuel (SNF). Man-made elements created by fission uranium in a nuclear reactor are isolated by reprocessing of the irradiated or "spent" reactor fuel. Because this is known as the most hazardous industrial operation in the world, these reprocessing plants were located in remote areas. Fuel cladding (metal covering around the uranium fuel) types reprocessed at ICPP included zirconium, aluminum, stainless steel, graphite and specialty cladding.

The INTEC (ICPP) is a large complex made up of numerous individual buildings. Current major process buildings at the INTEC include the following:

Fluorinel and Storage Facility (FAST) (CPP-666) built in 1978 and is divided into two sections **-** Fluorinel Dissolution Process (FDP) and fuel storage facility. The FDP is the first step in zirconium clad spent fuel reprocessing primarily from the Navy reactors. The fuel is dissolved in a solution of hydrofluoric acid and other chemicals. The FDP hot cell contains three dissolves designed for remote operation. The last campaign (reprocess run) at FDP was in 1988, however the plant remains on standby status. **The Custom Dissolution Process Facility (CPP-627)** customized small scale SNF reprocessing systems operated in the Hot Chemistry Laboratory located in CPP-627 to process nuclear materials that could not be handled in existing ICPP dissolution facilities. Only small quantities of material were processed in each campaign. The facility comprises the Multi Curie Cell, and anteroom and a radio chemistry laboratory.

The Head-end Processes (CPP-640) houses the Hot Pilot Plant which is a five level structure with each level containing one or more shielded dissolution process areas. Five process areas were used for the Rover Dissolution Process and one for the Electrolytic Dissolution Process. The Rover reprocessing facility recovered uranium from graphite-based SNF from a nuclear powered rocket project conducted in the 1960's.

The facility consists of the Mechanical Handling Cave and four shielded cells. Cell 5 of the Hot Pilot Plant contains the electrolytic dissolver used to dissolve stainless-steel clad SNF.



Separations Facilities (CPP-601) contains a series of 29 cells used to extract uranium from dissolved fuel. Most cells are about 20 feet square and 28 feet deep and are lined with stainless steel. Most of the equipment is stainless steel except for some pieces made of more exotic alloys for resistance to sulfuric or hydrofluoric acids or to electrolytic currents. With the exception of four special cells provided with viewing windows and manipulators, the in-cell equipment was controlled from an operating corridor. The corridor runs the length of the building between two rows of cells and contains equipment for regulating the flow of liquids through the process.

The Denitrator (CPP-602) is where liquid uranium solutions from chemical extraction processes were converted to a solid in a heated, fluidized bed. The granular product was packaged and stored in an adjacent vault pending shipment to the Un-irradiated Storage Facility. CPP-602's last campaign was in 1994.

The Rare Gas Plant (CPP-604) has three off-gas cells on the west side that cryogenically recovered radioactive krypton and xenon from dissolver off gas streams for commercial use. The three cells range in size from 20 to 24 feet wide and nine to 24 feet long, and 35 feet high. All have thick concrete walls and ceilings and contain equipment used in the off-gas recovery process. The Fuel Processing Restoration Facility (CPP-691) is a new plant that was under construction when reprocessing was discontinued in 1992. It was intended to replace CPP-601 and 602.

The Waste Calcining Facility (WCF) was the world's first plant-scale facility for solidifying liquid high-level waste from reprocessing. WCF converted high-level radioactive liquid wastes into granular solids, which are less corrosive, more stable and have less volume. From 1963 to 1982, WCF calcined over four million gallons of liquid waste before it was replaced by the New Waste Calcine

Facility (NWCF), which incinerated another 4 million gallons of high-level waste. Critics of the calcining process characterize it as a giant radioactive aerosol. In April of 2000, the Environmental Defense Institute, Keep Yellowstone Nuclear Free, and David McCoy filed a Notice of Intent to Sue DOE, EPA, and the state of Idaho for operating the NWCF for eighteen years without a RCRA permit. DOE immediately shut down the Calciner and implemented a closure plan.

I.D. 1 RaLa Process Runs

"The term "RaLa" is an abbreviation for **Ra**dioactive **La**nthanum-140 which is a decay product of barium-140. The term RaLa as used here refers to all phases of Barium-140 production from development to actual production facility operation." [IDO-14344 @10] CDC's analysis of the RaLa releases between 1957 and 1961 shows 3,269.818 curies of Iodine-131 and 17,233.610 curies of I-132 were released. [1] By contrast, the Three Mile Island reactor accident, considered to be America's worst nuclear accident, released 15 curies (Ci) of Iodine-131. [Benson, p.2]

Yet, RaLa fuel process runs at INL's Idaho Chemical Processing Plant (ICPP) produced "Radio iodine which can also be released under certain conditions amounts to 50,000 to 100,000 curies." [IDO-14532@13] The highest radioactive release period - over half of the total - occurred between 1956 and 1966 and amounted to 15,256,015 curies to the atmosphere. [ERDA-1536, p. III-7] [DOE/ID-12119 @A 55]

The Idaho Chemical Processing Plant (ICPP) conducted 11 process runs in 1953 for the capture of Krypton-85 and 113 process runs between May 1954 and February 1963 to recover Barium-140, Uranium-235, and Lanthanum-140 for the radiological/chemical weapons program. These isotopes were produced for Atomic Energy Commission (DOE's predecessor) Los Alamos National Laboratory. RaLa was used to produce material which Los Alamos used as a "substitute" for plutonium in certain types of radiological weapons tests. Barium-140 shared many of the physical properties of plutonium and could be used to disperse deadly fission products without destroying infrastructure. With a shorter half-life of twelve days it did not permanently contaminate the environs the way plutonium would with a half-live of 24,000 years. So, it was a people killer weapon (dirty bomb), not a building leveler that the nuclear priesthood was developing and testing on the residents of New Mexico.

"The government moved the RaLa project to Idaho from Oak Ridge, Tenn. because of concerns over the iodine releases connected with the processing "green fuel." The Oak Ridge plant was within five miles of the nearest site boundary, said [John] Horan who worked at the Tennessee facility during the early 1950s." [Times News(f)] In fact, a RaLa run blew up at ORNL when operators tried to produce a 100,000 curie batch of Barium-140 which resulted in a three day plant evacuation.

Recent disclosures by the General Accounting Office about radiation warfare experiments conducted at Oak Ridge on American citizens where hundreds of thousands of curies of Lanthanum were released suggests the Barium-140 came from either from Oak Ridge or the ICPP depending on the date of the experiment. According to the extremely limited documentation EDI has on the Ba-140/La-140 shipments from ICPP to Los Alamos, over 502,000 curies were sent and used in open air tests to evaluate the killing power of this radiological weapon.

"Radioactive Lanthanum-140, daughter of Barium-140 has been used as an intense radiation source for a number of years. Historically, a need has developed for increasing batches of the Barium-140 sources material with additional emphasis on increasing specific activity of the barium. The increasing demand resulted in inadequacy of facilities of the original barium producer, the Oak Ridge National Laboratories (ORNL). The more recent availability of high specific activity fuel from the [INL] Materials Test Reactor indicates the desirability of locating production facilities in conjunction with that reactor. In fact, a RaLa production cell was provided for in the ICPP original design of the Chemical Processing Plant [ICPP] by ORNL.

"The popular term 'RaLa' is a misnomer since the research, development, and production is

[1] CDC INEL Dose Reconstruction, Reported releases from the ICPP during RaLa Operations, From Hayden, R.E. 1957-1963. Activity Discharged to Atmosphere. INEEL Task Order Database MC Number 60111.

centered on the isotope barium-140." "At this time [1951], ORNL commenced the development of a process [at ICPP], based on irradiated MTR elements as feed material, capable of consistently yielding batches of at least 30,000 curies." [IDO-14445 @ 14]

RaLa runs were conducted at ICPP during the nine year period of 1954-1963. During some periods in 1954-55 while the process was being developed, un-irradiated fuel was used. Between 1953 and 1963 the ICPP released 6,092,985 Ci to the atmosphere. [ERDA-1536@III-7] Discussions in this section focus primarily on pre-1957 Rala runs because DOE has not acknowledged them in their 1992 INL Historical Dose Evaluation report as Rala runs.

Acknowledged ICPP Iodine-131quantities released between 1957 and 1963 were 2,800 Ci, with the highest year being 1958 releasing 1,028 Ci of I-131. [ERDA-1536.@II-242] Internal DOE documents suggest the quantity of I-131 that may have been released in a single run was more than what DOE acknowledged for an entire year.

This RaLa program is the INL equivalent of the infamous Hanford "Green-Runs" which also processed "green" reactor fuel. When reactor fuel is processed "green", that is, prior to a cooling period that allows short-lived radioactivity to "safely" decay, a significant amount of radioactivity is released to the environment when the fuel is processed. The ICPP emission control system during that period was very primitive.

The veil of secrecy also allowed the nuclear alchemists to proceed without public notification or accountability. This secrecy persists today. DOE's 1991 INL Historical Dose-Assessment Report does not include nor acknowledge many RaLa runs or the 1956 Bluenose releases from ICPP. Some of the first process runs were conducted with non-irradiated simulated fuel. Full access to ICPP operations documentation is needed to accurately assess the RaLa program. It should be noted that it took nearly five years of public pressure on DOE to allow Q-clearance access to the daily fuel processing documentation at Hanford, however, all the documents are yet to be declassified. The same is true for INL. The Department of the Navy is a claiming jurisdiction over some of DOE's secret documents because they pertain to Navy fuel processing and they refuse to declassify the information.

"The RaLa process involves the dissolution and processing of a 2-day cooled MTR [Materials Test Reactor] fuel assembly for recovery of radioactive barium-140. The operation is performed over a 24 to 36 hour period several times each year and involves about 1,200,000 curies of short-lived fission products. While 1.2 million curies is not a great amount compared to the normal processing plant operations [ICPP], the quantities of such elements as xenon, iodine and lanthanum are tremendous compared to those normally encountered; furthermore, the 1.2 million curies is contained in a solution volume of only a few liters. Xenon and krypton, which go to the off-gas, amount to about 100,000 curies and special measures must be taken to prevent unauthorized release. Radio iodine, which can also be released under certain conditions, amounts to 50,000 to 100,000 curies." [IDO-14532,p.13]

Phillips Petroleum, then operator of the ICPP, reported in the second quarter of 1957, that; "The liquid waste system operated satisfactorily except for failure to remove iodine resulting from RaLa processing". [IDO-14419,p.7] RaLa Run 002-RH originally scheduled for process on November 26, 1956, was delayed until November 30 "due to weather conditions being too adverse to permit gas release to the stack." [IDO-14414 @ 156] During run 002-RH, "Area AEC radiation surveys indicated that activity in the dissolver off-gas discharging from the stack persisted for about five minutes. During this period, the AEC sky scanner radiation instruments read maximum and then dropped to zero." [Ibid. @ 158] During this run, the Process Makeup Area was contaminated by a burst of airborne activity into the work area when the shipping pot was removed from the process cell. [[IDO-14414 @ 45]

"The Barium-140 recovery (RaLa) at ICPP produces a separate off-gas stream, treated with extreme care because it normally contains kilocurie quantities of radio xenon and Radio iodine. The xenon is released under controlled conditions. If the weather permits, it goes directly to the plant stack. If the weather does not allow immediate release, it is held in a 10,000 cubic foot shielded gas holder until a more opportune time, or until the xenon has decayed to a low level." [IDO-14532,p.26]

This holding tank was, however, not built and fully functional until 1958, two years after hot RaLa processing began. [IDO-14414 @ 170] Another problem, even after the off-gas holding tank was built, was that it could only hold 10 hours of operational emissions. [IDO-14414 @29&42] Since significant amounts of radionuclides continued to be released over days and weeks after the process run, the holding tank was of limited value even after it was installed.

RaLa Materials Test Reactor (MTR) fuel runs No.3 (12/56), and No.5 (2/57) contained 6,580 and 166,000 Ci of Iodine respectively. "Runs No. 3 & 5 weather conditions permitted venting all gases to the stack." [PTR-185 @6&7] Run No. 3 had significant equipment malfunctions that resulted in extensive contamination of the L Cell. "Four hundred man-hours were expended in reducing the general background radiation in L cell from an estimated 1000 R/hr. to 0.3-1 R/hr." [Ibid. @45] Exposure to the decontamination workers under those conditions would be expected to be considerable.

“Scrubbers were later installed as part of the off-gas emission control system. "There are indications that considerable iodine activity passed through the scrubber. Smears indicated the presence of iodine in the stack. AEC site surveys indicated that local rabbits showed significant increases in thyroid radiation count immediately following Runs 3, 4, and 5. Since gases from the runs were not collected and sampled it is not known how much activity was discharged from the stack. The stack monitor, which was put into service just prior to Run No. 4, indicated that significant iodine activity continued to be released for several days after each of the last two runs was completed. This would indicate that iodine has a tendency to plate out or deposit in lines and vessels only to be released gradually." [PTR-185 @19&20] The biological significance of the release of radioactive iodine is that the human body readily assimilates it into the thyroid gland.

Rala Run No. 001-RP (Feb.1, 1957) which processed 38,800 curies of barium and 70,000 curies of Iodine was delayed 17 hours until the wind changed directions away from populated areas. [PTR-185,p.6] February 20, 1957 run No. 002-RP contained 166,000 curies of Iodine. [Ibid.] The reason both Runs No.001-RP and 002-RP had such high Iodine content was because the cooling time for the fuel was two and less than one day respectively. Barium-140 runs in the third quarter of 1962 totaled 61,252 curies. [IDO-14599,P.1]

"RaLa off-gas involves a two-fold problem; namely, activity hazard due to contained active iodine and xenon, and explosion hazard due to contained hydrogen. The off-gas activity is too great to permit indiscriminate venting to the atmosphere and the hydrogen concentration is in the explosive region making mechanical compression and storage hazardous." [IDO-14414 @ 170] "Consequently operation was necessarily limited to periods when the weather was favorable for stack disposal." [Ibid]

In other words, the ICPP operators were reluctant to put much off-gas into the holding tank because of the hydrogen explosion potential and therefore it was expedient to release it to the atmosphere. So processing was delayed until the radiation would be blown north away from the more populated areas to the southeast.

"The [ICPP] fission product noble gases are present in the dissolver off-gases, and any not recovered go to the atmosphere. Krypton-85 in amounts up to 2,000 curies per-day could be released from power fuel processing. Comparable quantities of Krypton-85 have been released during previous operations without hazard to personnel on or off the site. This will be diluted by stack gas to 0.3 micro curie per liter [3 x 10^5 pCi/L] at the top of the stack, about 100 times maximum permissible [at the time] level for air." [IDO-14532 @46]

These documented statements by Atomic Energy Commission (AEC), predecessor to DOE, demonstrate the cavalier attitude about releasing large quantities of radiation to the environment. Moreover, no warnings were ever offered so that the public could take appropriate measures to protect themselves and their families.

"Total Iodine present in an [one] irradiated MTR fuel assembly after two days cooling approaches 76,000 curies with Iodine-131 accounting for 28,000 curies of the total. Approximately 80 % of this iodine was expected to reach the off-gas scrubber which was estimated to be 95% efficient in removing iodine. Thus about 3,000 curies of total iodine activity was expected to pass through the scrubber within a one hour period." [IDO-14414 @ 170]

Even weeks after the fuel dissolution process is completed, iodine continues to escape. “It has been found that during quiescent conditions in the cell the iodine release will be from five to ten curies a day. Solution transfer or vessel decontamination will raise this to 20 to 50 curies per day. [IDO-14419, p.61]

Considerable uncertainty exists between the design efficiency of scrubbers and the actual efficiency. [See Stack Emission Section I(G) below] Uncontrolled iodine releases were also "escaping from centrifuges to cell off-gas which does not pass through the scrubber." [IDO-14419, p.61] +[14494, p.19] The combined releases from these multiple sources were significant.

A postulated example of iodine releases applied to run number 002-RP would yield the following scenario. Run 002-RP had 166,000 ci of I-131. Using the extremely optimistic design standard of 95% efficiency of the scrubbers, and 80% release to the scrubber, and subtracting 80% from 166,000 Ci in the fuel, leaves 132,800 Ci released to the scrubber which theoretically had 95% efficiency. That leaves 6,640 curies of iodine going out the stack over a two-day period. This figure would not include any DOE acknowledged releases escaping the centrifuges and cell off-gas system.

The above assumption scenario (non-conservative) is supported by DOE internal documents. "Approximately 80% of the I-129 is released as an airborne effluent and 20% is in the liquid effluent." [DOE/ID-12119@A-18]

A 1978 DOE engineering study by Allied Chemical Idaho Operations for INL proposed an I-129, C-14, Ru-106 and Kr-85 filtration system for ICPP fuel reprocessing to reduce the emission of these radionuclides. "More than 99% of these volatile isotopes were assumed to be released during dissolution of the fuel rods." [ICP-1126@iv]

The design was to include a matrix of filters to trap these volatilized isotopes. Should these filters fail or become plugged the system would just go back temporally to normal non-filtered operation. During RaLa Run 003-RH, "Approximately 7 percent of charged iodine was found in the scrubber solution after the run was completed." [IDO-14414 @ 158]

This suggests iodine release fractions in the range of 93%. "Since the current practice of releasing all airborne iodine species is acceptable, short-term releases in future reprocessing plant would be considered an inconsequential accident." [IDO-14414.@18]

The above discussion is supported by the 1977 INL Environmental Impact Statement (EIS) which stated that "the efficiency of this scrubber was low for iodine." [ERDA-1536 @ 242] The iodine content was so high in the RaLa reprocessing that the liquid waste evaporator would experience “Iodine-131 boil over during several batches when RaLa operations were in progress.” [IDO-14430 @ 11] “Recent [1957] operational practices in the concentration of process equipment waste provided essentially no reliable decontamination of the condensate from iodine-131 in the feed. Many different schemes have been tried to retain iodine ...” ... “These schemes were not successful in improving the iodine decontamination of the stream.” [IDO-14430 @ 18]

RaLa Iodine releases varied widely depending on the fuel processed and the cooling time before processing. The extremely optimistically low figures for part of the Rala period (1957-63) offered in the ERDA EIS were 2,800 Ci. of Iodine-131 released to the atmosphere. Based on the crude emission system in use, these figures can only be considered as extremely understated. A thorough analysis of the entire process and the efficiency of the emission systems are needed to assess the probable radioactive releases.

Considerable variation existed in scrubber efficiency in removing Iodine-131 from 7% to 70% due to filter problems. [IDO-14287] These runs produced Barium-140 solutions averaging 5,400,000 R/hr [IDO-14306 @ 7] , and containing a minimum of 30,000 curies. [IDO-14445 @14]

The RaLa process MTR throughput fuel had extremely high burnup rates of 24% which generated 55,600 curies of Ba-140 as opposed to undesirable 17% burnup fuel that only produced 38,800 curies of Ba-140 for every 168 grams processed. [IDO-14445 @21]

The known hazard with reprocessing high burnup fuel with less than a two-day cooling time was the release of volatilized iodine, ruthenium and krypton. “Ruthenium accounted for about 10% of the volatile activity other than krypton, with about nineteen times as much ruthenium coming off during the acid dissolution as during the caustic dissolution.” [IDO-14445 @31]

Efforts by ICPP operators to reduce iodine releases included dilution of the post process waste and neutralization of the caustic “supernate.” “In the case of the caustic solution diluted thirty-fold, the maximum amount of iodine trapped from the off-gas was 0.93 percent. Material balances were good.

With the caustic solution diluted only fifteen-fold, the amount of iodine trapped averaged about 1 percent."[IDO-14445 @80]

Another 1958 Phillips Petroleum report discussed attempts to improve the Process Equipment Waste (PEW) iodine scrub efficiency by adding neutralizing solutions. "With no neutralization of the evaporator feed, there was essentially no decontamination from Iodine-131 in the [PEW] condensate." But even this effort "yielded a condensate which contained about 0.5 percent of the iodine from the feed." [IDO-14443 @ 16][IDO-14430 @18]

This documentation suggests extremely poor performance of emission control systems to filter/ scrub out iodine prior to release to the atmosphere. "Since the curies of activity associated with these elements [iodides] is of similar magnitude to that of the barium being produced [30,000 to 60,000 curies] provisions to conduct dissolution under meteorological control may be necessary or an accumulator vessel to retain the gases for several weeks; decay prior to venting may be required, in order to avoid possibilities of area contamination or personnel exposure if dispersion of the plant stack gas is inadequate." [IDO-14308 @8]

Even at very low PEW efficiency rates for iodine the condensate was still extremely radioactive because of very high curie content of the fuel being dissolved as feed. "Because the feed to this [PEW] evaporator is usually fairly high in activity, the condensate represents a significant source of activity discharge to ground from the plant." [IDO-14362 @ 8] This is a reference to waste discharged to the injection well. 1959 Phillips Petroleum reports continue to acknowledge that low iodine scrubber efficiencies of 17.9% of the calculated iodine were found in the caustic and less than 1% in the acid solution. [IDO-14445 @94]

Recent revelations about Hanford releases from fuel reprocessing exposed by the Hanford Environmental Dose Reconstruction (HEDR) Project are germane to INL. [TSP News letter, 12/92] The original estimates or 530,000 curies of I-131 released from Hanford were based on unreliable stack monitoring data. The public and independent researchers knew this was not true. After nearly five years of public pressure, DOE finally allowed access to classified daily fuel reprocessing data that allowed scientists to do a physical reconstruction of the Green Runs. The results showed an increase of 70% over previously DOE acknowledged releases of 530,000 curies Iodine-131. [Benson @2] The key elements of the data needed for a physical reconstruction were:

1.) Cooling time of the fuel processed. Short cooling periods of hours or days rather than months means that short-lived isotope inventories such as I-131 will be much higher in the fuel.
2.) Release fractions. This figure is based on how much of the iodine present in the fuel is released to the environment. For Iodine-131, HEDR calculated the release fraction to be 90.5%.
3.) Reactor power levels of fuel used. A direct relationship exists between the reactor power level and the isotopes created in the fuel. The higher the power level, the more Iodine-131 is generated. [TSP News letter, 12/92]
4.) Fuel type and percentage U-235/Pu-239 enrichment.

HEDR now estimates Iodine-131 releases between 1944 to 1972 at about 740,000 curies which produced a 870 rad exposure to an infant born in Ringold, WA in 1943 or 1944. [Connections(a)] While working on the Hanford Downwinders class-action lawsuit, Owen Hoffman, President of the SENES Oak Ridge Center for Risk analysis, determined that approximately 900,000 curies of Iodine-131 were released by the AEC's Hanford plants between 1944 and 1957, a period known as the Hanford "Green Runs." This amount is 150,000 curies more than the "official" estimates from the Centers for Disease Control. [Hoffman]

The Hanford Health Information Network reports independent downwinder consultant research showing Plutonium-239 releases between 1945 and 1969 as high as 1600 curies. These plutonium release estimates are based on Hanford's George Brabb's 1961 internal memo assessing fuel reprocessing (Z Plant) "and found the filtering system was not adequate to capture the vaporized plutonium oxide which was essentially in a gaseous form when released by burning. This was revealed by the fact that a significant amount of plutonium was found in the ducts of the vacuum system...even though it was protected by filters. This convinced me that fine plutonium was being released into the atmosphere from Z Plant." [Connections(b)] The reason for citing the Hanford problems is not to compare the release numbers but to compare the emission control system problems because the technology in any given era was the same whether at Z Plant or the ICPP.

CDC refused, in its INL Dose Reconstruction, to do a physical reconstruction of the INL RaLa Runs as part of the INL Dose Reconstruction Health Study. CDC is opting for the use of discredited DOE stack monitoring data. This is another deliberate attempt by CDC to understate the radiation release estimates in the hope that the government's liability exposure will be minimized. There are extremely important "lessons learned" from the Hanford studies that the public justifiably wants applied to the INL studies.

Plutonium was also extracted from the high burnup power reactor fuels processed at the ICPP. F and V cells generated plutonium batches up to 500 grams. [IDO-14306] Plutonium emissions must be included in any analysis. The solvent burner is noted in numerous reports as a problem area. The solvent burner is used to incinerate the waste solutions used to dissolve the fuel rods containing plutonium. "Plutonium is the most bothersome contaminate" in this Solvent Burner and its "Combustion gases go directly to the main plant stack without filtering." [IDO-14287] "The solvent burner is probably the largest source of Transuranic discharged to the stack and the largest unfiltered radionuclide discharge at ICPP." [ENICO-1086 @1]

Acknowledged Chem Plant (ICPP) airborne radioactive releases during the Rala runs (1953 through 1963) totaled 6,092,985 curies of gross beta and gamma isotopes. RaLa runs in 1959 released the highest airborne radioactivity at 1,334,902 curies of gross beta and gamma isotopes. [DOE/ID-12119@A-41][Also see Guide Appendix listing by year]

These figures do not include other INL facilities that were also releasing considerable quantities of radiation. For instance, the Test Reactor Area's Materials Test Reactor that provided the RaLa Run fuel rods released excessive amounts of Strontium 90 both to the air and to effluent water used to cool the reactor. [IDO-16375, p.8-9] Between 1952 and 1968 alone, the Test Reactor Area released 5,035,572 curies of radioactivity to the atmosphere. [Ibid @ A-30]

Iodine-131 (around ICPP) activity in jack rabbit thyroids for the 1958 sampling period peaked in March 1958 at 709,000 d/m/g. At sixteen and twenty miles distance from the ICPP the I-131 activity dropped respectively from to 140,000 d/m/g to 93,000 d/m/g. "The highest thyroid I-131 activity ever observed at the NRTS [up to 12/58] jack rabbits was observed in two animals collected on September 10 [1958]. Their mean I-131 activity was 7.7×10^6 [7,700,000]." [IDO-12082(58)@78-87]

DOE's INL Historical Dose Assessment Report acknowledges only 78 Rala Runs. This DOE report list begins with what they call Rala Run 001 in February 1-3, 1957. [DOE/ID-12119 @ A-33] Yet, Phillips Petroleum, ICPP contractor at the time, documents that, "Hot runs were begun on November 24, 1956." [PTR-185 @ 5] Although fifteen runs are acknowledged, details are given for only eight runs up to June 1957. [IDO-14414 @ 131]

It must be emphasized that the Environmental Defense Institute's analysis is limited due to DOE's unwillingness to declassify all INL operating history documents. Therefore, the information contained here is not by any means conclusive. DOE has yet to declassify documents requested by CDC for both the Hanford and the INL dose reconstruction health studies. This is discouraging since the Hanford requests are seven years old and the INL requests are three years old.

Partial Listing of EARLY RaLa Run Fuel Iodine Content

Run Date	Run Number	I-131 Curies	Cooling Days	Ba-140 Curies
11/24/56	001-RH	?	3	?
11/30/56	002-RH	1,260	4	3,033
12/6/56	003-RH	6,580	1	18,000
2/1/57	001-RP	70,000	2	39,000
2/20/57	002-RP	166,000	4	55,000
4/5/57	003-RP	13,560	2	28,000
5/19/57	004-RP	14,500	?	29,150
6/24/57	005-RP	16,180	6	32,000

[IDO-14414][PTR-181 & 185] [IDO-14430][IDO-14419]

Incomplete Listing of RaLa Run Barium-140 Produced

Run Date	Run Number	Ba-140 Curies
?	006 -RP	?
10/57	007-RP	22,800
12/57	008-RP	37,000
4/58	?	30,000
6/58	?	30,000
4/59	022-RP*	23,400
?	023-RP	10,200
?	024-RP	24,800
?	025-RP	23,160
?	026-RP	19,270
?	027-RP	23,900
6/59	028-RP	26,200
10/59	034-RP*	19,695 #
?	035-RP	21,620
?	036-RP	14,075
12/59	037-RP	26,137
7/62	?	21,085
9/62	?	40,067
6/13 to 9/13/63	071RP to 079RP *	200,000
Last Run 4/63	?	?
Incomplete total	83 Runs	501,920 curies Ba-140

[IDO-14430][PTR-185][PTR-181][IDO-14419][IDO14414][IDO-14410][IDO-14344]

Notes for above table:

* break in run number sequence [PTR-749][IDO-14599][IDO-14494][IDO-14512][IDO-14453]

 # ICPP Criticality Accident (16 October 1959) "During the [accident] evacuation of the building airborne fission products (within the building) resulted in combined beta and gamma doses of 50 rem (one person), 32 rem (one person) and smaller amounts to 17 persons." A Review of Criticality Accidents, 2000 Revision, Los Alamos National Laboratory; pg.18; LA-12638.

Atmospheric RaLa Releases of Iodides and Beta Activity

Year	Run Numbers	Curies Released
1957	006 through 008	6,399.00
1958 *	009 " 021*	5,334.87
1959	022 " 037	1,605.60
1960	038 " 049	246.44
1961	050 " 066	352.27
1962	067 " 075	253.26
1963	076 " 079	116.55
Totals	79	14,307.99

[DOE/ID-12119 @ A-33] [* IDO-12082(58) lists 13 RaLa runs between 1/6/58 & 10/23/58]

CDC INL Dose Reconstruction Review of RaLa I-131 and I-132

Compiled by Risk Assessments Corp. Task Order Database MC Number 60111

1,000 mCi = 1 Ci

Reported releases from the ICPP during RaLa Operations

From Hayden, R.E. 1957-1963. Activity Discharged to Atmosphere. INEEL Task Order Database MC Number 0111.

		Beta emitters (mCi)	I-131 (mCi)	I-132 (mCi)
	Feb-57	403	472000	
	Mar-57	35	50,400	
	Apr-57	1	68,800	
	May-57	6	50,400	
	Jun-57	43	132,800	
	Jul-57	3	32,860	
	Aug-57	0	140	
	Sep-57	5	33,750	
	Oct-57	16,348	277,745	
	Nov-57	19,265	225,841	
	Dec-57	14,727	2512	
1957 Total			**1347248**	
		Beta emitters	**I-131**	**I-132**
	Jan-58	**(mCi)**	**(mCi)**	**(mCi)**
	Feb-58	23,284	75,327	
	Mar-58	19,763	129,710	
	Apr-58	14,146	686,000	
	May-58	49,623	275,645	1,540,300
	Jun-58	24,465	212,173	128,100
	Jul-58	25,129	1,495	2,276
	Aug-58	52,260	78,524	21,100
	Sep-58	44,318	24,492	7,600
	Oct-58	86,040	109,680	804,000

	Nov-58	46,420	35,030	117,400
	Dec-58	34,965	2,846	7,308
1958 total			**1,630,922**	**2,628,084**
	Jan-59	9,600	240	1,296
	Feb-59	319,600	111,860	187,925
	Mar-59	120,000	47,160	62,520
	Apr-59	148,600	7,727	124,378
	May-59	82,400	3,131	43,590
	Jun-59	100,800	2,419	65,117
	Jul-59	287,200	8,903	238,877
	Aug-59	80,900	4,045	63,102
	Sep-59	69,600	7,934	55,262
	Oct-59	10,011,000	15,016	9,963,948
	Nov-59	137,130	13,302	114,092
	Dec-59	37,470	1,836	27,990
1959 total			**223,333**	**10,948,097**
	Jan-60	30,030	1,120	21,321
	Feb-60	37,400	9,200	21,804
	Mar-60	12,520	1,865	7,299
	Apr-60	34,170	4,578	27,712
	May-60	3,150	400	1,899
	Jun-60	33,840	2,132	27,985
	Jul-60	33,840	2,132	28,020
	Aug-60	25,560	2,056	22,493
	Sep-60	11,540	1,235	9,601
	Oct-60	37,620	3,762	32,353
	Nov-60	1,970	969	601
	Dec-60	220	40	180
1960 total			**28,369**	**201,268**
	Jan-61	144,350	17,466	121,831
	Feb-61	22,280	3,632	16,599
	Mar-61	19,890	2,347	15,395
	Apr-61	2,210	1,050	100
	May-61	33,050	2,479	29,216
	Jun-61	5,300	1,458	1,601
	Jul-61	9,890	2,660	2,799
	Aug-61	4,890	2,342	1,198
	Sep-61	25,500	1,836	20,575
	Oct-61	10,730	2,886	7,103
	Nov-61	10,780	919	8,001
	Dec-61	37,710	871	1,901
1961 total			**39,946**	**3,456,161**
1957 to 1961 total			**3,269,818**	**17,233,610**

Source: CDC INEL Dose Reconstruction, Reported releases from the ICPP during RaLa Operations, From Hayden, R.E. 1957-1963. Activity Discharged to Atmosphere. INEEL Task Order Database MC Number 60111.

RaLa Accidents at ICPP

A criticality (uncontrolled nuclear chain reaction) accident at the ICPP on October 16, 1959, one day after a RaLa run on the 15th increased the atmospheric releases. An AEC accident report noted twenty-one workers were exposed and offered the following description of the RaLa run.

"A RaLa run had been completed on the afternoon of October 15. This process involves the separation of radio-barium from short-cooled MTR fuel elements. Dissolution of these short-cooled elements and even later disturbance of solutions in post-run cleanup usually cause some release of fission product iodine to the process vent system. On some occasions iodine has escaped to the access corridor and PEW control room in sufficient quantity to set off the sensitive air monitor alarms in those areas. Consequently, it was natural initially to suspect that the release of apparently short-lived air-borne activity was in some way related to the RaLa equipment. This assumption seemed to have been further substantiated by the fact that : the RaLa process instruments indicated that a pressure surge had occurred, no other instruments that were observed in the hurried re-entry [after ICPP accident evacuation] showed evidence of more than minor disturbance, and high level (greater than 25 R/hr) contamination was discovered around the RaLa slug chute. High level contamination noted in the PEW control room was a reasonable consequence of the pressure surge initiated in the RaLa system." [IDO-10035 @ 16]

Another ICPP criticality accident on January 25, 1961 during the RaLa period also released radioactivity to the atmosphere. This incident (requiring full evacuation) occurred during the work week when 251 employees were at the ICPP. The radioactive cloud traveled southwest toward Big South Butte where it stagnated for several hours before moving on south. Radiation readings at Big South Butte ranged over 200 counts per second. Readings at Central Facilities Area, 2 miles south ranged over 30 mrem. [IDO-10036@35]

AEC accident report notes the following: "Two processes in the plant handle gaseous and volatile fission products, viz., a radio-barium separation system (RaLa process) and the dissolver off-gas handling system. A RaLa processing run had been completed two days earlier and no operations were being performed in that equipment. However, post-run activities in the past had resulted in some release of Iodine-131. Chemical changes in the process and essentially eliminated this problem, but the associated high concentrations of short-lived fission products cause this system to be suspect in any unidentified radiation incident." [IDO-10036@35]

I.D.2 Post RaLa ICPP Releases

This section discusses the post RaLa Idaho Chemical Processing Plant (ICPP) from 1964 to present. Within part of this period, (1964 to 1981) ICPP released 1,417,210 Ci of radioactivity to the atmosphere and 22,200 Ci to the aquifer via injection well and 6,523 Ci discharged to the percolation ponds. [ERDA-1536@II-89&III-7][INL-95/0056@2-13][IDO-10054(79)(81)@14]

In 1974 the ICPP alone released over 259,955 curies (6,055 were not noble gases) of radiation into the air. These figures do not include what went into the soil and aquifer below INL via injection wells. [ERDA-1536, p. II-18] Airborne releases between 1980-81 included 416 curies of barium, 42 curies of cesium, 153,589 curies of krypton, 10,053 of xenon. [ID-10054-80&81, p.3-4] Between January and November of 1982 28,943 curies of radioactivity were released at INL (28,020 curies of that were airborne) 2,592 billion liters (683 billion gallons) of radioactive waste were dumped in the ground, 1,552 billion liters (409 billion gallons) of which were injected into the aquifer. [Williams, 1/31/83, 4-4]

ROVER Spent Fuel Processing

The space vehicle nuclear rocket ROVER program used graphite reactor fuel that was reprocessed at the ICPP now INTEC. The graphite around the fuel was first burned off in an auxiliary building not part of the head end fuel processing system, which at least has some emission scrubbers. After the graphite was burned off, the residual containing 80 to 90% enriched uranium was then put through the normal ICPP chemical extraction process. A full investigation is needed to determine how much ROVER fuel was burned, what emission systems (if any) were in use, and how much radiation was released. Workers sent in to decontaminate the ROVER burn cells were severely contaminated due to inappropriate protective clothing. Later attempts to decontaminate the burn cell caused additional personnel contamination due to the fine graphite powder plugging respirators and leaking through protective garments. Management refused to allow worker requests for pressurized air lines. Workers claim exposures of 800 to 2,000 rem per person per entry into a ROVER cell. [Allan] Also see Section I.C. 6. ROVER Reactor Tests for more discussion.

Decontamination operations were canceled and the ROVER process lines remain plugged with high activity material. In 1997, ROVER process decontamination was again attempted.

After a criticality accident in one interim storage tank under the ICPP Head End fuel dissolution building, a worker was sent in to inspect for damage. The criticality occurred because enough uranium and plutonium remained in the raffinate to cause a spontaneous reaction. Barium acting as a poison was dumped into the tank and the mix was pumped out to underground storage tanks. Instruments indicated that the tank was empty, but when the worker was lowered into the tank, he ended up in shin deep high-level raffinate before he was pulled out. Later after the tank was pumped out workers were sent in to move a robotic vacuum between the piping that laced the entire bottom of the tank. The radiation exposures these workers received during this and other decontamination projects must be fully included in CDC's worker dose reconstruction health study. Also see Section

Contaminate Migration from ICPP/INTEC Operations

Congress's Office of Technology Assessment states that INL, "contaminates have migrated into surrounding soil; floods have enhanced migration." ... "Plutonium has been detected in a clay layer about 110 feet beneath the site." ... "Hazardous contaminates have been measured in the groundwater that is about 600 feet beneath the site." [OTA @ 34]

For decades public interest groups have tried to convince DOE that continued operation of the ICPP not only exacerbated waste generation but also diversion of precious resources needed for environmental restoration. A principal tenet to responsible waste management is source reduction or minimizing waste. The largest single liquid waste generator at INL is the Idaho Chemical Processing Plant (ICPP). The mission of the ICPP has been the recovery of highly enriched uranium for the four Savannah River reactors. These reactors have been shut down since 1988 because of safety violations and only one (K-Reactor) is likely to restart. According to DOE, K-Reactor will only restart for a short period of testing - not for a full production schedule. Therefore, the ICPP mission has radically changed. DOE's recent decision to shut down the ICPP should be permanent not temporary. Jim Werner, former senior environmental engineer for the Natural Resources Defense Council, offered (at a 1/24/91 PEIS hearing in Boise) the following comments:

"The Chem Plant produces hundreds of millions of gallons of hazardous and radioactive wastes annually. From 1953 to 1974, DOE discharged nearly 7 billion gallons of radioactive wastes to an underground injection well at an average rate of more than 300 million gallons annually -- nearly a million gallons a day. In addition, 10,000 to 35,000 gallons of radioactive chemical wastes such as nitric acid raffinate, and 19,000 cubic feet of radioactive solid wastes were generated each year at the Chem Plant. Because of significant modifications to increase the capacity of the Chem Plant, the volume of wastes currently generated by the Chem Plant has approximately doubled and have more recently been estimated to be as much as two million gallons of radioactive liquid waste daily."
[Werner, NRDC, PEIS Testimony, Boise, 1/24/91]

"For FY 1991, the operating cost of the Chem Plant is budgeted at more than $150 million. In addition, more than $120 million is budget in FY 1991 for additional construction and capital equipment costs. Hence, for FY 1991 alone, DOE will likely spend nearly a quarter billion dollars on the Chem Plant. However, these costs do not account for the future waste treatment and disposal costs for the hazardous and radioactive wastes generated and in long-term storage at the Chem Plant. Moreover, the costs of this "temporary" long-term storage of calcined waste at the Chem Plant have increased substantially from 1981 when DOE estimated the costs of the sixth set of storage bins at approximately $14 million to a 1989 estimate for the eighth set of storage bins of more than $30 million."
[Werner, NRDC, PEIS Testimony, Boise, 1/24/91]

"In light of the significant quantities of hazardous and radioactive waste resulting from reprocessing, and the hundreds of millions of dollars that may be spent to renovate the Chem Plant, storage alternatives should be considered for naval reactor and other fuel now scheduled for reprocessing at the Chem Plant. A full and fair analysis of these and other alternatives may very well show that the construction of additional spent fuel pools or a dry cask facility would be far cheaper than renovating and operating the ICPP. Any funds saved could be spent on critical environmental restoration activities at INL and elsewhere. Since there does not appear to be any clear environmental advantage to reprocessing naval fuels compared to direct disposal, DOE should discontinue any Chem Plant operations that cannot be justified for national security purposes." [Werner, NRDC, Testimony, Boise, 1/24/91]

DOE will spend an additional $409 million through 1994 on upgrades to the ICPP just for standby capacity. [DOE 1993 Budget Request] As previously discussed, the $467.7 million ICPP Spent Fuel Program presented to former Idaho Governor Andrus is slated for converting the ICPP into DOE's complex wide incinerator of high-level waste. Since there is actually an increase in waste volume when reactor fuel is processed, the question is raised as to why DOE is proceeding with such a program. One logical scenario is that the ICPP waste program is only a guise for continued nuclear weapon materials production and other military nuclear material needs. A January 17, 1996 State Permit granted to DOE to construct air pollution emitting source describes:

"... the ICPP is a multipurpose, spent fuel recovery facility with the following assigned objectives: The safe and economical receipt, storage and recovery of highly enriched uranium from fuel elements discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic) as well as from other unique fuels that cannot be processed elsewhere. The safe storage and management of the resulting high-level radioactive waste". [DEQ]

At a time when Congressional appropriations are being cut on cleanup programs, DOE has developed creative accounting approaches to shifting production projects over to so called "environmental" categories. Another waste issue involves the exhumed waste that will need to be dug up at the old burial sites. These quantities will be considerable. DOE waste management resources must be fully applied to isolating these wastes from the environment. It is not acceptable that environmental restoration activities must be made to compete with newly generated waste from nuclear materials production.

CDC INL Annual Release Estimates for INTEC/ICPP 1953 to 1960 (Curies)

Nuclide	Half-life	1953	1954	1955	1956	1957	1958	1959	1960
H-3	12.35 y	7.75E+02	1.93E+03	2.71E+03	2.81E+03	5.51E+03	7.81E+03	6.41E+03	6.05E+00
C-14	5730 y								
Mn-54	303 d								
Mn-56	2.6 hr								
Co-57									
Co-60	5.27 y								
As-76	26.5 hr								
Br-82	35.3 hr								
Kr-85	10.7 y	1.41E+04	3.52E+04	4.95E+04	5.40E+04		1.42E+05	1.17E+05	1.15E+02
Kr-85m	4.48 hr				5.52E-15	7.29E+00	21.9	2.12E+01	1.12E+01
Kr-87	1.27 hr					4.61E-08	1.38E-07	1.32E-07	6.91E-08
Kr-88	2.86 hr					2.71E-01	0.814	7.81E-01	4.08E-01
Kr-89	3.2 m								
Kr-90	33s								
Rb-90	2.91 min								
Sr-89	52 d	4.92E+00	1.23E+01	1.73E+01	2.07E+01	1.92E+01	1.48E+01	7.56E+00	9.38E-01
Sr-90	27.7 y	4.92E+00	1.23E+01	1.73E+01	1.99E+01	3.50E+01	4.98E+01	4.09E+01	4.31E-01
Sr-91	9.7 h				4.71E-09	9.19E-01	1.02	4.31E-01	3.85E-02
Y-91	58.8 d	1.06E+01	2.65E+01	3.72E+01	4.36E+01	2.11E+01	1.61E+01	8.29E+00	1.02E+00
Y-91m	50.3 d								
Zr-95	65.5 d	1.55E+01	3.87E+01	5.45E+01	6.36E+01	2.13E+01	1.64E+02	8.47E+00	1.03E+00
Nb-95	35 d	3.31E+01	8.27E+01	1.16E+02	1.34E+02	5.72E+00	4.29E+00	2.35E+00	2.60E-01

Nuclide	Half-life	1953	1954	1955	1956	1957	1958	1959	1960
Tc-99m	6.01 h								
Ru-103	39.4 d	9.61E-01	2.40E+00	3.38E+00	4.46E+00	1.53E+01	1.18E+01	6.05E+00	7.49E-01
Ru-106	1 y	5.03E+00	1.26E+01	1.77E+01	2.03E+01	5.87E+00	8.18E+00	6.65E+00	8.11E-02
Sb-125	2.7 y								
Te-132	3.26 d				1.50E-01	3.41E+01	3.06E+01	1.51E+01	1.77E+00
I-129 (Total)	1.57E+07	2.69E-17	6.72E-17	9.45E-17	3.42E-08	1.29E-06	8.35E-07	1.84E-07	2.71E-08
I-131	8.04 d				1.11E+01	1.40E+03	1.03E+03	2.24E+02	3.20E+01
I-132	2.28 h				9.83E+00	4.03E+03	3.38E+03	1.55E+03	1.76E+02
I-133	20.9 h				6.73E-03	4.41E+02	4.84E+02	9.98E+01	1.14E+01

I-134	**52.5 min**								
I-135	**6.61 h**				2.08E-11	6.65E+00	7.67E+00	1.51E+00	1.35E-01
Xe-131m	**12 d**				3.22E+02	1.65E+03	2.41E+03	3.17E+03	2.34E+03
Xe-133	**5.25 d**				2.54E+04	4.62E+04	8.43E+05	1.09E+06	7.92E+05
Xe-133m	**2.26 d**				1.16E+02	9.16E+03	2.02E+04	2.49E+04	1.74E+04
Xe-135	**9.1 h**				2.76E-04	1.24E+04	3.73E+04	3.81E+04	2.17E+04
Xe-135m	**15.6 min**				2.17E-10	6.97E+00	1.89E+01	1.71E+01	8.84E+00
Xe-138	**17.5 min**								
Xe-139	**43 s**								
Cs-134	**2.06 y**	1.97E-01	4.93E-01	6.93E-01	7.97E-01	5.38E-01	7.62E-01	6.24E-01	6.81E-03
Cs-136	**13 d**				3.69E-02	3.17E+00	2.23	4.97E-01	7.06E-02
Cs-137	**30.1 y**	4.99E+00	1.25E+01	1.76E+01	2.02E+01	3.57E+01	5.07E+01	4.17E+01	4.39E-01
Cs-138	**32.2 min**								
Cs-139	**9.5 min**								
Cs-140	**66 s**								
Ba-139	**83 m**								
Ba-140	**12.8 d**	6.55E-06	1.64E-05	2.31E-05	1.31E+00	5.85E+01	4.67E+01	2.37E+01	2.91E+00
La-140		7.55E-06	1.89E-05	2.65E-05	1.50E+00	6.31E+01	4.96E+01	2.53E+01	3.13E+00
Ce-141	**32.5 d**	5.40E-01	1.36E+00	1.91E+00	3.37E+00	3.32E+01	2.57E+01	1.31E+01	1.63E+00
Ce-144	**284 d**	6.86E+01	1.72E+02	2.41E+02	2.77E+02	5.40E+01	7.39E+01	5.97E+01	8.21E-01
Pr-143	**13.6 d**	2.06E-05	5.14E-05	7.23E-05	1.40E+00	5.79E+01	4.56E+01	2.32E+01	2.87E+00
Pm-147	**2.62 y**	1.65E+01	4.14E+01	5.82E+01	6.69E+01	1.40E+02	2.00E+02	1.64E+02	1.72E+00
Eu-152									
Eu-154	**16 y**	1.19E-02			4.81E-02	7.05E-02	1.00E-01	8.21E-02	8.70E-04
Eu-155	**1.8 y**								
Eu-156			8.31E-07	1.17E-06					
Ta-182	**115 d**								
Ir-192	**74 d**								
Hg-203	**47 d**								
Tl-208									
Ac-228									
Pa-231									
Th-232	**1.41E10 y**								
Np-237	**2.14E6 y**								
U-238	**4.5E9 y**								
Pu-238	**86.4 y**	1.10E-02	2.75E-02	3.87E-02	4.44E-02	7.78E-02	1.12E-01	9.07E-02	0.0312
Pu-239	**24390 y**	1.62E-03	4.04E-03	5.69E-03	6.53E-03	1.15E-02	1.64E-02	1.33E-02	4.55E-03
Pu-240	**6580 y**								
Pu239,240		1.62E-03	4.04E-03	5.69E-03	6.53E-03	1.15E-02	1.64E-02	1.33E-02	4.55E-03

Source: CDC INEL Dose Reconstruction, Facility Reported Annual Air Releases from the ICPP in curies.

Section I. E. On-site Waste Hazard

Due to questions about the waste acceptance criteria prohibiting high-level waste at the Waste Isolation Pilot Project (WIPP) in New Mexico which receives some of INL stored Transuranic wastes (TRU), [WIPP,1/88] and DOE's inability to open the Yucca Mt. high-level repository in Nevada [1] , INL continues to be a defacto nuclear dump. Pursuant to the 1995 U.S. Federal Court settlement between Governor Andrus/Batt and DOE, all of INL's stored TRU waste, but only 10% of "targeted" of the buried SDA waste is shipped to WIPP. Legal dispute over this Settlement Agreement and subsequent 2006 "Agreement to Implement" [2] significantly undermined the original intent of the 1995 Agreement by limiting INL waste to be exhumed (only targeted waste) and reclassifying waste in order to reduce the amount DOE must ship out of Idaho.

In 2015, Idaho Attorney General Lawrence Wasden took a remarkable stand explaining why he had not yet signed a waiver to allow the two proposed shipments of spent nuclear fuel for research into Idaho. Only two signatures are needed in order to grant waivers to the 1995 Idaho Settlement Agreement: current Gov. Otter and Idaho Attorney General Lawrence Wasden. [3]

Former Idaho Governor Cecil D. Andrus who originally initiated the 1995 Settlement Agreement wrote: "The Department of Energy's culture of secrecy will not allow it to engage in a frank discussion about its plans for this state, writes Cecil D. Andrus.

> "Most Idahoans know that since January, former Gov. Phil Batt and I have been raising questions about a plan by the U.S. Department of Energy to bring additional shipments of commercial spent nuclear fuel (SNF) to the Idaho National Laboratory (INL) for "research."
>
> "Our opposition to these shipments involves several concerns including, most importantly, that the DOE action violates the historic agreement Gov. Batt negotiated with the feds in 1995 that specifically prohibits commercial SNF from coming to Idaho.
>
> "We also object to the fact that DOE still has no permanent disposal site for this material, which effectively means once it's here it will stay here for a very long time. The fact that DOE has also missed key milestones to treat highly radioactive liquid waste at INL further complicates the picture.
>
> "When I first learned of DOE's plans to bring additional SNF to Idaho back in January, I started to gather information and ask questions. It seemed a logical step to request under the Freedom of Information Act (FOIA) copies of correspondence, internal memos, etc., that I felt certain then - and still feel certain now - would shed light on just what the federal government has planned for Idaho.
>
> "My odyssey in search of those documents has been both eye-opening and disturbing. The fact that the federal government has refused to release information pertaining to its internal planning and how Idaho fits into its plans should raise red flags for the state and its citizens.
>
> "After taking months to respond to my request for information and finally producing page after page of redacted or blacked out, documents, I appealed the decision to stonewall on public information.
>
> "Perhaps not surprisingly, DOE rejected my appeal recently saying that releasing information about its plans in Idaho would "cause the harm of chilling open and frank discussion, limit government personnel's range of options … and detract from the quality of Agency decisions."
>
> "DOE simply decided the release of the information I requested and would have shared with Idahoans "would not be in the public interest."
>
> "But wait just a minute. It is hardly the job of a bureaucrat sitting in office in the Forrestal Building in Washington, D.C. to decide what information about nuclear waste management in Idaho is "in the public interest." What about our interest regarding what goes on within the borders of our state?
>
> "A careful reading of DOE's rationale shows the department wants to consider waste options in secret without involving or in any way consulting Idahoans and then tell us what they have decided. I can guarantee that public knowledge of DOE's "open and frank discussions" about its "options" would be

[1] DOE has been blocked from opening Yucca Mt. thanks primarily due to the State of Nevada's litigation showing fatal the flaws in the EIS.

[2] Agreement to Implement, U.S. District Court Order Dated 5/25/ 06, Signed 2008.

[3] See more about Idaho's Settlement Agreement at https://www.deq.idaho.gov/inl-oversight/oversight- agreements/1995-settlement-agreement.aspx

"chilled" by public awareness in Idaho.

"DOE's culture of secrecy was, I believe, born during World War II when nuclear weapons where first developed and secrecy during wartime was a paramount consideration. But the agency never adapted, as the current situation in Idaho demonstrates, to a culture of transparency and engagement that engenders trust and confidence and, when warranted, public acceptance.

"I'm left to conclude that the agency does have plans for Idaho that likely would not pass muster in the sunlight. We do know that DOE has briefed the [Governor Otter's] LINE Commission on the possibility of future "research" at INL involving more than 20 metric tons of spent fuel. What else do they have in mind? They're not saying.

"Some DOE apologists have attempted to make this dispute about whether Idahoans "support the INL," but that is not the issue. The issues Gov. Batt and I have focused on are bigger and much more important: what ultimately happens to the significant quantities of nuclear waste already in Idaho, what is DOE's plan to honor commitments already made and what happens if we agree to take even more waste?

"DOE owes all of us a real discussion about those questions followed by real answers." [4]

Most Idahoans do not know that one fourth of all military nuclear waste is dumped at INL together with over one thousand metric tons total mass of commercial and military reactor spent fuel. DOE plans to add 15-20,000 metric tons of commercial spent fuel to its Complex wide inventory in the next decade. All the Three Mile Island contaminated Unit 2 reactor components (250,000 pounds) are stored at INL. [Deadly @ 50]

Little money has been spent on environmental restoration at the INL site relative to nuclear production spending. Current management practices indicate that adequate cleanup for volumes such as those dumped at INL require a financial commitment many times greater than currently allocated. Former Governor Andrus said; "This society has botched the job of managing by-products of nuclear energy and weapons production. It is our opportunity, perhaps our last opportunity, to make amends for this society's failures and treat with specific management plans the lasting curse of the nuclear age." [Idaho State Journal 8/27/94]

INL has four areas where high-level reactor spent fuel is stored – INTEC formerly Idaho Chemical Processing Plant (ICPP), Advanced Test Reactor Complex (formerly Test Reactor Area), Navel Reactor Facility, and Materials and Fuels Complex (formerly Argonne-West). Each area has numerous individual SNF storage facilities. The INTEC contains five facilities for spent fuel storage: the ICPP-603 Irradiated Fuel Storage Facility (IFSF), the ICPP-666 Underwater Fuel Storage Area (FSA), and the ICPP-749 Underground Storage Facility, and the INTEC dry Independent Spent Fuel Storage Facility. [DOE(a)]

Section I.E.1 Spent Nuclear Fuel (SNF) Inventory

a. INTEC/ICPP SNF Inventory

ICPP-603 Underwater Fuel Storage Facility (FSF); Prior to being recently closed, the FSF had three unlined concrete pools - north, middle, and south basins. The north and middle basins were built in 1951 and the south basin was added in 1959 and recently closed. The FSF was loaded to about 52% capacity, and 23% of the positions are currently considered unusable because of corrosion. Largely because of its age and past operating practices, the FSF had many deficiencies. The spent fuel, aluminum storage structures, and the carbon steel storage yokes and buckets have severely corroded over time. Numerous racking failures have caused fuel to fall to the bottom of the basin. Since the racks provide criticality spacing between fuel, failure of the racks poses significant risk of a criticality incident. The pools are unlined. Radionuclides have diffused into the pools' concrete walls and there is limited capability to monitor the pools for potential leakage. One hundred gallons per day was estimated to have leaked from the pools based on the water volume required to maintain the water levels. [AP(g)] CPP-603 Irradiated Fuel Storage Facility (IFSF) section for dry storage (discussed below) is still used.

Seismic evaluations have shown that there are weak areas in the storage facility superstructure, resulting in some potential for loss of confinement, release of radioactive materials, and decreased margins for preventing criticality from rack failure. This is due to the unique system of hanging the fuel from an overhead monorail supported by the building superstructure. The basin wall failure and

[4] Post Register Guest column: A real problem for Idaho, Posted: September 13, 2015, By Cecil D. Andrus.

superstructure collapse due to a large seismic event poses a significant risk. Finally, the facility does not have a ventilation system for radionuclide confinement. [DOE(a)] Investigators noted that exposures and releases to the environment occurred during encapsulation of fuel in the CPP-603. The CPP-603 SNF pool was later D&D. The many decades of leaked radioactive coolant water into the soil and eventually the aquifer represents a long-term environmental hazard not addressed by DOE or Idaho.

ICPP-603 Irradiated Fuel Storage Facility (IFSF), built in 1974, is composed of shielded dry vaults for storage of graphite fuels. The spent fuel is stored in 636 carbon steel canisters, which are approximately 18 inches in diameter and 11 feet long. Decay heat is removed by a forced-flow ventilation system. DOE's assessment team noted that a potential Category l fire hazard may exist because a few graphite fuel assemblies are stored in cardboard fuel containers inside this facility and the ventilation system for maintaining cooling appears to be unreliable.[DOE(a)] Investigators found that in the event of a large seismic event, the IFSF roof would collapse and there would be control room equipment failure. [SNF Vulnerability] Also see Guide Section I (H).

A WINCO Standing Root Cause Committee Report dated 6/14/93 analyzed the history of safety problems at the ICPP-603 storage facility. This report cites a long history dating back to 1969 and volumes of documents outlining the severity of the corrosion and fuel disintegration problems. Corrective measures were never taken. The report notes:

> "The reason given by the supervisors was lack of time, people, and money. They indicated they knew of the problems and would like to have fixed them, but it was a continual battle with management over resources. They could not get the contractor priorities on fuel storage."
>
> "Operating contractor management was asked to provide DOE a plan and schedule to get the fuel out of CP-603. Plans and schedules were transmitted but the operating contractor did not follow the plan for fuel removal." [SPG-31-93 @ 14]
>
> "Even when the operating contractor was able to secure funding, the funds were spent on FDP start-up and other fuel reprocessing facilities, and fuel storage did not receive much priority." [Ibid.@15] "Some of the work performed at CPP-603 resulted in high radiation exposure and personnel contamination. This violated 'As Low As Reasonably Achievable' (ALAR) considerations and interviews indicated this may also have contributed to the reduction of the work in CPP-603. Between the 1970s and 1988 the worker exposure in CPP-603 had been decreased from an average of 90 mrem per month per individual to 10 mrem."
>
> "Management always thought that they could move the fuel out of the CPP-603 by processing or moving the fuel before a major problem would occur." "There was a perception among the ICPP management that keeping the Navy happy was their most important mission. The Navy was the main source of operating money, and they could always pull the funding and the mission of the ICPP if management did not continue to accept and process Navy fuel." [SPG-31-93 @ 16-17]

ICPP-749 Underground Storage Facility has 218 underground dry vaults, built between 1971 and 1987. One hundred twenty-eight of the 218 dry vaults contain fuel from Peach Bottom Core I and the Fermi Blanket stored in aluminum canisters. The carbon steel liners of the 61 first generation vaults have undergone significant corrosion due to seepage of moisture. Fifty-nine of these vaults contain fuel in aluminum canisters. Some of these canisters have been inspected and show moderate corrosion. Gas samples show some canisters may be breached but there is no current indication of failed fuel clad. Water that collects in these vaults may leek to ground. The dry well design offers limited confinement capabilities, since it must be opened during fuel handling and inspection. A significant hazard associated with the first generation wells is the potential for carbide-water reactions. If the fuel is damaged and water is allowed to contact it, the carbide-bearing fuels could react exothermal with water to produce acetylene and oxygen. Acetylene together with oxygen forms an explosive mixture.[DOE(a)] Other 1994 inspections found degraded Peach Bottom fuel and degrading aluminum fuel cans and baskets at ICPP-749. [SNF Vulnerability] Since INTEC is already in a flood-zone, the underground ICPP-749 SNF vaults are vulnerable to flooding the carbide-bearing fuels could react exothermal with water to produce acetylene and oxygen and the acetylene together with oxygen forms an explosive mixture.

The Summary table below showing spent fuel storage inventories are expressed in metric tons heavy metal (MTHM), which means only the weight of the plutonium, uranium, and thorium in the fuel is noted.

This MTHM nomenclature is new (post-1994) to DOE since previous fuel inventories were expressed in total mass (i.e. weight of fuel element fissile material, cladding and end caps). DOE's stated reason for this change in nomenclature is that it more accurately describes the hazardous constituents.

Notwithstanding the usefulness of the MTHM number, all parts (i.e., entire assembly) of the fuel represent a significant hazard, and therefore the total mass number should be predominately used because it more accurately describes the total hazard. Inventories of spent nuclear fuel can be expressed with at least six different nomenclatures. In addition to the previously discussed MTHM and total mass, there is volume, number of storage units, uranium mass, fissile mass. Of the total (1,373 cubic meters) spent nuclear fuel volume held by DOE in 1994, INL has 53.5%. Of the total (78 metric tons) spent nuclear fuel fissile mass held by DOE, INL has 49.9%.[Hoskins 7/11/94] Given that INL gets all of the Navy's SNF, the inventory is continually increasing.

Although INL fuels account for only ~12% of the MTHM in DOE's SNF inventory, they are expected to account for over half of the spent fuel canisters.

Under international treaty agreements, US reactor fuel supplied to foreign country reactors was returned to the US in an effort to avoid foreign reprocessing of the SNF into bomb grade material. Consequently, significant quantities of SNF ended up at INL in addition to the domestically generated SNF. So the above inventories are grossly outdated, and are significantly increased. Also, DOE implemented a complex plan to move all aluminum clad SNF to the Savannah River Site and all the Zirconium/stainless steel clad SNF to INL. This program was implemented to facilitate a major reprocessing program where the reprocessing could be specialized. In other words the chemical reprocessing of aluminum clad SNF is different from zirconium/stainless SNF that requires highly toxic acids.

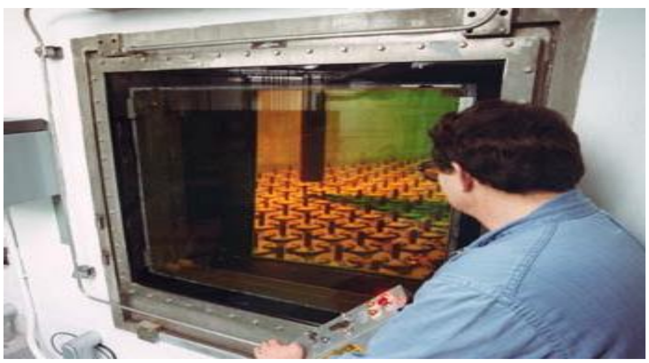
> "**The INL stores 275 MTHM of spent nuclear fuel (SNF) consisting of 150 MTHM of commercial fuel including core debris from the Three-Mile Island Unit 2 (TMI-2); 56 MTHM of sodium-bonded fuels from EBR-II, FFTF, and Fermi reactors; and an additional ~69 MTHM from a variety of defense, government research, and commercial demonstration programs**. Although INL fuels account for only ~12% of the MTHM in DOE's SNF inventory, they are expected to account for over half of the spent fuel canisters.
>
> "Spent fuel at the Materials and Fuels Complex (MFC) is stored at the Radioactive Scrap and Waste Facility (RSWF). The RSWF, The RSWF operates under a HWMA/RCRA mixed waste storage permit. Other fuels at MFC are stored within a variety of hot cells. (See Section II. E for MDC details)
>
> "INTEC contains several SNF storage facilities, each with a monitoring and surveillance plan for ensuring the facility remains within its safety authorization basis. A summary of each of the spent fuel storage facilities at INTEC is provided below.
>
> on the left side of photo below.

"**CPP-1774** is an above-ground storage facility containing 30 concrete vaults storing ~82 MTHM of TMI-2 fuel and core debris. It is an NRC-licensed ISFSI and its current license is valid through 2019 seen in photo above on right side.

"CPP-2707 is a concrete pad storing six casks, with room available for another ~14. Two rail casks filled with SNF from the West Valley site, presently on a rail spur near CPP-603, may be relocated to CPP-2707 in the future." These pads can be seen on the left side of the above photo.

"**CPP-749 is a series of** underground storage vaults consisting of an array of 214 carbon steel pipes inserted into the ground with grouted bottoms. The first-generation vaults were constructed in the early 1970s. The first fuel was loaded in September 1971 and remains in storage. Accelerated corrosion of stored fuels has occurred as a result of moisture intrusion. The second-generation vaults were designed to prevent water intrusion and maintain an inert internal atmosphere. Some moisture has been observed even in these second-generation vaults. About 80 positions are available in the 2nd generation vaults." Seen on the right side of photo above. CPP-749 stores 884 fuel units consisting of 78.4237 metric tons heavy metal (MTHM). INTEC lies in a flood zone and as such these underground vaults are vulnerable to flood waters.

"CPP-603 Irradiated Fuel Storage Facility (IFSF) is a shielded cell containing 636 vertical tube storage positions. The storage vault was added on to a 1950s vintage fuel storage pool in the early 1970s to receive fuels from the Fort St. Vrain reactor. However, because much of the Fort St. Vrain fuel has remained in storage in Colorado, the IFSF has been used to store domestic and foreign research reactor fuels and to support consolidation of other INL fuels into dry storage. Approximately 90% of the 636 storage positions will be filled by the end of 2010. See photo below.



CPP-603 Idaho Fuel Storage Facility

"CPP-666 is a third generation wet basin with a stainless steel liner and leak detection system. It was placed in service in 1984 and contains 2911 fuel storage ports of 5 different sizes. CPP-666 also contains two deep unloading pools that provide the capability for cask unloading and transfer of commercial-length fuels.

"CPP-666 will reach the end of its 40-year design life in 2024. If properly maintained, it is reasonable to assume that life extensions would be achievable." [5] [6] "To date, the basin is nearly 95 percent empty. Experimental Breeder Reactor-II spent nuclear fuel is being transferred to two dry-storage locations at the Materials and Fuels Complex: the Radioactive Scrap and Waste Facility and the Fuel Conditioning Facility. Advanced Test Reactor spent nuclear fuel is being transferred to CPP-603 for dry storage. Fluor Idaho is tasked with treating sodium-contaminated debris in the Fluorinel Dissolution Process (FDD) cell of CPP-666 and inside a hot cell at Building CPP-659, the New Waste Calcining Facility (NWCF), to enable the debris to be shipped to the Waste Isolation Pilot

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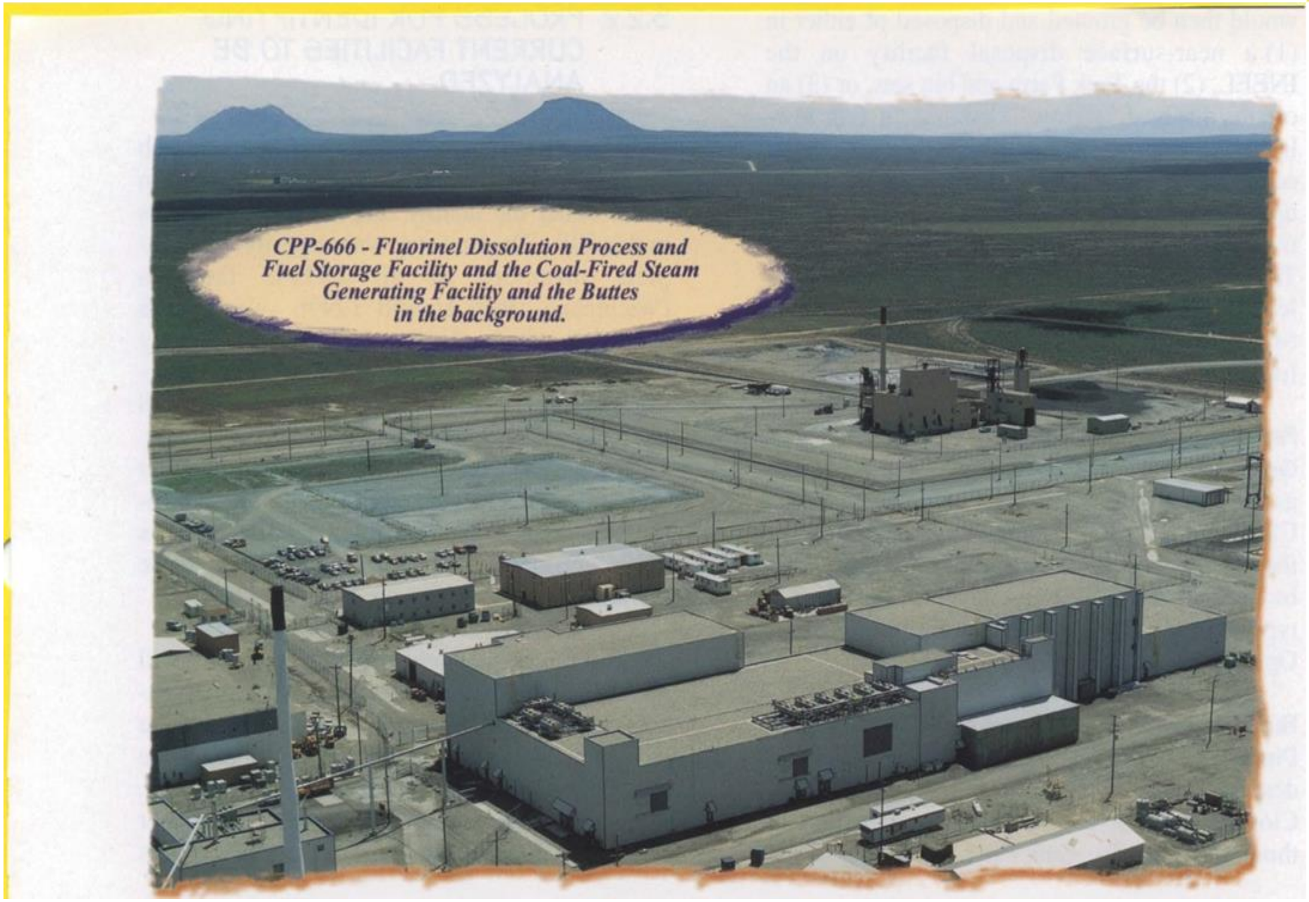
[5] Energy and Environment *Storage of DOE SNF at the Idaho National Laboratory DOE/EM*

[6] DOE-INL Energy and Environment, Fact Sheet, Storage of DOE SNF at the Idaho National Laboratory. The above INL SNF inventory numbers are understated when compared to independent assessments by the Blue Ribbon Commission 2012 Report. DFNSB states CPP-666 built in 1984 confirms the 2024 end-of-life.

Plant (WIPP)." [7]

CPP-666 Storage Basin

Idaho Nuclear Technology and Environmental Complex (INTEC) formerly Idaho Chemical Processing Plant (ICPP), CPP-666 main Spent Nuclear Fuel Storage Facility



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[7] DOE-EM Fluor 11/3/20

Defense Nuclear Safety Board Review of CPP-666

DNFSB Recommendations 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report. Below are excerpts of this report:

"No systemic, recurring or significant issues or trends were identified which would require corrective actions. However, the Ventilation System is degrading due to facility aging. This degradation could result operational down time, radiological contamination and personnel.

"The ventilation system is the first line of worker defense in the event of an accident and therefore should be classified as health critical.

"As of 2002 INL SNF is stored in 6 configurations:

- CPP-2707 –Cask Storage Pad
- CPP-749 –Underground Fuel Storage Facility
- CPP-603 –Irradiated Fuel Storage Facility
- CPP-666 –Fuel Storage Area (Basin)
- CPP-1774 –TMI-2 Independent Spent fuel Storage Installation (NRC licensed)."

Exhibit C.7 - INTEC EM-Owned Spent Nuclear Fuel Inventories

INTEC only and does not include MFC, PBF or NRF SNF

		Amounts		10/01/04 Location	
	Fuel Description	Fuel Units	MTHM	Onsite	Offsite/ Previous
1	ATR	1,816	1.5245	CPP-666	
2	ATR FY05 Receipts	120	0.1008	TRA-670	
3	Univ of Washington	26	0.0039	CPP-666	
4	HFBR	220	0.0585	CPP-666	
5	MURR	32	0.0219	CPP-666	
6	FERMI Driver	214	3.9321	CPP-666	
7	TRIGA (STD & FLIP)	280	0.0519	CPP-666	
8	BORAX V	36	0.0208	CPP-666	
9	Shippingport PWR	40	0.5217	CPP-666	
10	Pathfinder	417	0.0534	CPP-666	
11	SNAP	31	0.0291	CPP-666	
12	TORY-IIA	146	0.0486	CPP-666	
13	ANP	2	0.0011	CPP-666	
14	APPR & SPSS	2	0.0008	CPP-666	
15	BMI	3	0.0018	CPP-666	
16	GCRE	2	0.0010	CPP-666	
17	VBWR (Geneva)	4	0.0124	CPP-666	
18	GETR Filters	70	0.0044	CPP-666	
19	SM-1A	93	0.0658	CPP-666	
20	Pulstar - Buffalo	24	0.2522	CPP-666	
Subtotal	**CPP-666**	**3,578**	**6.7067**		
21	TORY-IIC	655	0.0591	CPP-603/ IFSF	
22	Peach Bottom (Unit I Core II & FECF)	786	1.2821	CPP-603/ IFSF	

23	Peach Bottom (Core II & PTE-1)	5	0.0105	CPP-603/ IFSF	
24	Ft. St. Vrain Reactor	744	8.6273	CPP-603/ IFSF	
25	Rover UBM FY-98	65	0.1198	CPP-603/ IFSF	
26	Ber-II TRIGA	21	0.0092	CPP-603/ IFSF	

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		Amounts		10/01/04 Location	
	Fuel Description	Fuel Units	MTHM	Onsite	Offsite/ Previous
27	TRIGA AL (CPP-603)	558	0.1025	CPP-603/ IFSF	
28	TRIGA FRR (stored)	951	0.1723	CPP-603/ IFSF	
29	TRIGA High Power	267	0.0056	CPP-603/ IFSF	
30	ARMF/CFRMF	71	0.0129	CPP-603/ IFSF	
31	Aluminum Plate	189	0.1235	CPP-603/ IFSF	
32	Core Filter	1	0.2185	CPP-603/ IFSF	
33	WAPD (Na/K Bonded) & SPEC (ORME)	25	0.0090	CPP-603/ IFSF	
34	MTR Canal Test Fuel	105	0.2613	CPP-603/ IFSF	
35	PBF Driver Core (2003)	2,425	0.5616	CPP-603/ IFSF	
36	Oak Ridge (2003)	62	0.2080	CPP-603/ IFSF	ORR
37	General Atomics (2003)	2	0.0052	CPP-603/ IFSF	DRR
38	FRR Japan (2003)	71	0.0138	CPP-603/ IFSF	FRR
39	FRR Indonesia (2004)	240	0.0459	CPP-603/ IFSF	FRR
40	Cornell Univ (2004)	122	0.0228	CPP-603/ IFSF	DRR
41	Univ of Illinois (2004)	210	0.0375	CPP-603/ IFSF	DRR
Subtotal	**CPP-603/IFSF**	**7,575**	**11.9084**		
42	Peach Bottom (Unit 1 Core 1)	814	1.6465	CPP-749	
43	LWBR Reflector	15	17.3314	CPP-749	
44	LWBR Blanket	12	16.7857	CPP-749	
45	LWBR Seed	12	5.1105	CPP-749	
46	LWBR 15681-C	1	0.7735	CPP-749	
47	LWBR Scrap	6	2.3489	CPP-749	
48	LWBR Scrap Module	1	0.2451	CPP-749	
49	Fermi Blanket	14	34.1715	CPP-749	
50	ORR Peach Bottom (2003)	9	0.0106	CPP-749	ORR
Subtotal	**CPP-749**	**884**	**78.4237**		

Exhibit C.7 – Continued INTEC EM-Owned Spent Nuclear Fuel Inventories

INTEC only and does not include ATRC, MFC, PBF or NRF SNF

		Amounts		10/01/04 Location	
	Fuel Description	Fuel Units	MTHM	Onsite	Offsite/ Previous
51	GNS V/21 Cask (VEPCO)	21	9.2722	CPP-2707	TAN-791
52	MC-10 Cask (BCD B-17-TURKEY POINT 3)	1	0.4118	CPP-2707	TAN-791
53	MC-10 Cask (TURKEY POINT)	5	2.2216	CPP-2707	TAN-791
54	MC-10 Cask (VEPCO)	12	5.3135	CPP-2707	TAN-791
55	VSC-17 Cask (DRCT)	17	15.0060	CPP-2707	TAN-791
56	TN-24P Cask (DRCT)	7	6.1450	CPP-2707	TAN-791
57	LOFT Center Fuel Module	4	0.8149	CPP-2707	TAN-791
58	LOFT Corner Fuel Module	4	0.2791	CPP-2707	TAN-791
59	LOFT Square Fuel Module	4	0.8130	CPP-2707	TAN-791
60	LOFT FP-2 (epoxied remains)	2	0.0999	CPP-2707	TAN-791
61	LOFT FP-1 (202 rods)	1	0.2017	CPP-2707	TAN-791
62	35 Encapsul. Tubes	3	0.0939	CPP-2707	TAN-791
63	Connecticut Yankee (S004)	1	0.3938	CPP-2707	TAN-791
64	H.B. Robinson (B05)	1	0.2292	CPP-2707	TAN-791
65	Loose Fuel Rod Storage Basket (LFRSB)	1	0.3111	CPP-2707	TAN-791
66	Peach Bottom (PH0006 & PH0462)	2	0.2853	CPP-2707	TAN-791
67	Dresden I (E00161)	1	0.1099	CPP-2707	TAN-791
68	Dresden I (UN0064)	1	0.0573	CPP-2707	TAN-791

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Exhibit C.7 – Continued INTEC EM-Owned Spent Nuclear Fuel Inventories

INTEC only and does not include ATRC, MFC, PBF or NRF SNF

		Amounts		10/01/04 Location	
	Fuel Description	Fuel Units	MTHM	Onsite	Offsite/ Previous
69	VEPCO Surry (9 rods)	1	0.0197	CPP-2707	TAN-791
70	TMI Core Debris (D-153 & D-388 epoxy)	2	0.0188	CPP-2707	TAN-791
Subtotal	**CPP-2707**	**91**	**42.0977**		
71	WV BRP-B	85	11.1880	INTEC RR Siding	WVDP
72	WV ROBERT E. GINNA	40	15.1270	INTEC RR Siding	WVDP
Subtotal	**INTEC Rail Siding**	**125**	**26.3150**		
73	TRA Various (Table C.7)	<13	0.0045	TRA Various	
Total EM-Owned SNF*		**12,266**	**165.4560**		

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* ***Does not include 15.3 metric tons heavy metal (MHTM) of EBR-II and Navy SNF in CPP-666, comprised of 7,857 fuel units. Does not include Post FY2005 ATR SNF receipts and does not include ATRC, MFC, PBF or NRF SNF.***

**** Inventories are pre-2005 which explains the difference between above totals and previous stable totals.***

Early INL Spent Nuclear Fuel DRY Storage Facilities

INTEC (ICPP)	CPP-603 (IFSF) 636 Slots 573 Fuel slots full	10.00 MTHM
	CPP-749 (underground 218 vaults)	78.40 MTHM
	CPP-1617 (MWSF) (RH-TRU)	?
Test Area North	TAN-SFCTSP (above ground cask dry pad)	38.40 MTHM
Materials and Fuels Complex	HFEF (hot cell)	11.90 MTHM
	RSWF (underground dry steel pipes)	11.30 MTHM
	ZPPR (dry cask storage in concrete)	9.50 MTHM
	TREAT (concrete pits)	0.01 MTHM
Naval Reactor Facility	400 SNF Assemblies	?

Total Dry Storage	159.51 MTHM
Total Wet and Dry Storage	275.55 MTHM

1994 figures in metric tons heavy metal (plutonium, uranium, and thorium) [Hoskins 7/11/94] DOE-INL Energy and Environment, Fact Sheet, Storage of DOE SNF at the Idaho National Laboratory

Earlier Spent Reactor Fuel Dumped at INL's RWMC Subsurface Disposal Area Burial Grounds 1952 to 1980 [RWMIS][75]

Generator	Mass in Grams
Materials Fuels Complex (MFC) aka. Argonne Laboratory-West	2,177,150
Idaho Nuclear Technology and Environmental Center (INTEC)	9,246,306
Naval Reactors Facility (NRF)	27,707,700
General Dynamics, General Atomics Division San Diego, CA	22,861,440
General Electric, Vallecitos Atomic Laboratory Pleasanton, CA	11,568,800
Special Power Excursion Test (SPERT) INL	14,517
Test Area North (TAN) INL	16,433,193
Advanced Test Reactor Complex aka. Test Reactor Area (TRA)	273,866
Total Mass in Grams	90,282,972
Total Mass in Metric Tons	90.282

Source for above table: Radioactive Waste Management Information Data Base Solid Master Data Base (P61SH090), List for 1954 to 1970, Run Date 3/29/89, pages 517, 518, 519 and 520 (RWMIS).

The above preliminary numbers, compiled by the Environmental Defense Institute, are drawn from DOE's Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) and represent about 57 shipments specifically identified as "irradiated fuel." Not included in the above listing are even more numerous shipments called "un-irradiated fuel", "fuel rods", "control rods", and other reactor fuel not identified specifically as "irradiated". The curie content of these shipments identified as "fuel rods" (>7,000 curies) suggests that they are also irradiated reactor fuel. [8] [9]

Section I.E. 2. INTEC High-Level Waste Tank Farm

The reprocessing of used reactor fuel, called spent nuclear fuel (SNF), at INTEC (formerly ICPP) involves dissolving the metal rods in highly acidic and solvent solutions from which select radioactive isotopes (highly-enriched uranium for military) are extracted. The remaining high-level/hazardous radioactive and toxic liquid waste (raffinate) was then stored in eleven 300,000 gallon underground tanks

8 EGG-WM-10903 @ 2-30.

9 A. Hoskins, WINCO, 7/11/94. The Blue Ribbon Commission report can be cited as a more current reference; there are INL citations in the BRC of INL spent fuel, 308 metric tons heavy metal.

currently reduced to three using extensive evaporation operations explained in more detail below.

Definitions:

"reprocessing: dissolving used nuclear reactor fuel (spent nuclear fuel) in acid (typically nitric acid) and performing chemical separations and extractions to remove the valuable (reusable) materials such as plutonium and uranium.

recovered product: reusable materials such as plutonium (for nuclear weapons) and highly enriched uranium extracted from the dissolved SNF for Nuclear Navy fuel .

generation: In nuclear fuel reprocessing, several cycles (generations) may be required to extract all of the usable material from acid-dissolved fuel. The liquid waste from the first generations will have nearly all of the radioactivity in it.

liquid waste not related to reprocessing: radioactive liquids produced during activities like decontamination of equipment (wash water) and during laboratory analyses (lab drain water). At INEEL, some of these liquids were stored in the same tanks as high-level waste.

sluice or sluicing: moving a solid or sludge by flushing or rinsing out with liquid.

tank heels: the stuff that remains in storage tanks after as much of the liquid has been removed as can be using the available equipment and technology. This includes liquids, suspended solids and sludges that have settled out of the liquid. Tank heels are typically highly radioactive as the solids and sludges tend to concentrate the radioactive material.

derived solid waste: a solid waste (i.e. calcine) generated from the treatment of reprocessing liquid waste.

fission products: in this case, highly radioactive isotopes produced as a result of the splitting (fission) of uranium or plutonium in a nuclear reactor. Example: A uranium atom in nuclear fuel can absorb a neutron and split (fission) into two smaller atoms and produce fission products like cesium and strontium." [10]

"The tanks are encased in concrete vaults which have sumps and leak detection. Seven tanks have been cleaned to *[questionable]* RCRA standards and have been grouted in place for final closure. The remaining four tanks (three full and one spare) will be cleaned and grouted once the sodium-bearing waste has been removed. Some leaks from transfer lines outside the tanks have occurred, and this drives the current cleanup program. Crews have transferred material from tank WM-190 to WM-187 and washed and grouted inactive lines." [11] [emphasis added see discussion below]

"In 2003, a federal judge told the U.S. Department of Energy it can't make high-level nuclear waste into something else simply by giving it a new name. In response to the court ruling, then DOE Secretary Spencer Abraham asked Congress to change the law so it can do just that.

"The ruling applies to high-level waste at several DOE facilities: INL, Hanford in Washington, Savannah River in South Carolina, and West Valley in New York.

"At issue is the definition of high-level waste, the highly radioactive material left over from reprocessing (recycling) of spent nuclear fuel. **There are three types of high-level waste at INL: a granular form called calcine, liquid waste, and the residuals (heels) left in the tanks after most of the liquid waste is removed.**

"Removing high-level waste from tanks and treating it for disposal presents an enormous and expensive challenge. Unlike Hanford and Savannah River, most of INL's nearly **10 million gallons of liquid high-level waste** has already been converted [via incineration] into a solid form (calcine). But we still have to find a way to treat the calcine and the remaining one million gallons of liquid waste so they can be disposed appropriately. And we have to find a way to deal with residuals so

[10] INEEL 8/03 Oversight *Monitor* newsletter published by the state INEEL Oversight program, which monitors activities at INEEL on behalf of the citizens of Idaho.www.Oversight.state.id.us.

[11] DOE/EM Flour 11/3/20

INEEL's Tank Farm area doesn't pose a threat to people or the environment.

"Tank residuals [sludge/heels] high-level waste is tougher to get this out of the tanks. Residuals can be a sludgy mix of chemical and radioactive elements. The tanks have pipes and other equipment in them that is hard to rinse off.

"DOE's legal and legislative actions at the national level have caused Idaho and other states concern about DOE's future plans for managing high-level waste. In response to a lawsuit brought by the Natural Resources Defense Council, EDI, numerous activist groups and Shoshone-Bannock Bannock Tribes challenging DOE's internal process for reclassifying high-level waste, DOE argued it could reclassify waste based on economic, technical or other undefined alternative requirements. DOE also argued that the federal law requiring disposal of high-level waste in a repository didn't apply to DOE waste.

"Troubled by these [NRDC] arguments, states affected by DOE high-level waste facilities; Idaho, South Carolina, Oregon and Washington joined the case as friends of the court **to protect their interests in safe, cost-effective, cleanup and responsible use of repository capacity**. Idaho representatives felt the court ruling supported the states' position, saying the federal court decision only confirmed long-standing national policy, which requires disposal of high-level waste in a geologic repository **while allowing properly treated, less radioactive wastes to be disposed elsewhere**." [12] [emphasis added]

Tragically, Judge Windmill's decision was problematic because it allowed DOE to effectuate an end-run around the law – with the states concurrence - by coming up with plant designs to "properly treat" the high-level (HLW) waste into two waste forms (one HLW and one LLW). That was back in 2003. Now >14 years later and DOE still has no functioning treatment plants at any of the three DOE sites.

Judge Windmill decision stated:

"NRDC seeks injunctive relief prohibiting DOE from taking any actions inconsistent with NWPA, including plans for grouting with concrete for permanent disposal any HLW in Washington, Idaho, and South Carolina. There is no indication, however, that DOE will ignore this decision and continue with any plan inconsistent with NWPA. Thus, the court finds no need at this time to issue injunctive relief. Should that need arise in the future, plaintiffs are free to re-open this case and pursue that relief." [13]

The states who claimed to be; "Troubled by these [NRDC] arguments - states affected by DOE high-level waste facilities - Idaho, South Carolina, Oregon and Washington," affectively blocked any possible reopening of the case to hold DOE accountable. The states' claims "to protect their interests in safe, cost-effective, cleanup and responsible use of repository capacity" were nothing but a smoke screen for the federal government to obfuscate the law. Moreover, the aging and leaking tanks daily put Idaho's sole-source aquifer at risk by failing.

DOE's Legacy One Million Gallon High-level Waste

Radioactive decay of the short-lived isotopes reduces the total activity levels over time. DOE's 1997 *Linking Legacies* credits INL's high-level liquid waste at 300 curies per cubic meter, or 2,430,000 curies in one 8,100 cm tank of waste.[DOE/EM-0319@38] Plutonium concentrations of wastes discharged to the tanks can reach 30 milli-curie of alpha activity/liter.[IDO-14532 @ 13] . Another DOE report found this HLW raffinate can range in concentration between several to12,000 Ci/gal to 5 million Ci/gal. depending on the batch. [IDO-14532 @18&24]

This waste is so radioactively toxic, if a person was exposed to even a small cup, it would be lethal. Previously, ICPP-601 spent fuel raffinate waste went to the tank farm for temporary storage before being sent to the ICPP New Waste Calcine Facility incinerator. Raffinate from the 1950's that contains sodium is still in the underground storage tanks because of incompatibility with the Calciner.

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[12] INEEL 8/03 Oversight *Monitor* newsletter published by the state INEEL Oversight program, which monitors activities at INEEL on behalf of the citizens of Idaho.www.Oversight.state.id.us.

[13] U.S. District Court for the District of Idaho, CIV. No. 01-0413-S-BLW, 2003 July 3, NRDC, et al v. Spencer Abraham, DOE.

Also EDI forced DOE to shut-down both Calciner for emissions violations. [14] The current plan is to send tank waste to the Integrated Waste Treatment Unit (IWTU) if/when it starts operation. As previously discussed, DOE has been trying for >14 years to get IWTU operational. See Section E.2.b for more discussion on the IWTU.

The ICPP underground tank farm had eleven 300,000 gal. (1100 cm) tanks, eight of which have cooling lines; four 30,000 gallon (113 cm) tanks. Three additional 18,000 gal. (70 cm) tanks are located in the Waste Treatment Building (CPP-604). [ICPP RI/FS] Coolant is required because the highly radioactive waste also generates considerable thermal heat that must be cooled. The rate of decay heat in a tank is 373,000 btu per hour. [IDO-14502 @9] Other documents quantify decay heat generation at 100 watts/cubic meter. [DOE-EA-0831]

As of this writing DOE has emptied 7 of the original 11 (300,000 gal tanks) by concentrating the waste and leaving 3 (300,000 gal tanks) yet to remediate the 900,000 gal. using the Integrated Waste Treatment Unit (IWTU) as treatment process discussed more in Section E.2.b

The tanks are at risk of failure from age and other factors. "The [1100 cm] tanks are, however, slightly over stressed in compressive bending, according to criteria of the [American Society Mechanical Engineers] ASME Code, Section VIII, Division 2 regarding buckling." [RE-A-80-102 @ 7] This assessment did not allow for a full tank, or corrosion which has occurred in the tanks, some of which are 58 years old. [ENICO-1131@13] Also see Earthquake Section below.

Corrosion resulting from the highly toxic acids, solvents, and radiation has been documented as high as 1.0 mil. [ENICO-1131 @ 15] This represents a reduction of the original steel in addition to the more vulnerable welds at the seams. The welds were a large concern, after testing showed high corrosion rates at the welds.

Another tank analysis found; "Three welds were cut from welded coupons which were prepared at the fabrication site using the process that was used to fabricate the tanks. In the as-welded condition, these specimens suffered high corrosion rates at the end of the third cycle; and average corrosion rate of 0.0211 inches per month being observed."... "The corrosion resistance of these welds was revealed by Heuy(sic) test rates indicates extremely poor resistance. Further, these tests indicate that the actual tank welds are susceptible to intergranular attack."... "In order to prolong the life of the tanks, type 316 ELC stainless steel plates were welded over the inside surface of the original welds by the fabricator. The cover plate dimensions were 4 inch wide strips cut from 1/4 inch sheet." ... "Huey tests were conducted on five metal-arc process fillet deposits cut with a grinding disk from the cover plate edges." "... specimens Y-80 and Y-83 exceeded (0.0096 & 0.0087) the rate of 0.003 inches per month average of five 48 hour periods which is the specification allowance." [IDO 14364 @ 49]

The tanks "largest compressive stress is the longitudinal stress in element 1 and has a value of 2163 psi. The ASME Code, Section VIII, Division 2, however, allows a compressive stress of only 2117 psi (for 347 and 304L [steel]) because of potential for buckling. This suggests that the tank is slightly over stressed." [Additionally, the tanks will only sustain an earthquake] "with a ground acceleration slightly less than 0.24 g, providing that no corrosion is assumed." [RE-A-80-102 @ 6] Connecting systems to the tanks can only sustain a 0.18 g ground acceleration. [DOE/EA-0831] A 1977 INL Environmental Impact Statement used the May 18, 1940 El Centro, CA earthquake to evaluate the ICPP's waste tanks. "Even when subjected to the 1940 El Centro earthquake record scaled to a peak ground acceleration of 0.5 g, the waste tanks were stressed only to 21,300 psi." [ERDA-1536@II-77] The unscaled 1940 El Centro earthquake record would generate a peak ground acceleration of 0.33 g. "This latter acceleration, 0.33 corresponds to the acceleration expected at the ICPP from a hypothetical earthquake of Richter magnitude 7-3/4 on the Arco fault at a point 15 miles from ICPP." [Ibid.]

Comparing the previous engineered stress analysis of the tanks (without the corrosion factor) to sustain less than 0.24 g with even the unscaled hypothetical earthquake of 0.33 g reveals a striking 38%

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[14] May 5, 2000 EDI Notice of Intent to Sue --New Waste Calcining Facility (NWCF); (1) Petition for Declaratory Ruling; (2) Request for Imposition of Financial Sanctions Against DOE for Failure to Furnish a Closure Plan as Mandated by the Second Modification to the Consent Order and by the Resource Conservation and Recovery Act ("RCRA")

over stressed tank scenario. The 1983 Borah Peak quake's epicenter, only 40 miles northwest of Arco, registered 7.3 on the Richter scale. The 1959 and 1975 Yellowstone quakes registered 7.5 and 6.1 respectively on the Richter scale. The combined risk of old over stressed and corroded tanks with earthquake hazard is significant. Moreover, DOE has negotiated a sweetheart Consent Order with the State to replace the tanks in the next 20 years. The design life of the tanks is 20 years. They have already been in use for nearly 40 years. When DOE complies with the Consent Order, they will be 60 years old, assuming they have not ruptured in the meantime. Should such an accident occur, it would be a catastrophic disaster with extensive impacts on the entire northwest because the Snake River is a tributary of the Columbia River.

The State of Idaho commissioned a limited study by Boise State University seismologist James Zollweg who found that "if a large earthquake struck, the biggest worry would be those tanks". Zallweg's assessment was endorsed by U.S. Geological Survey's Larry Mann who said, "that would be a catastrophic release. It couldn't be intercepted before reaching the aquifer". Zollweg calculated that, "if an earthquake of 7 on the Richter scale hit the fault closest to the tanks, a ground acceleration of about 0.24 G could hit the vaults". [Statesmen (b)] A catastrophic risk exists with these sixty-year-old tanks which DOE refuses to address. The tanks are 400 feet above the Snake River Plain Aquifer that provides drinking water for over 275,000 Idahoans. Scientists also believe that if the tanks fail, then the acids in the tanks will react with the concrete in the vaults and release large amounts of radioactive gases into the atmosphere. See Section I for more information on volcanic hazards.

DOE contends that a spare tank is available in the event a problem arises; waste can be transferred to the spare tank. This contingency relies heavily on there being no more than one tank failure, that the service lines needed to pump out the failed tank remain intact, that the pump capacity is sufficient to remove the waste in minutes, and that operators can respond quickly in a multiple event accident scenario. DOE's 1993 assessment shows that the tank service lines could not survive greater than 0.18 g and the pumps to transfer the waste to another tank can only deliver 50 gallons/minute. [DOE/EA-0831] That means it would take 100 hours to transfer 300,000 gallons assuming the transfer lines survive. This does not qualify as a credible rapid emergency response to prevent tank contents from leaking into the ground.

Of particular concern is the long-term reliability of tanks WM-185, 187, and 188, whose corrosion rate is "definitely increasing". [ENICO-1131 @ 19] The 9,000 feet of underground piping used in transfer of radioactive waste does not meet RCRA standards for continuous secondary containment. Some lines are encased in concrete. "The concrete encasement is found in the immediate vicinity of valve boxes and around about 5% of the underground piping." [Ibid. @ 2] According to the General Accounting Office these underground pipes have leaked substantial quantities of high-level waste to the ground. [GAO/RCED/91-56] Also in March 1962, two tanks discharged to their vaults due to poorly designed service lines. Twelve INL tank or waste line leaks are documented through 1976. [ERDA-1536@II-79] DOE is currently replacing some of these service lines.

The tanks also do not meet Resource Conservation Recovery Act (RCRA) requirements for secondary containment of hazardous wastes. "A Notice of Noncompliance was issued on January 29, 1990 by the EPA because the secondary containment (concrete vaults) is subject to attack by the acidic solutions stored in the tanks", and "the pillar and panel construction style of the vaults has insufficient seismic resistance." [Spent Fuel Plan @ 8&11] Indeed, the 30,000 gal. tanks do not even have any vaults or secondary containment. In 1995, these un-vaulted tanks were emptied and taken out of service.

The vaulted tanks also support 10 feet of earth plus a 12,000 pound concrete structure for radiation shielding of the vent pipes. That puts the bottom of the tank over 32 feet in the ground generating considerable earth loads. In an earthquake scenario, a collapsing vault would compound the stresses on the weak tanks and add to the likelihood of a total tank failure. The integrity of the vaults and their ability to hold the tank contents if it ruptured are further challenged because five of the 11 (300,000 gal.) tanks get water "in-leakage" that must be periodically pumped out. [ERDA-1536@II-79]

The State Oversight Program disclosed that an average of more than 2,400 gallons per month was pumped from the concrete vaults enclosing the high-level waste tanks. This compares to a maximum of 100 gallons per year that normally would be expected to seep into the tank vaults. [Oversight 92 @ 17] Another uncertainty is how much of the 2,400 gallons pumped out of the vaults is tank leakage and how much is ground/surface water migration into the vaults.

"Major discrepancies were discovered between recorded volumes of water pumped from the aquifer for [ICPP] production use when compared with water used and disposed or lost from February 1990 to December 1990. Approximately 20 million gallons were unaccounted for in June 1990 alone."..."Since 1988, water level in a perched body of water approximately 370 feet below the tank farm rose nearly six feet. Measurements were taken in a well about 500 feet southwest of the tank farm." [Oversight 92]

ERDA documents show a long history of tritium plume migration under the ICPP. In 1960 the plume registered 1,000,000 pCi/L and was expected to migrate 12 miles south of the boundary. [ERDA@III-69] Significant spills and leaks have frequently occurred over INL's history. "Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [DOE/EH/OEV-22-P,p.3-166] DOE sources cite that high-level tank wastes can range in concentration between 12,000 Ci/gal or 5 million Ci per batch [IDO-14532 @18&23] to 25,000 Ci/gal. [IDO-14414] One gallon is equal to 3.79 liters. Converting the previous concentrations to metric would be 3,166.22 Ci/L and 6,596.3 Ci/L respectively. Plutonium concentrations can reach 30 millicurie of alpha activity per liter. [Ibid @ 13] There is no doubt that these figures characterize an extremely radioactive witch's brew which when released to the environment via leaks represents a significant hazard. Also see Section IV(H) for more discussion of groundwater contamination under the ICPP.

INTEC/ICPP Tank Farm High-Level Sodium Bearing Liquid Waste

Tanks WM-180, 181,182, 183, 184, 185 and 186 were emptied using a series of evaporators (High-level Waste Evaporator) with the remaining concentrate flushed to the three remaining tanks that include; WM-187, 188, 189. DOE's High-level Waste EIS puts the total tank volume at 1,400,000 gal. [15] A later DOE EIS Supplement put the curie content of the 11 tank waste at 3,500,000 curies. [16] It is important to note that the waste curie content has been transferred to the remaining 3 tanks (WM-187, 188, 189). Tank WM-190 is kept empty as a spare.

"Additional samples of the heel in several tanks have been taken this year and will help resolve present uncertainties in the estimates of total tank solids. However, in light of the above indications that there could be more solids than originally estimated, the following estimates are proposed for the quantity of solids that will be present in the tanks at commencement of SBW treatment." [17] The volume of solids in the three remaining open tanks (WM-187, 188, 189) is between 120,000 kg and 200,000 kg. [18]

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[15] Idaho High-level Waste and Facilities Disposition Draft Environmental Impact Statement December 1999 DOE/EIS-0287D Pg. 4-99. [BEMR @26] By January 1998 the non-sodium liquid portion is to be calcined and the sodium bearing waste is to be reduced by 330,000 gallons (1250 cm) to comply with a court order. However, as of this writing the total volume is ~ 900,000 gallons.

[16] SUPPLEMENT ANALYSIS For The Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement June 2005 United States Department of Energy Idaho Operations DOE/EIS-0287 -SA-Ol; Figure 2. Sodium Bearing Waste--Total Curie Inventory Versus Time Comparison of Current-2005-Composition to FEIS, pg 9.

[17] Feed Composition for the Sodium-Bearing Waste Treatment Process, September 2003, INEEL/EXT-2000-01378, Pg. 54.

[18] Ibid.

Section I.E.2.a

INTEC High-Level Tank Farm Residual Stabilization andTank Grout Filling

"Residual radioactivity in small amounts of solids and contaminated flush water that could not be removed from the tanks by the cleaning process or technically practical means was stabilized in the tank with cement based grout….The residual inventories for each of the cleaned tanks are given in Table II."

Table II Residual Inventory in "Cleaned" Tank Farm Facility Tanks [19]

Tank	Residual Inventory Gigga /Becquerel (GBq)*	Volume in kilo grams [20]
WM-103-106	5,300	?
WM--180	39,000	542
WM—181	28,000	246
WM—182	89,000	1,238
WM—183	50,000	702
WM—184	40,000	558
WM--185	51,000	720
WM—186	24,000	334
Total	**281,300 G/Bq**	**4,340 kg**
*Cesium-137 / Ba-137m accounts	for ~95% of total activity	

1 Giga Becquerel (GBq) = 1 Billion Becquerel (Bq); 1 Curie = 37 billion Becquerel;
281,300 GBq = 7,603 Curies

INTEC Tank Farm soils: "Concentrations of strontium-90 (Sr-90), technetium-99 (Tc-99), iodine-129, and nitrate-N currently exceed State of Idaho groundwater quality standards (maximum contaminant levels [MCLs]) in the Snake River Plain Aquifer (SRPA). The baseline risk assessment concluded that Sr-90 concentrations in the SRPA would exceed MCLs beyond the year 2095 and that cesium-137 concentrations in the soil will exceed risk-based levels after 2095. It also concluded that the other aquifer contaminants will meet MCLs by 2095.

Remedial Investigation/Baseline Risk Assessment (RI/BRA) and Feasibility Study (FS) for tank farm soil and groundwater: "The BRA concluded that cesium-137 (Cs-137) concentrations in the soil will continue to exceed risk-based levels after 2095 for soil inside the tank farm boundary but will meet risk-based levels before 2095 for the two sites outside the boundary. The groundwater beneath INTEC currently exceeds State of Idaho groundwater quality standards at one or more monitoring wells for strontium-90 (Sr-90) and iodine-129 from the former injection well and for technetium-99 and nitrate measured as nitrogen from historical tank farm releases. Modeling results predicted that Sr-90 concentrations in the SRPA would continue to exceed the State of Idaho groundwater quality standard beyond the year 2095, but all other contaminants would meet the standards before 2095. Remedial action objectives and preliminary remediation goals are defined in the FS based on the BRA predictions."

"The performance assessment for the Tank Farm Facility predicted peak concentrations of Tc-99 in the SRPA of 9.3E-09 pCi/L **150 years after tank closure** from the sand pads, and 116 pCi/L from the tanks and 0.27 pCi/L from the piping **14,600 years after closure**. The maximum Tc-99 groundwater concentration predicted from the WCF was 82 pCi/L **790 years after closure**. The peak Tc-99 concentration in the OU 3-14 model is predicted to exceed MCLs briefly in 1999 and is predicted to be 10 pCi/L in **92 years**. Because the predicted peak concentrations from each non-CERCLA source are much less than the MCL of 900 pCi/L and **occur post-2095**, and the peak predicted concentration post-2095 from CERCLA sources (10 pCi/L) is also much less than the MCL, there would be no

[19] *Recent Progress in DOE Waste Tank Closure*, WM Symposium 2008 Paper 8396, 2/24-28, 2008, Phoenix, AZ, WSRC-STI-2007-00686, 1/31/08, Pg.8-9.

[20] Basis for Section 3116 Determination for the Idaho Nuclear Technology Center Tank Farm Facility, November 2006, DOE/NE-ID-11226, pg 33.

concerns for cumulative risk, even if the maximum predicted concentrations from the non-CERCLA INTEC sources occurred at the same place and time and were summed. [pg. 1-20] [21]

DOE sources cite that INTEC/ICPP high-level tank wastes can range in concentration between 12,000 Ci/gal or 5 million Ci per batch [IDO-14532 @18&23] to 25,000 Ci/gal. [IDO-14414] One gallon is equal to 3.79 liters. Converting the previous concentrations to metric would be 3,166.22 Ci/L and 6,596.3 Ci/L respectively. Plutonium concentrations can reach 30 millicurie of alpha activity per liter. [Ibid @ 13] If one were to apply the previous concentrations (3,166.22 & 6,596.3 Ci/L) to the 7,582 cubic meters (7,582,000 L) in the waste tanks, the curie content might be in the range of 2.4 x 10^{10} (24 billion) to 5.0 x 10^{10} (50 billion) curies at the time of internment in the tank. (DOE-RW-0333P)." [22]

The residuals from the incineration of the high-level liquid waste in the New Waste Calcine Facility (NWCF) are combined with a calcine material and stored in huge underground silos which must be mechanically cooled because of the heat generated by the radiation. Between 1992 and when the first Calciner (WCF) was built at the ICPP in 1962, more than 7.5 million gallons of high-level liquid waste have been incinerated in the Calciner. The 7.5 million gallons (28,000 cm) calcined plus 2.1 million gallons (8,100 cm) in the tanks makes a total of 9.6 million gallons (36,100 cm) of high-level liquid waste generated. The calcine volumes include 3 campaigns of the NWCF. 1993 calcine volumes in 5 silos are 123,000 cubic feet (3500 cm). Two additional silos are ready for additional calcine campaigns. [Spent Fuel Plan @ 49] As of 1995, the calcine volume is 3,700 cm.[BEMR© @26] Calcine entering the silos is over 200 degrees generated from the radioactive decay heat of the waste, and thus requires continuous cooling.

Due to process restrictions in the calcine process, only acid based high-level liquid (raffinate) waste from reactor fuel reprocessing is incinerated. Earlier high-level liquid sodium-bearing raffinate waste and system decontamination solutions are chemically not readily compatible for the Calciner without dilution. The sodium raffinate must be either blended with non-sodium raffinate or mixed with large quantities of aluminum nitrate "nanohydrate" before it can be calcined. In order to calcine the existing 1.8 million gallons of sodium-bearing high-level waste, the Department estimates it will have to dilute it with about 5.4 million gallons of aluminum nitrate. The Calcine plant can process about 3,000 gallons per day. [Times News(g) 7/27/92]

Therefore, this waste has remained in the holding tanks since the ICPP first started operations in 1952. DOE, in a particularly misguided attempt to write off high-level liquid waste volumes, now states that: "... sodium-bearing waste, which has been primarily generated from decontamination chemicals used to clean tank farm piping, is not legally considered to be HLW, so it will be considered separately." [EMSSAB @ 7][BEMR© @26]

Review of the ICPP early reactor fuel reprocessing, "... involved dissolution of [Materials Test Reactor] MTR assemblies in a sodium hydroxide-sodium nitrate solution, leaving a precipitate of sodium diuranate [sic] and fission products." [IDO-14445 @ 14][IDO-14300@5][IDO-14307@8][IDO-14362@5][IDO-14295@27][IDO-14567@4&15]

These Phillips Petroleum Co. (ICPP operating contractor) documents show without a doubt that ICPP sodium-bearing waste in the Tank Farm includes appropriately designated high-level waste from reprocessing reactor fuel and any recent attempt by DOE to delist this waste as "not high-level waste," is illegal. The nine year RaLa program (1954-1963) focused on the recovery of Barium-140 from reactor fuel, and required different chemical processes from highly enriched uranium reprocessing programs. Some RaLa runs involved four cycles. The first two cycles were for Barium-140 extraction and the third and fourth were for uranium extraction. Even more outrageous is the fact that State and EPA, as regulators, are willing to go along with DOE on this delisting initiative. See Section I.D for more on the RaLa runs.

"In order to cut costs in the early years of the Cold War, the US Government built carbon steel tanks for the wastes, which were first made alkaline by adding sodium hydroxide. This has had a number

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[21] Operable Unit 3-14 Tank Farm Soil and Groundwater Feasibility Study May 2006, DOE-ID-11247

[22] DOE-INL Energy and Environment, Fact Sheet, Storage of DOE SNF at the Idaho National Laboratory. The above INL SNF inventory numbers are understated when compared to independent assessments by the Blue Ribbon Commission 2012 Report. DFNSB states CPP-666 built in 1984 confirms the 2024 end-of-life.

of consequences. First of all, as soon as a solution is no longer acidic, many of the substances which were dissolved in the acid precipitate out (settle to the bottom) as sludge. Thus, instead of a well-mixed liquid, the waste becomes a combination of liquid and sludge, this can lead to uneven distribution of materials, resulting in hot spots (if radioactive materials build up in one area) and introducing the risk of criticality (if plutonium materials build up in one area). It also makes it more difficult to determine the actual contents of the tanks, because samples are less representative of the whole than in the case of an evenly mixed liquid solution.

"Also, alkaline wastes are more difficult to solidify into glass than are acidic wastes. Acidic wastes tend to pose fewer problems since they can more easily be solidified for long-term management and the potential hazards introduced by making the waste alkaline are avoided. However, acidic wastes also can pose dangers. For example, since the stainless steel tanks necessary for storing acidic wastes are very expensive, there are strong economic incentives to minimize waste volumes. This means that the concentration of radioactivity tends to be much higher, and consequently the wastes also generated much more heat. Continuous cooling of the waste is crucial. The importance of the tank cooling system is illustrated by an accident at the French reprocessing plant at La Hague in 1980. La Hague experienced a plant-wide electrical failure in April 1980, when a fire and subsequent complications at the reprocessing plant knocked out both the regular and the emergency power supplies. Among the systems affected was of course the cooling system for the waste tanks, which contain radioactive wastes that are typically orders of magnitude more radioactive and therefore generate more heat than the average wastes stored in the US Tanks. A cooling failure of three to ten hours could result in these wastes boiling at which point they would begin releasing cesium-137 and ruthenium-106. The releases would contaminate the site and possibly the environment. The uncooled tanks could boil completely dry in a few days, possibly resulting in an explosion." [IEER(e);Plutonium: Deadly Gold of the Nuclear Age @ 96]

DOE acknowledges 13 pounds of plutonium and 1,000 pounds of uranium are in the INL tank farm wastes. [Times News(g) 7/27/92] US Senate Government Affairs Committee investigative team warned DOE that a nuclear waste tank at the INL could explode like the April 1993 Russian Tonsk-7 tank explosion that spewed radioactivity over a 47-square-mile area. [Times(b) 12/10/93] Hydrogen build-up in the tanks has been of particular concern with the high-level waste tanks at Hanford. The explosive nature of hydrogen coupled with the potential criticality of tank constituents poses a significant risk. This is in addition to the previously mentioned structural and seismic risks of INL tanks. Collectively, these present a formidable and unacceptable hazard.

The magnitude of the hazard warrants a comprehensive, independent, engineering, structural, and seismic analysis of the tanks that includes a full assessment of the current and projected corrosion factors. These studies must identify a priority sequence for decommissioning and decontamination (D&D) starting with the worst tanks. An integral part of this study also must fully characterize the waste constituent composition of each tank. A time table of not more than five years must be imposed on DOE to decommission and decontaminate these high-level waste tanks.

The Notice of Non-compliance issued by EPA on January 28, 1990 and the resulting Notice of Non-compliance Consent Order signed April 3, 1992 outlines a schedule that will result in the permanent cession of use of the ICPP five pillar and panel (segmented) high-level tanks before March 31, 2009 and the remaining six cast in place (monolithic) tank vaults before June 30, 2015. This time line for the ICPP high-level waste tanks WM-182 through 186 fails to prioritize this project based on the significant risk these old tanks pose. Seventeen years to D&D the first five tanks and twenty-three years for the other six 300,000 gal tanks makes a mockery of hazard prioritization and the Federal Facility Compliance Act. Admittedly, the State is partially at fault for accepting that time line. Had the State provided the appropriate documentation to the US District Court, the time line would have been appreciably shorter. Additionally, the enforceable time line and the project description in the INL EIS provide no action on the three 70 cm tanks WM-100, 101, and 102 that had high-level liquid wastes and no containment vaults.

These engineering studies by definition also must include the tank concrete vaults. DOE has been fully aware of the problem for decades and has chosen to maintain its spending priorities with nuclear materials production projects as opposed to spending on immediate environmental and safety hazards.

DOE's new INL Spent Fuels Plan will only increase the load on the tanks thereby increasing the risk of catastrophic contamination of Idaho's sole source aquifer underlying the site. DOE plans (in the next 20 years) to replace five of the 300,000 gallon high-level tanks with four new 500,000 gallon tanks, which will result in a net increase in storage capacity of 500,000 gallons. Presumably, the five tanks slated for replacement are the ones with segmented vaults which do not meet seismic or containment standards. This investment is the best indicator of DOE's intentions to expand production capacity at INL. Given that existing tank capacity, coupled with calcine campaigns, has been able to meet full scale ICPP production needs for four decades, it begs the question of why is additional capacity needed?

The unstated hidden agenda is to build new production capacity under the guise of waste management programs designed to process spent fuel for final disposal in a repository. Again, as former Governor Andrus has correctly stated, spent fuel requires no processing prior to internment in a nuclear waste repository. Approximately, 20,000 metric tons of commercial spent fuel from 112 reactors must be disposed. DOE has agreed to take possession of this spent fuel by 1998. By the year 2030, there will be four times more spent fuel to be disposed. This issue is more fully discussed in the Spent Fuel Plan Section II(A).

ICPP Waste Tank Leak Incidents [23]

Date	Site	Description	Activity Released
December 1958		service line leak	?
March 3, 1959		leak to vault	?
1974	CPP-15	Solvent tank leak	2000 L 3 R/hr. 43,400 pCi/g
January 1976	CPP-16	transfer line rupture tank 181	3,000 gal 9.66 R/hr.
1978	CPP-20	Tank truck loading station	100 gal.
February 1954	CPP-24	Tank 181 condensate line	1,470 Ci/gal. 280 mR/hr.
August 1960	CPP-25	transfer line rupture to CPP-604	10 gal. 9 cm soil contam./330 pCi/g
March 1962		2 tanks leaked into vaults	?
May 10, 1964	CPP-26	15 gal. service line leak	22,400 pCi/g Ce-144/10 acres contaminated
April 1974	CPP-27/33	tank vent failure	540 gal./1,000 to 3,000 Ci
October 1974	CPP-28	Transfer Line leak	230 gal./ 3,000 Ci/46 cm soil contam.
October 1974	CPP-33	service line leak	6,000 Ci
June 1975	CPP-30	valve box leak	12 cubic meters soil contaminated
September 1975	CPP-31	18,600 gal service line leak	8,990,000 pCi/g/30,000 Ci
January 16, 1976		12 gal leak in diversion valve	1,130 Ci
December 1976	CPP-32	service valve leak	8 cubic meters soil contaminated
July 1989		Condenser Transfer Pipe Leak	?
March 1992		2 tanks discharged to vaults	?
1975	CPP-58	service line leak	20,000 gal./63.1 pCi/g soil contaminated
1954	CPP-58W	PEW service line leak	1,000 gal./72*u*Ci Cs-137
September 1976	CPP-79	20,000 gal service line leak	.06 Ci

Other DOE documents cite that, "Most spills have been the result of line and tank failures, leaking valves, and equipment and tank overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [DOE/EH/OEV-22-P @3-116] N.S. Nokkentved reports a 30,000 gal. leak plus a 20 year leak starting in 1955 and discovered in 1975 which contaminated 1,800 yards of soil. [Times News, 8/29/89] The ICPP Remedial Investigation Feasibility Study lists 13 release sites related to the tank farm out of 100 total chemical and radiological release sites at the ICPP. This study estimates that 23,041 curies (decayed to 1992 values) were released to

[23] Operable Unit 3-14 INTEC Tank Farm Soil and Groundwater Risk Assessment, DOE/NE-ID-11227,

the soil at the ICPP, and 22,200 curies (decayed to 1992 values) were dumped down the ICPP injection well. [INL-95/0056 @ 2-139; 2-13] See ICPP cleanup section IV part H for more details.

"And as Carroll Wilson, the first general manager of the Atomic Energy Commission, acknowledged in 1979: Chemists and chemical engineers were not interested in dealing with waste. It was not glamorous; there were no careers; its was messy; nobody got brownie points for caring about nuclear waste. The Atomic Energy Commission neglected the problem .... The central point is that there was no real interest or profit in dealing with the back end of the fuel cycle." [IEER(e) @ 111] Also see Section IV(I)(1) ICPP Tank Remediation.

Section I.E.2.b INL's IWTU High-Level Radioactive Liquid Waste Treatment Plant Having Major Startup Problems

The Integrated Waste Treatment Unit (IWTU) is designed to convert ~900,000 gallons of previously classified high-level liquid waste generated over decades of nuclear fuel reprocessing to a solid form suitable for final disposal in a geologic repository. DOE's Occurrence Reports document serious malfunctions of the IWTU.

"On Saturday, June 16, 2012, the Integrated Waste Treatment Unit (IWTU) was performing startup and testing activities when an unexpected pressure transient caused a loss of vacuum in the Carbon Reduction Reformer (CRR) vessel activating the Rapid Shutdown System (RSS). IWTU Operations were in the process of performing the system lineup to transfer Off-Gas Filter (OGF) material to the Product Receiver Filter/Product Receiver Cooler-1 (PRF/PRC-1) when the CRR began losing vacuum needed to maintain established operating parameters and to continue heat-up of the steam reforming process. Control room operators backed out of the product transfer lineup, exited the transfer procedure and continued to operate the plant under the IWTU startup procedure. IWTU Operations personnel, with engineering support, continued to monitor the system and make adjustments throughout the evening attempting to restore CRR heat up and to maintain vacuum. During the adjustments, the pressure in the CRR rose to approximately 14 inches of water column. The RSS trip point is 14.0 inches of water column. Downstream temperature and differential pressure problems became evident in the HEPA filters, 260 and 240 blower systems. A pressure increase in the Off-Gas Cooler (OGC) caused a rupture of the rupture disk on the OGC and an increase in the OGC outlet temperature which tripped Safety Instrumented Function (SIF)-2. The failure of the rupture disk and the tripping of SIF-2 are the initiating events for this ORPS occurrence. Timeline: 11:57 - A Hi CRR pressure alarm was received. Operators responded per procedure by raising the Off-Gas Blower speed. CRR pressure responded as expected and pressure returned to normal. 12:08 CRR pressure began to rise. Operators responded per procedure and pressure became erratic. 12:20 - CRR pressure began to rapidly rise passing through the Hi and Hi-Hi alarm set-points. 12:24 - A Hi-Hi-Hi CRR pressure alarm was received along with the corresponding Distributed Control System (DCS) - RSS activation. 13:05 - The shift supervisor commenced plant shutdown per procedure. During shutdown a dark plume was noted coming from the stack. 13:35 - The OGC rupture disc pressure alarm was received indicating Rupture Disc PSE-SRC-160-003, a design feature SSC, had ruptured. 13:59 - Following rising temperatures at the outlet of the OGC, SIF-2 High-Temperature Protection System (a Safety Significant System) activated.

"Immediate Action(s): All applicable Emergency Action Response procedure steps were verified completed and a plant shutdown/cool-down was initiated. Notifications were made to DOE-ID and CWI Corporate." [24]

"On March 13, 2012, a Hot Work Permit was authorized and a Fire Safety Watch was present for workers to weld and grind brackets in Room 109 South Corridor at IWTU. At 1430 hours MST, the Fire Safety Watch observed smoke coming out of the fume extractor unit, disconnected the unit and took it outside of the facility. After taking the smoking unit outside the Fire Safety Watch removed the spark trap cover and observed a small flame in the pre-filter which self-extinguished.

"The workers were performing hot work (welding and grinding) installing supports on an electrical

[24] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0008

cable tray. The workers were in compliance with the hot work permit. Due to the restricted work area the intake funnel on the fume extractor hose was located below the hot work area, pointed up and positioned close to the welding location, but not directly under. The cable tray is approximately 10 feet above the ground with the fume extractor, ACE Industrial Products, Model No 73-200 M, located on a cart below. It appears that a hot spark was sucked into the funnel and down the hose into the spark trap portion of the fume extractor. The spark was drawn onto the surface of the pre-filter where it caused the pre-filter media to smolder generating the smoke observed by the fire watch." [25]

July 17, 2012: A potential inadequate safety analysis was declared as part of the investigation into the pressure event that occurred during start-up of the Integrated Waste Treatment Facility. It was determined that the potential for "blinding" filter systems in the facility with unburned charcoal had not been adequately analyzed in the current safety documents. The facility was shut down after the June 16 pressure event, and an investigative team was commissioned to determine the root causes of the event and how to correct them. (EM-ID—CWI-IWTU-2012-0009).

Waste Treatment Progress: Progress continues in the effort to resume start-up activities for the Integrated Waste Treatment Unit, after the "pressure event" halted start-up activities last summer. The IWTU is designed to treat the remaining 900,000 gallons of liquid waste stored at the Idaho Nuclear Technology and Engineering Center tank farm. With the completion of the IWTU main process piping flush, the project can now start reassembling the process gas filter, off gas filter and the carbon reduction reformer. Restart activities are anticipated to resume this summer. [26]

In 2013 an investigation was initiated into the adequacy of controls for relief valves and a rupture disk at the Integrated Waste Treatment Unit (IWTU). If the valves are not properly controlled, pressure could increase downstream of the rupture disks during process heat-up. This increase could cause a condition where the rupture disks would not rupture at the required pressure to protect the process off-gas system. IWTU operations have been shut down and will not resume until the necessary changes have been made to the facility or procedures. (EM-ID—CWI-IWTU-2012-0013). [27]

In 2012 operators at the Integrated Waste Treatment Unit were performing start-up testing when an unexpected pressure transient caused a loss of vacuum in the Carbon Reduction Reformer vessel, activating the Rapid Shutdown System. All applicable emergency action procedures were followed, and a plant shutdown was initiated. A team has been formed to evaluate the cause of the incident and recommend corrective actions. (EM-ID—CWI-IWTU-2012-0008). [28]

Also in 2012 a potential inadequate safety analysis was declared as part of the investigation into the pressure event that occurred during start-up of the Integrated Waste Treatment Facility. It was determined that the potential for "blinding" filter systems in the facility with unburned charcoal had not been adequately analyzed in the current safety documents. The facility was shut down after the June 16 pressure event, and an investigative team was commissioned to determine the root causes of the event and how to correct them. (EM-ID—CWI-IWTU-2012-0009). [29]

Waste Treatment: Startup testing was suspended on June 16, 2012, at the Integrated Waste Treatment Unit (IWTU), which is designed to treat about 900,000 gallons of liquid radioactive waste stored at the Idaho Nuclear Technology and Engineering Center. Testing was suspended and plant heat-up was terminated to allow detailed evaluation of the process temperature, pressure and flow excursion observed on June 16. Facility startup testing has been ongoing for the past month, evaluating system and component operation and response during operating conditions. Radioactive waste has not been introduced into the facility, pending successful completion of startup testing. [30]

The Integrated Waste Treatment Unit was built to treat about 900,000 gallons of liquid sodium

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[25] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0004

[26] DOE-ID Operations Summary -13 4-1; For the Period Feb. 12 to Feb. 25, 2013

[27] DOE-ID Operations Summary 13.01; For the Period Dec. 11, 2012-Jan. 2, 2013

[28] DOE-ID Operations Summary; For the Period June 19 to July 12, 2012

[29] DOE-ID Operations Summary; For the Period July 13 to Aug. 2, 2012

[30] DOE-ID Operations Summary; For the Period June 5 to June 18, 2012

bearing radioactive waste sitting in three 50-year-old steel tanks on the desert site. Luke Ramseth reports in the Post Register:

> "Idaho environmental regulators have started fining the U.S. Department of Energy $3,600 per day after the agency failed to start a radioactive waste treatment facility before a Friday deadline.
>
> "DOE officials said in May they expected to miss the Sept. 30 deadline after facing continued technical problems at the Integrated Waste Treatment Unit. The first-of-its-kind facility, located 50 miles west of Idaho Falls, was built to treat 900,000 gallons of radioactive sodium-bearing waste, but it has been unable to get past the testing phase without breaking down. The project is at least $200 million over the original $571 million budget.
>
> "Last year, after DOE missed a 2014 state-mandated deadline to start the facility, the two parties negotiated a new set of deadlines. The new agreement required starting waste treatment by Sept. 30, and finishing the job by 2018.
>
> "Safety is our overarching concern and we will not begin radioactive waste treatment until we are convinced we can do it safely and efficiently," DOE spokeswoman Danielle Miller said in an email.
>
> "The liquid waste resides in three underground stainless steel tanks. Federal officials have said the tanks are not at risk of leaking, despite being more than 50 years old. But environmental regulators want the tanks emptied as soon as possible, as a leak could threaten the Snake River Plain Aquifer below.
>
> "Department of Environmental Quality Director John Tippets on Sept. 23 sent a letter to DOE, reminding the agency that fines of $1,200 per tank, per day, would start to accrue after the Sept. 30 deadline. After 180 days, the fines could increase up to $2,000 per tank — or $6,000 total per day.
>
> ""While DEQ recognizes the complexities associated with the design, construction, and operation of the IWTU, we have an obligation under law to ensure that enforceable agreements are met to resolve violations of (hazardous waste and environmental) statutes and rules," Tippets wrote.
>
> "In previous letters, DOE officials had requested that DEQ consider not assessing the fines, citing a provision that said DOE wouldn't be fined if an "upset or breakdown" required treatment to be stopped. But Tippets pointed out treatment of waste never started, and the current issues are "nearly identical" to the ones that caused the agency to miss the 2014 deadline.
>
> "Several problems have plagued the plant. One is the accumulation of a substance called "wall scale," which looks like tree bark, inside the facility's main processing vessel. Another problem is associated with replacing a faulty component called a "ring header." There also have been issues with an "auger/grinder" component.
>
> "Last year and earlier this year, officials tested the facility with a material that mimics real radioactive waste, called simulant. But it has more recently been in an outage mode as further testing occurs at a smaller-scale Colorado facility run by Hazen Research, Miller said.
>
> "New cleanup contractor Fluor Idaho, which took over for CWI on the project in June, has made several significant steps toward fixing the plant, Miller said. The company has experience working with similar "fluidized bed" technology, its president Fred Hughes told the Post Register in July. Three specialized teams are working to fix the facility, he said.
>
> "A Fluor spokeswoman did not return a call seeking comment." [31]

As of November 2019, INL reports: "In the two most recent demonstrations, IWTU filters became plugged with fine particulates. Testing at a Colorado facility called Hazen Research helped EM and Fluor Idaho select new filters to improve the efficiency of IWTU's process gas filters. Further testing will refine new operating parameters and installation requirements for the new filters.

"IWTU engineers are working with a company to test a robotic arm for decontaminating stainless steel canisters that would be filled with treated waste once IWTU begins operating.

"Testing continues on a new system to allow operators to decontaminate a cell, vessel, and piping without disassembling and cleaning them. A sump system would transfer the liquid decontamination solution from the cell for processing.

"Crews also are working with a mock-up of the IWTU's primary reaction vessel — called the Denitration Mineralization Reformer — to test the ability to enter the vessel and replace its internal parts once radioactive waste treatment begins. A mock-up has also been fabricated for the process gas filter and

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[31] lramseth@postregister.com

off-gas filter vessels to test removal and replacement of filter bundles and associated equipment in a radiological environment." [32]

U.S. Nuclear Waste Technical Review Board

"The NWTRB is an independent agency of the U.S. Federal Government. Its sole purpose is to provide independent scientific and technical oversight of the Department of Energy's program for managing and disposing of high-level radioactive waste and spent nuclear fuel." [33]

According to Dr. Darryl Siemer, former INL scientist, "the people on the NWTRB Board are supposed to serve as totally independent advisors/counselors to DOE on its "technical' issues - kinda like what the folks at the National Academy of Sciences & Defense Nuclear Facility Safety Board are also supposed to be doing for it (us?). Frankly, I think that DOE has made captives of all of its "advisors" because 1) it's both fun & lucrative (about $165K/yr for part time work) to be one of DOE's pet independent experts, and 2) they don't really have to do all much for it (their support staff does all the scut work). The main problem is that DOE usually dictates what its independent experts are supposed to "think" about & provides them with carefully rehearsed dog & pony shows/selected documents to "bring them up to speed" on each such issue. Most of these experts don't seem to question what they're being told & therefore usually end up not spotting/fixing the real problem(s)."

Additional Occurrence Reports on IWTU Problems

7/30/12; ITWU – Failure to Follow Confined Space Entry Process; [34]

5/2/12; ITWU Potential Inadequacy of Safety Analysis (PISA) – Inadequacy of Technical Safety Requirements TSR-level Controls for Fire Detection in Granular Activated Carbon Beds; [35]

4/25/12; ITWU Hazardous Energy Control Process Violation; [36]

2/27/12; IWTU – Safety Significant Pressure Safety Disk PSE- SRH-141-001A Discovered Ruptured; [37]

"July 17, 2012: A potential inadequate safety analysis was declared as part of the investigation into the pressure event that occurred during start-up of the Integrated Waste Treatment Facility. It was determined that the potential for "blinding" filter systems in the facility with unburned charcoal had not been adequately analyzed in the current safety documents. The facility was shut down after the June 16 pressure event, and an investigative team was commissioned to determine the root causes of the event and how to correct them." [38] (EM-ID—CWI-IWTU-2012-0009).

I.E.3. INL Plutonium Vulnerabilities

DOE's Office of Environmental, Safety, and Health convened a Plutonium Working Group to evaluate plutonium vulnerabilities associated with the Department's plutonium storage. This group's report noted that; "Most Argonne National Laboratory-West (ANL-W) [at INL] vulnerabilities stem from packages of scrap/residues shipped to this site from Argonne-East and Lawrence Livermore National Laboratory as a result of their consolidation activities. In decreasing order of priority, the most significant ANL-W vulnerabilities are:

> "ZPPR and Fuel Manufacturing Facility (FMF) vaults hold 193 packages of plutonium metal that are susceptible to oxidation, container failure and plutonium release."
> "The FMF vault has canisters of decontamination rags containing plutonium metal particles (fines) that might pose a fire hazard."

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[32] INL EM Idaho Site Improves Waste Treatment Facility After Successful Demonstration
[33] http://NWTRB.gov
[34] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0011
[35] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0007
[36] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0006
[37] DOE Occurrence Report; EM-ID-CWI-IWTU-2012-0002
[38] EM-ID—CWI-IWTU-2012-0009

"Current safety analyses do not fully consider plutonium accidents in the ZPPR [reactor] and FMF faults." [DOE/EH-0415 p.45]

"These vulnerabilities are associated with plutonium metal, oxide, and scrap/residues packages stored in the FMF and ZPPR vaults. Consequences would mainly be limited to worker exposures. The majority of the ANL-W plutonium is in the form of ZPPR stainless steel clad fuel; no vulnerabilities were identified for this rugged fuel. The Mark III sodium test loops in the Transient Reactor Test Facility at ANL-W have not been inspected in over five years. However, the loops represent an insignificant potential for worker exposure." [DOE/EH-0415 p.45-46]

"ZPPR and FMF vaults contain plutonium metal in 193 food pack cans. Plutonium in 49 of these cans has oxidized and could rupture the cans. Oxidation has occurred due to packaging failures and in leakage of air. Packaging involved placing plutonium metal inside food pack cans, the cans inside plastic bags, and the bags inside larger food pack cans. This packaging configuration is similar to those that have failed or bulged at LANL and Hanford. Oxides and ash are also stored in this manner and pose hazards for workers involved in routine inspections or repackaging." [DOE/EH-0415 p.46]

"Oxide removed from the surface of plutonium metal during repackaging is collected on synthetic 'tack cloths'. These cloths are then placed into storage containers and held in the FMF vault pending disposal in Transuranic waste drums. The radio lyric decomposition of organic cloth in contact with plutonium metal particles (fines) and resultant hydrogen generation could lead to fires or explosions within drums. The plutonium metal particles could also ignite combustibles within the waste drums. The consequences could be worker injuries and exposures." [DOE/EH-0415 p.46] See Section IV Part J more discussion on ANL-W.

INL Facilities Storing Plutonium		Quantity
ANL-W/MFC		
ZPPR fuel	4,000.00 kilograms	
Metal Feed Stock	200.00 kilograms	
Other	29.02 kilograms	4,229.0200 kilograms
Naval Reactors Facility		0.2720 kilograms
Test Reactor Area/ ID Chemical Processing Plant		0.7836 kilograms
Plutonium in EBR-II fuel		?
Plutonium in Transuranic Waste		1,800.0000 kilograms
Total Pu at INL		6,030.0756 kilograms

[Hull][DOE/EH-0415 p.A-22][DOE-2/6/96@52

More recent reports by the Defense Nuclear Facilities Safety Board (3/10/05) "Recommendation 2005-1 Nuclear Packaging" confirms that DOE's ability to deal with these major plutonium storage vulnerabilities remain unresolved and continue to threaten site workers and the general public. [www.dnfsb.gov/pub_docs/dnfsb/rec_2005.html]

Materials and Fuels Complex formerly Argonne National Laboratory-West (ANL-W) has a solid high-level waste site called the Radioactive Scrap and Waste Facility (RSWF) that is seldom acknowledged. It has 12-foot-deep steel walled underground repositories (27 rows on 12 ft centers and 40 rows on 6 ft. centers for a total of 1200). According to DOE, the existence of severely corroded storage wells coupled with the lack of a monitoring program for soil contamination was identified as a vulnerability. RSWF had, as of 1981, 81 cubic meters containing 9,823,000 Ci of radioactive materials, including 40.73 grams of plutonium. [ID-10054-81@19]

Responding to pressure, Materials and Fuels Complex (formerly ANL-W) upgraded 1,016 of the

RSWF vaults in 1995 and plan on upgrading another 350 in the next three years.[RSWF] Even the new upgrades do not meet regulatory requirements for spent fuel storage because the contents cannot be inspected due to the welded cap on the top of the vault. However the regulators granted ANL-W a variance.

ANL-W radioactive airborne releases for the 1952-81 period were 44,580 Ci. [ID-10054-81@19] The 1977 radioactive content of ANL-W's annual waste generation sent to the RSWF or RWMC was 1,300,126 curies. [ERDA-1552 @V-23] DOE claims that ANL-W dumped 1.1 million curies at the RWMC between 1952 and 1983. [EG&G-WM-10903] ANL-W's Zero Power Physics Reactor fuel is releasing fission product because the uranium has oxidized and hydrided on approximately 25% of the plates, causing stainless steel cladding to bulge. In a few isolated cases, the cladding is breached. A total of 83,276 spent fuel elements/assemblies are stored at ANL-W. [DOE Spent Fuel Working Group Report, p.25]

I.E. 4. Highly Enriched Uranium Vulnerabilities

In December 1996, DOE released a Highly Enriched Uranium Vulnerability Assessment Report [DOE/EH-0525] that identified problem areas within the Complex were unsafe conditions exist. The report acknowledged 11 sites at the INL that pose significant safety hazards.

ICPP-604/SAT/01; "A few large volume vessels of unsafe geometry in the Mechanical Handling Cave and in cells 3 and 4 of the ROVER Facility contain large amounts of uranium. While dry, these vessels are critically safe. The addition of moderator [i.e. water] to a vessel, however, could create a critical system. Also, the addition of moderator into a process cell, combined with a spill of material from one of the vessels, could result in a criticality on the cell floor. Tight control of the amount of moderator present is essential for critically safety. The roof of the facility leaks. Water exists in the lower level of the fire sprinkler system but the system is isolated from the upper level."[DOE/EH-0525@3]

ICPP-604/SAT/02; "CPP-604, which houses the ROVER process system is not seismically qualified to current standards (built in 1961). The ROVER process cells have thick, reinforced concrete shielding walls that appear to be structurally sound. A severe earthquake could cause structural damage, compromising the process vessels and other confinement features, and resulting in a localized spread of contamination. The CPP-640 roof is not qualified to withstand extreme winds, and wind failure of the roof could cause damage to confinement features in the Mechanical Handling Cave, resulting in a localized spread of contamination and loss of strict moderator control."[DOE/EH-0525@3]

Another CPP-640 vulnerability is criticality, spread of radioactive contamination under fire. Fire is related to two vulnerabilities because water used to fight a fire would spread contamination and could contribute to a criticality by moderating and reflecting the fissile material in the ROVER cells. In 1997 DOE launched the Rover Deactivation Project to collect, package and transfer the HEU in CPP-640 to the Irradiated Fuel Storage Facility (CPP-603). Unfortunately, CPP-603 is not a compliant storage facility because of other safety deficiencies. The ROVER burn cell was grouted to stabilize the residual HEU that was not removed. Some 800 entries into the highly contaminated areas through the course of the project and one of which resulted in a contamination incident.

ICPP-651/SAT/03; "Fuel storage racks containing LANL material in Room 102 do not meet design requirements of KEFF <0.95 for cans fully flooded and containing the maximum U-235 allowable."
[DOE/EH-0525]

ICPP-651/SAT/04; "Seismic qualifications of the inner building (north and south vaults) and the south vault fuel storage racks have not been verified. A seismic event could cause a failure of the inner building, which supports all fuel storage racks. Damage to the fuel storage racks and rack supports and a consequent loss of geometry could result in criticality." [DOE/EH-0525]

INL/Site/SAT/05; "Numerous aging facilities throughout the INEL contain small amounts of inactive HEU that collectively enhance the probability of an HEU incident and a consequent increase in contamination within the next 5-10 years." [DOE/EH-0525]

RWMC/SAT/06; "Drums of U-233 are currently stored inside cargo shipping containers and located in a concrete shielded storage arrangement on the ILTSF Pan. Since the containers are in the open yard, corrosion and potential compromise of container spacing is possible, potentially resulting in a criticality."[DOE/EH-0525]

RWMC/TSA/SAT/07; "U-233 containers stored under earthen cover at the TSA Pad are subject to corrosion and loss of integrity due to age and storage conditions. This can potentially lead to a loss of drum spacing and a criticality."[DOE/EH-0525]

ICPP-640/WGAT/01; "Fire is possible on the operating floor area of the ROVER Fuel Processing Facility. The operating floor contains a significant combustible loading, the sprinkler system has been disabled in this area, and housekeeping is very poor. An operating floor fire could breach confinement barriers and release contamination to the environment. The emergency fire response procedure does not reflect the correct facility mission as it does not identify the potential for criticality and does not prohibit the use of water for manual fire suppression. Inadvertent criticality is possible."[DOE/EH-0525]

INEL/SITE/WGAT/02; "Inconsistent or incomplete implementation of the INEL Fire Protection Program increases as the potential for a fire involving HEU holdings and the severity of the consequences of such a fire. Typical of the problems in CPP facilities are deficient controls on the fire protection equipment, housekeeping, facility modifications, and the storage of combustible material."[DOE/EH-0525]

RWMC/WGAT/03; "Drums of U-233 are collected with thousands of drums of TRU waste in the RWMC. Over 200 drums (containing more than 40 kilograms of material) of U-233/232 waste from the Bettis Atomic Power Laboratory Light Water Breeder Reactor are in storage in the RWMC. This material did not originate from a typical waste stream, but is being stored and handled in the RWMC as waste in compliance with a DOE declaration. Owning to the high-level gamma field created by the U-232 contaminates, these materials pose severe radiological hazards uncommon for materials declared as waste."[DOE/EH-0525]

RWMC/WGAT/04; "In ASB-II, U-233 drums are collocated with TRU waste drums and stacked five high with no restraints. Many of the drums show signs of corrosion that could compromise their structural integrity. In the event of drum mishandling, a forklift accident, or a seismic event, drums containing TRU waste and U-233 could fall from the stack and rupture, thereby releasing and exposing workers to radiological and hazardous materials."[DOE/EH-0525]

There is a radical difference in the HEU inventories at INL noted in the Vulnerability Study (2,797 kilo grams) because the exact inventory was "classified." However, then DOE Secretary O'Leary's 1996 Openness Press Conference Fact Sheets acknowledges HEU at INL at 23,400 kilo grams (23.4 metric tons). [DOE-2/6/96]

In March 1996 the Idaho Department of Environmental Quality issued 135 individual counts of environmental violations and a fine of $892,725. The violations were based on September 1995 and January-February 1996 investigations. [Star 9/2/97]

See Section IV.C for more information on INTEC high-level Waste Tanks

Section I.E. 5. Advanced Test Reactor Complex (ATRC)

Advanced Test Reactor Complex (ATRC) formerly Test Reactor Area (TRA) has spent fuel largely stored at three locations. These are TRA-603 Materials Test Reactor, TRA-660 Advanced Reactivity Measurement Facility (ARMF), and the Coupled Fast Reactivity Measurement Facility (CFRMF), and the TRA-670 Advanced Test Reactor (ATR).

TRA-603 Materials Test Reactor (MTR) recently D&D [39] facility design (i.e.., canal cleanup, seismic design, ventilation, leak detection, monitoring, and chemistry control) neither supports nor was intended for long-term fuel storage. Although it is stainless-steel-lined, the canal does not have a leak detection system. There is no programmatic ownership for this facility. In addition, the facility is not adequately funded for upgrades, analysis, and/or documentation update. Minor corrosion of the canisters has occurred. [DOE(a)]

TRA-660 ARMF and the CFRMF reactors, along with the neutron radiography facility, share a single

[39] D&D refers to decontamination/decommissioning and remediation.

canal. The facility is not designed to support long-term storage. It lacks leak detection and water cleanup systems. Corrosion monitoring is also inadequate at ARMF. Presently, preventive maintenance and surveillance activities by the M&O contractor are being performed with limited overhead funds and staff. Because these facilities have no active programs or funding, the facility has no qualified operating personnel that can manipulate the fuel that is currently in the reactors. For similar reasons, no program office oversight was observed by DOE inspection teams. [DOE(a)]

The ATRC (Test Reactor Area) (TRA) is second to the Navy by INL facility areas in radioactive solid waste disposal relative to curie content. DOE summary data between 1952 and 1991 cite 5 million Ci. of solid waste disposed. [EGG-WM-10903 @6-25] TRA supports the Advanced Test Reactor, Advanced Reactor Critical Facility Reactors, Hot Cell Facility, Nuclear Physics Research Program, Advanced Reactivity Measurement Facility, and Coupled Fast Reactivity Measurement Facility Reactors. TRA also leads the list of INL facilities for radioactive liquid waste discharges (83%). Between 1952 and 1981 TRA released 50,840 Ci. to the soil. This figure does not include "short-lived radioactivity less than 2-3 day half-life. [DOE(a)@ 14] This remains a long term environmental hazard. **For more discussion on ATRC see Section IV.D.61.**

Section I.E.6. Test Area North (TAN)

TAN had two areas for spent fuel storage: TAN-607 Pool and the TAN-607 Cask Storage Pad. TAN-607 pool and supporting facilities were constructed in the 1950's. "TAN's North Hot Shop storage pool currently contains greater than 7.5 million curies of spent fuel and fuel debris consisting primarily of 342 canisters of core debris from the Three Mile Island reactor accident." [INL DEIS @ OP1-1] The pool is unlined and does not comply with leak detection and control requirements specified for new, stainless steel lined, concrete pools. Investigators found that there was not even a leak trending (tracking amount of additional water required to keep the pool full) of the Storage Pool Water Inventory. The positive pressure ventilation system at this facility was inappropriate for preventing airborne radioactive material release to the environment. Vulnerability was identified with respect to the seismic inadequacy of the pool. Failure of the pool during an earthquake would cause a criticality due to the loss of spacing between the fuels. Investigators also found that corrosion monitoring was inadequate at TAN spent fuel storage units. [SNF Vulnerabilities] This remains a long term environmental hazard.

By mass, 75% of all U.S. buried transuranic waste is at INL. [Deadly Defense, p.50] Additionally, the site stores 68% of the retrievable stored waste. [GAO/RCED-91-56] The waste comes from all over the country: Argonne, Betts, Battelle-Columbus, Mound and Rocky Flats. [Deadly Defense, p.50] Waste is also being shipped from commercial reactor facilities such as Peach Bottom Reactor, Fort St. Vrain in Colorado in addition to the Nuclear Navy's reactor spent fuel. INL has 368 separate CERCLA (Superfund) hazardous waste cleanup sites. [DOE/ID/10253(FY91)@ 30] Between 1952 and 1970, 16 billion gallons of radioactive waste water containing 70,000 curies of radioactivity were pumped into the Snake River Aquifer using injection wells. [Deadly Defense, p.51] *Nuclear Legacy* also offers independent summary of INL waste:

"The service wastes are discharged to the water table through [ICPP] a 600-foot deep waste [injection] well. These wastes are monitored for radioactivity; when levels become too high, operations are halted until the source of the trouble is located and corrected. There is a discharge limit of three times drinking water tolerance, plus limits of 0.22 beta, except for a limit of 7 curies of iodine-131 per million gallons. Limits are based on known or assumed geo-hydrological conditions and are set to insure dilution and/or decay to drinking water tolerance levels before effluent reaches either the site perimeter or the nearest downstream water well at Central Facilities Area." [IDO-14532,p.13] See Section I(F), Snake River Contamination. For more discussion on TAN see Section IV.D.61.

Section I.E.7 Radioactive Waste Management Complex (RWMC)

RWMC is where most of the [solid] wastes at INL were dumped at the RWMC in cardboard boxes [IDO-14532,p.25] and pose such a significant threat to workers during excavation that DOE considers it "impracticable" to clean up. "Burial of high level waste [at INL] continued until 1957 with no upper limit for the level of radiation. Items of up to 12,000 rems per hour were buried [at INL]." [Deadly Defense@50] Standard operating practice throughout INL's history was to cut off the metal ends of all spent nuclear reactor fuel that was shipped to the site or generated at the site. These highly radioactive fuel element parts were then sent to the RWMC for burial as "low-level" waste.

DOE's early public documents acknowledge that there are at least 800 pounds of plutonium dispersed throughout the buried waste at the Radioactive Waste Management Complex (RWMC). [DOE\ID-10253(FY91),@33] Other independent analysts cite "nearly 1000 pounds of plutonium, more than 200 tons of uranium, and 90,000 gallons of contaminated organic solvents were dumped into shallow trenches at the RWMC. [Facing Reality @ 6] N.S. Nokkentved cites 431,700 pounds (216 tons) of uranium including 250 pounds of U-235, and 808 pounds of plutonium including 757 pounds of Pu-235, and 33 pounds of americium. [Times News, 7/29/89] More recent DOE revelations acknowledge 3,208 pounds (1,455 kg) of plutonium were dumped at the RWMC or enough for over 70 Nagasaki-type bombs. [ER-BWP-82] The reason for these varying numbers is because plutonium inventories have been secret, and early numbers were based on DOE's misinformation. DOE's 1988 *Environmental Survey Preliminary Summary Report of the Defense Production Facilities* ranks INL first in its critical data category "A", and third in its ranking units of most concern from potential public hazard perspective, after Rocky Flats and Pantex. [DOE/EH-0072,p.ES-2] For more discussion on RWMC see Section IV.F.

The below incomplete summary table (because it only goes to 1983) of radioactive content of waste dumped is considered understated. The Environmental Defense Institute analysis of the curie content of Navy shipments to the burial ground, for instance, adds up to 8,140,668 curies. [40] However the above DOE data using annual summaries attributes the Navy to only 4.2 million curies or only half as much. DOE admits that the annual summaries are understated. [41] **For more information on RWMC see Section IV.F.**

Summary of Waste Dumped in the Subsurface Disposal Area

Radioactivity of Waste Dumped at the Subsurface Disposal Area 1952-1983

Major Generator	**RWMIS Shipping Roll-up in Curies**
Test Area North (TAN)	63,000
Test Reactor Area (TRA) Currently Advanced Test Reactor Complex	460,000
ID Chemical Processing Plant currently Idaho Nuclear Technology Environmental Complex	690,000
Naval Reactor Facility (NRF)	**4,200,000**
Argonne-West Currently called Materials Fuel Complex (MFC)	1,100,000
Rocky Flats Plant (RFF)	57,000
Other	55,000
Total	11,000,000
Source EG&G-WM-10903 @ 6-26	

[40] DEIS @ A-9
[41] EGG-WM-10903 @ 6-26.

Section I. E. 8 Naval Reactors Facility

U.S Department of Energy - Idaho National Laboratory Photo

2 Naval Reactors Facility Background

This Section consolidates information the Environmental Defense Institute (EDI) gained over several decades from Freedom of Information Act (FOIA) requests, public access sources and interviews with Idaho National Laboratory (INL) workers concerning the Nuclear Navy and Department of Energy (DOE) operations. Due to ongoing information restrictions, EDI is blocked from offering a comprehensive and current review of Navy and DOE operations at INL because these facilities continue to be held behind a shroud of secrecy to "protect national security." EDI firmly believes – since only environmental information is requested - that all that is being protected is the reality of serious public, worker health and environmental threats from mismanagement of worker radioactive dose exposure, hazardous and nuclear waste that if made public, would compromise public support.

EDI further believes that the general public must be informed about these immediate threats to worker and public health, so they can make informed decisions about nuclear policy and its impact on future generations of Idahoans using the Snake River Aquifer as a sole source water supply; or, worst-case-scenario, a Fukushima like meltdown.

Congress continues a six decade long carving out of exemptions from federal laws (including FOIA and NEPA) for the Atomic Energy Commission (starting with the Manhattan Project that produced the atomic bomb) and continuing through to the present Department of Energy (DOE) and Nuclear Navy. Consequently, challenges are limited to litigation that brings the federal Court into arbitrage a resolution for access to environmental operating information. This litigation has been nearly continuous since 1992. EDI's report discusses the progression of lawsuits by the State of Idaho and other stakeholders. [42]

Despite the fact that Naval Nuclear Propulsion Program operations include INL's Advanced Test Reactor [43], four prototype reactors used for training in the states of New York and South Carolina, and numerous shipyards on both east and west coasts, this report only focuses on the INL Naval Reactor Facility in Idaho.

There is no legitimate way to separate the Navy's Naval Reactor Facility (NRF) from DOE's INL operational management from an analysis; thus this report covers both simultaneously. The Nuclear Navy effectively disassociates its operations from DOE's other INL nuclear facilities by inaccurately claiming they run a clean – tight ship. The fact remains that both hiding their operations behind the fog of secrecy and Congressionally sponsored regulatory exemptions since day one at the expense of past, present and future Idahoans.

1. Naval Nuclear Propulsion Program (NNPP) Background

"The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint U.S. Navy and Department of Energy (DOE) organization and responsibility for all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to- grave)." [44] The Naval Reactors Facility at INL part of the NNPP is operated under contract by Westinghouse Electric Co. Pittsburg, PA, for the Naval Reactors of the U.S. DOE. [45] INL is operated under contract by Battelle Energy Alliance. [46]

The National Nuclear Security Administration (NNSA) was established by Congress in 2000 as a separately organized agency within the U.S. Department of Energy, responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. Basically, NNSA only adds another ineffective layer of bureaucracy much the same as Home Land Security provided ineffective coordination with the many national security and emergency response agencies.

The NNPP was born in Idaho in 1949 [47] because Idaho was nationally designated by the Atomic Energy Commission (AEC) as the National Reactor Testing Station (NRTS) where nuclear reactors could be tested for all manner of purposes ranging from electrical power generation, to power for submarines, to aircraft nuclear jet engines, to space nuclear rockets, to space nuclear auxiliary power. At this stage in post WW-II nuclear research and development, the AEC knew the risks and hazards of radiation, thus the choice of a remote unpopulated area with large water resources available via the underground aquifer.

During the Nuclear Navy's first decade in Idaho, only four major installations were located at the Naval Reactors Facility (NRF) co-located with other related nuclear reactors (i.e. Advanced Test Reactor) [48] at the Department of Energy's Idaho National Laboratory (then called the National Reactor Testing Station); these are; a.) Submarine Thermal Reactor Prototype (S1W), b.) Large Ship Reactor (A1W); c.) Natural Circulation Submarine Prototype (S5G); d.) Expended Core Facility (ECF).

"The Submarine Thermal Reactor Prototype (S1W) was the first prototype of a submarine nuclear

[42] EDI has been plaintiff in numerous lawsuits against DOE for failure to conduct an EIS or FOIA denial.

[43] EDI's website contains extensive reports on the INL Advanced Test Reactor's operating history. http://www.environmental-defense-institute.org

[44] Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling, June 2015, DOE/EIS-0453-D, pg. 1-3. Herein after called DOE/EIS-0453-D.

[45] This is called the GOCO system; government owned-contractor operated.

[46] Battelle Energy Alliance (BEA) is a limited liability company wholly owned by Battelle and manages overall functions and operates INL Site services, including; Materials and Fuels Complex [MFC]; Idaho Nuclear Technology Complex (INTEC); Advanced Test Reactor Center (ATRC); Test Area North (TAN).

[47] Admiral Hyman Rickover, generally considered the father of the Nuclear Navy, first test reactor was built at Shippingsport, PA. Rickover later decided to move his reactor program to the remote Idaho site on the new Atomic Energy Commission (AEC) site, National Reactor Testing Station now called the Idaho National Laboratory operated by Department of Energy.

[48] Advanced Test Reactor at INL, mission is to test Navy fuel specimens and materials in high radiation fields.

reactor and the first instillation in 1951 at the NRF. To support work on the nuclear reactor, a shielded cell, controlled water-shielded fuel handling area, and decontamination facility were constructed within the prototype structure. Use of the support facilities was discontinued in 1958, when the Expended Core Facility was constructed with an improved capability for work on irradiated reactor core components. The S1W Prototype was shut-down in 1989 and was in operation for 35 years. Extensive testing was performed on reactor core components, including a series of experiments in 1955 for studying the effects of boiling conditions in naval reactors. The tests, conducted according to pre-planned procedures and carefully controlled conditions yielded a large amount of core performance and survivability data. During this period, NRTS (now INL) where running reactors deliberately to meltdown to determine the operating parameters of that design reactor. [49]

"The A1W Prototype Plant, constructed in 1958 had two nuclear reactor plants. The A1W prototype consisted of a dual pressurized water reactor plant representing a portion of the propulsion spaces for a large surface ship and shutdown in 1994.

"S5G Plant construction was initiated in 1961 and shutdown in 1995. This prototype was a pressurized water reactor having the capability to operate in either a forced circulation or a natural circulation mode, with cooling water flow through the reactor generated by thermal circulation rather than pumps." [50]

Currently, none of the NRF prototypes are operating. The Naval Nuclear Propulsion Program plans on major expansion Expended Core Facility and six new spent nuclear fuel (SNF) receiving and storage buildings discussed more below. [51] The current director of the program is Admiral Donald. He's the fifth director of the program.

2. History of Idaho's Litigation with DOE and Navy

Safety concerns over the long-term storage of large volumes of spent reactor fuel at INL reached a critical mass. Former Governor Andrus justifiably issued a unilateral ban on additional shipments to INL in 1992. Idaho's Department of Health and Welfare also filed a suit against DOE on the grounds that the shipments of nuclear waste from Fort St. Vrain into Idaho violated state air quality standards. [52] Public Service Co. (owner of Ft. St. Vrain) and the US Justice Department (on behalf of DOE) filed counter suits against Andrus. The Shoshone- Bannock Tribes also filed suit against DOE for National Environmental Policy Act (NEPA) violations related to the waste shipments. [53] The lower courts found in favor of the Tribes and the State and issued an injunction against DOE on additional waste shipments until a comprehensive Environmental Impact Statement (EIS) was conducted. DOE appealed this decision and the Ninth Circuit Court of Appeals vacated the injunction and remanded the case back to the US District Court. On June 28, 1993, after nearly two years of litigation, Judge Harold Ryan issued a summary judgment enjoining DOE from shipping waste to Idaho until a comprehensive EIS is conducted. Judge Ryan stated in his summary that:

> "DOE's strenuous opposition, and the tremendous efforts and taxpayer expense associated with such opposition, does not seem an appropriate course for an agency charged with overseeing such important, yet hazardous activities. DOE simply does not seem to understand that this nation is depending on it to protect the health and safety of all Americans from the

[49] INL has had 42 reactor meltdowns in its history; 16 of these meltdowns were accidental; the remaining 26 meltdowns were experimental/deliberate to test reactor design parameters, fuel design, and radiation releases. Citizens Guide to INL, page 17.

[50] Naval Reactors Facility, Environmental Summary Report, NRFRC-EC-1047, pg. 8.

[51] Navy's Bettis and Knolls Atomic Power Laboratories (KAPL) located in West Milton, NY that supports facilities for prototype reactor training/development plants. KAPL also has significant hazardous/radioactive contamination problems to INL's NRF; however these issues are beyond the scope of EDI's report. See Reference section below for the list of KAPL reactors. Also see FY 2013 Congressional Budget for Naval Reactors pages 480 to 486.

[52] ID v US; Idaho Department Health and Welfare v. United States, 959 F.2nd 149,153 (9th Cir. 1992).

[53] Shoshone-Bannock Tribes v U. S. Department of Energy, Civil No. 91-0436-E-EJL (D. Idaho, Nov. 1, 1991).

> dangers associated with its activities." [54]
>
> "In light of the fact that DOE wishes to bring in spent fuel from civilian reactors and from foreign reactors; it appears that DOE is quietly attempting to make INL the nuclear waste repository for the US and the rest of the world." [55]
>
> "Such callous disregard for the legitimate concerns raised on behalf of the citizens of Idaho is exactly the type of conduct which tarnishes the image of federal government agencies in the eyes of the people." [56]

In July 1993 the Navy attempted to gain Congressional exemption to the National Environmental Policy Act (NEPA), and thereby exclusion from the June 28, 1993 court order enjoining waste shipments to INL. The Navy is claiming national security priority and lack of storage facilities at its shipyards for its spent fuel. Proposed amendment to the 1994 Defense Authorization Bill under consideration by the Senate Armed Services Committee would provide a NEPA exemption that would circumvent the court injunction requiring an EIS. Senator Werner and Congressmen Norm Dicks whose districts include the Puget Sound shipyards were the major proponents of this amendment.

On August 9, 1993, then DOE Secretary O'Leary and former Idaho Governor Andrus announced that an agreement had been reached that will permit 19 more shipments of spent fuel to INL over the next two years, with additional shipments if the Secretary of Defense formally certifies that national security requires them. The Navy indicated in a statement that such a certification was likely before 1995 to prevent disruptions in refueling the USS Nimitz, a nuclear-powered aircraft carrier scheduled for refueling in 1996. Prior to the court order barring the spent fuel from being sent to Idaho, the Navy and DOE had anticipated 336 shipments between August 1993 and mid-1995.

Then Governor Andrus accepted the compromise after the DOE agreed to spend more money at INL to upgrade nuclear waste storage facilities and the Navy promised not to seek a congressional exemption from NEPA. Both the DOE and the Navy further pledged not to appeal the June 28 court ruling that instigated the confrontation over the Navy's nuclear waste. Both the DOE and Governor Andrus presented their agreement to Judge Ryan August 26 for his consideration of the proposed amendment to the courts' summary judgment.

According to the August 9 agreement, the other concessions that DOE agreed to include re-racking of fuel in existing storage facilities that have experienced extensive corrosion and failure of fuel support racks. Fuel is also to be moved by the end of the decade from the forty- two year old INL ICPP-603 storage facility that is unsafe compared to the newer ICPP-666 facility. Some fuel in ICPP-603 is apparently in such an advanced state of corrosion that it cannot be moved and represents a significant hazard. The Navy has also committed to conducting Environmental Assessments of its shipyard reactor fuel storage facilities on the Atlantic and Pacific coasts. DOE also agreed to accelerate calcining of 500,000 gallons of non- sodium high-level liquid wastes by 1/1/98, and decides on technology for dealing with 1.5 million gallons of sodium bearing high-level liquid waste by 11/15/93, and accelerates technology development to vitrify the calcine waste.

The Environmental Defense Institute (EDI) filed a motion to intervene in this case August 25, 1993 to apprise the court of the unique nature of Navy spent fuel processing at the Naval Reactors Facility at INL. EDI was very supportive of former Governor Andrus in his original position to block the waste shipments. However, the conditions stipulated in the August 9 agreement to allow 19 more shipments contains no provisions prohibiting continued dumping of Navy spent fuel parts at the INL burial grounds. DOE and Andrus filed a Joint Memorandum Opposing EDI's Motion to Intervene. [57]

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[54] Ryan; Harold Ryan, Senior US District Judge, summary judgment , 6/28/93, Public Services Co. of Colorado v. Cecil Andrus; United States of America v. Cecil Andrus , Civil No 91-0035-S-HLR & 91-0054-S-HLR, pg. 30.

[55] Ibid, Ryan; pg. 37

[56] Ibid, Ryan; pg. 39.

[57] EDI(b); Motion to Intervene or in the Alternative for an Order Granting Leave to File Amicus Curiae Brief, in US District Court of Idaho, August 25, 1993, in USA vs. Andrus

The fact that both the Governor and the Justice Department joined forces to prevent the facts about the Navy dumping to be presented before Judge Ryan seems suspect in light of the fact that Andrus litigated this to protect Idaho's citizens. The parties also opposed the Shoshone- Bannock Tribes' request to file an Amicus Brief. The radioactivity in this Navy waste poses an immediate threat to continued contamination of the Snake River Aquifer that lies below the INL.

Judge Ryan issued his summary judgment September 21, 1992 which contained minor changes to the Andrus, DOE, and Navy agreement. One change included giving the State full veto rights over any additional shipments beyond the 19 shipments stipulated. The Navy appealed Ryan's final Order Modifying Order of June 28, 1993 decision in the Ninth Circuit Court of Appeals on September 24. The concessions that DOE and the Navy had agreed to be required by law anyway however they were overturned by the US Court of Appeals which remanded back to Judge Ryan. Economic threats from the single largest employer in the state of Idaho have clearly influenced the Governor's decision to allow the 19 additional Navy waste shipments. According to Judge Ryan, the immediate threat to Idaho's environmental security far outweighs the unsubstantiated military security issues presented by the Navy. Idaho's then Republican Governor Batt announced that the State will allow the Navy to send 18 additional spent fuel shipments to INL.

Holding DOE to Its Commitments

Short-term economic gain is not worth setting aside the leverage the Batt Agreement gives Idaho with the federal government, writes Cecil D. Andrus:

> "In the 40-plus years I have been observing and dealing directly with the U.S. Department of Energy (DOE), I have noticed two things that seem never to change.
>
> "First, DOE makes promises that it does not keep and when called to account for those failures attempts to change the subject. Second, the agency - and the country for that matter - has never developed a realistic long-range plan for permanently and safely disposing of the most dangerous and long-lasting nuclear waste.
>
> "Both of these consistent DOE characteristics, true in both Democratic and Republican administrations, go a long way toward explaining why former Gov. Phil Batt and I feel so strongly about making sure Idaho maintains what leverage it has over DOE when it comes to keeping promises and contractual agreements regarding environmental cleanup at the Idaho National Laboratory.
>
> "DOE's recent decision to abandon a plan to bring highly radioactive spent fuel from a commercial power plant to INL is just the latest chapter in a long campaign to get the agency to keep its commitments to Idaho. There will be other chapters soon enough. In the meantime, I salute my old friend Phil Batt for doing the hard work 20 years ago to create a landmark agreement that provides Idaho with leverage over DOE and I applaud Idaho Attorney General Lawrence Wasden for standing firm in support of the integrity of Batt's agreement.
>
> "A chorus of voices has recently called for "re-negotiation" of the Batt agreement in the interest of allowing commercial spent fuel to come to Idaho, but the calls are both short-sighted and self-defeating. As Wasden has repeatedly pointed out, DOE is currently in violation of Batt's agreement and DOE has apparently rebuffed the attorney general's recent efforts to address how the agency might cure those violations.
>
> "A major violation of the agreement involves highly radioactive liquid waste that must be treated, solidified, and more safely stored. DOE committed in the Batt agreement to have liquid waste treatment facility operational months ago, but it has not happened. It is increasingly clear that it may not happen for some time to come. Failure by DOE to keep this commitment means that 900,000 gallons of liquid waste, some of the most dangerous material stored in Idaho, remains in 50-year tanks directly above the Snake River aquifer.
>
> "Furthermore, DOE apparently has made little or no effort to consider alternative approaches that could allow it to begin to come into compliance with the Batt agreement. Wasden correctly sees the agreement as the state's only real leverage to force a better approach from DOE, an approach that would treat dangerous liquid waste and remove it as a threat to the aquifer.
>
> "Meanwhile, I have brought suit in federal court questioning the adequacy of DOE's plans for

commercial spent nuclear fuel shipments to INL and also to force the department to make public documents that relate to the proposed shipments. I continue to suspect that DOE's reluctance to share its plans with Idahoans relates directly to how unacceptable most of us would find proposals to import significant new amounts of additional nuclear waste into our state.

"Supporters of DOE's plans to import more waste under the guise of "research" - many also want to re-negotiate the Batt agreement - say short-term economic benefits are worth turning a blind eye to the reality that any high-level waste entering Idaho will likely stay here forever.
They also seem willing to accept DOE's failure to honor past commitments. Neither position is in Idaho's best interest.

"No short-term economic gain is worth setting aside the leverage contained in the Batt agreement, particularly if it means accepting yet more waste material for what will certainly be long-term storage. DOE needs to do what unfortunately it has been unwilling to do for 40 years: level with the public about all of its short- and long-term plans, keep written commitments to the cleanup at INL, and permanently solve the waste disposal problem.

"Trying to divert attention from DOE's own failures is not acceptable. Idaho must aggressively enforce the Batt agreement." [58]

Navy's Safety Record

"The [Naval Nuclear Propulsion Program] NNPP maintains a proven record of over 151 million miles (243 million kilometers) safely traveled on nuclear power and over 55 years of naval nuclear reactor operation **without a reactor accident** or release of radioactivity that has adversely affected human health or quality of the environment. The NNPP currently operates 97 nuclear reactors and has accumulated over 6500 reactor-years of operation of naval reactors (NNPP-2013)." [59] [Emphasis added]

Admiral Bruce DeMars' Statement to U.S House Armed Services Committee in 1993 on the Navy's environmental and safety record states: "U.S. nuclear powered warships have now steamed over 93 million miles ---4,100 reactor years of safe operation –**without a reactor accident** or release of radioactivity which has had a significant effect on the crews, the public, or the environment." [Emphasis added] [60]

More recent reporting in the Department of Defense Fiscal-Year 2013, U.S. Naval Nuclear Propulsion Budget: "Naval Reactors … achieved 148 million cumulative miles of **safely- steamed,** militarily-effective nuclear propulsion plant operation." [Emphasis added] [61]

Safely Record Challenged

Two of the U.S. Navy's nuclear submarines' were lost at sea due to equipment failure accidents:

* The USS Thresher (Hull No. SSN-593) nuclear-powered attack submarine sunk in the North Atlantic during deep-diving tests approximately 220 miles east of Boston Massachusetts on 10 April 1963. Judging by the 129 crew members and shipyard personnel who were killed in the incident, historic context and significance, the sinking of Thresher was then, and remains today, the world's worst submarine disaster. This was the first acknowledged U.S. nuclear submarine lost at sea.

* The USS Scorpion (Hull No "SSN 589) was lost at sea on 22 May 1968 with 12 officers and 87 enlisted men -- one of the worst casualties in the Navy's history. Based on prior experience with such problems and an analysis of the acoustic [sic] signature of the Scorpion loss, the Navy initially

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[58] Cecil D. Andrus, Posted: November 1, 2015 *Post Register*, Cecil D. Andrus, Short-term economic gain is not worth setting aside the leverage the Batt Agreement gives Idaho with the federal government, writes Cecil D. Andrus.

[59] Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling, June 2015, DOE/EIS-0453-D, pg. 1-3. Herein after called DOE/EIS-0453-D.

[60] Statement of Admiral Bruce DeMars, U.S. Navy Director , Naval Nuclear Propulsion before the Military Applications of Nuclear Energy Panel of the House Armed Services Committee, 28 April 1993, pg. 4 & 5.

[61] FY-2013 Congressional Budget, Naval Reactors, Pgs. 480-489.

concluded that the most probable cause of the loss of the Scorpion was the launch of an inadvertently activated torpedo, which turned and struck the submarine. A six- month search eventually located the Scorpion's wreckage some 400 miles southwest of the Azores. Investigation of the boat's wreckage on the ocean floor found no evidence of torpedo damage. A six-month expedition in 1969 by Trieste II found no direct evidence to support the theory that the Scorpion was destroyed by a torpedo. While some portions of the Scorpion's hull were never found, the wreckage that was examined did not exhibit the conditions expected from the hydrostatic implosion of a submarine hull structure.

"Bow section of the sunken Scorpion containing two nuclear torpedoes on the sea floor. Stern section of Scorpion, seen in 1986 by Woods Hole personnel show the wreck of Scorpion as resting on a sandy seabed at the bottom of the Atlantic Ocean in approximately 3,000 m (9,800 ft.) of water. The site is reported to be approximately 400 [nautical mile] nmi (740 km) southwest of the Azores, on the eastern edge of the Sargasso Sea. The actual position is 32°54.9'N, 33°08.89'W. The U.S. Navy has acknowledged that it periodically visits the site to conduct testing for the release of nuclear materials from the nuclear reactor or the two nuclear weapons aboard her, and to determine whether the wreckage has been disturbed. The Navy has not released any information about the status of the wreckage, except for a few photographs taken of the wreckage in 1968, and again in 1985 by deep water submersibles." [62]

"The Navy has also released information about the nuclear testing performed in and around the Scorpion site. The Navy reports no significant release of nuclear material from the sub. The 1985 photos were taken by a team of oceanographers working for the Woods Hole Oceanographic Institution in Woods Hole, Massachusetts.

"Malfunction of trash disposal unit; during the 1968 inquiry, Vice Admiral Arnold F. Shade testified that he believed that a malfunction of the trash disposal unit (TDU) was the trigger for the disaster. Shade theorized that the sub was flooded when the TDU was operated at periscope depth and those other subsequent failures of material or personnel while dealing with the TDU- induced flooding led to the sub's demise." [63]

Greenpeace reports that: "There have been several dramatic collisions between U.S. and Russian nuclear submarines since 1960's. In one case in June 1970 in the Pacific involving the U.S. submarine USS 639 Tautog and Russian Echo-class submarine K-877 submarines in both crews thought the other submarine had sunk after the collision." [64] [65]

An unreported nuclear fuel accident occurred at NRF Expended Core Facility (ECF) that caused evacuation of the building when a transfer cask was not properly positioned over alignment posts. The bottom door cask had holes in it that are designed to receive the alignment posts on the deck above the water pools so that a tight seal is created when the bottom door opened and the fuel dropped into the water pool. In this accident the posts and holes were not aligned and therefore there was no seal. Workers claim that when the fuel was lowered into the pool, a 25 rad per hour beam escaped between the cask and the pool exposing workers in the area. This 25 rad is considered to be understated by many orders of magnitude. The miss- alignment occurred on one shift and the fuel transfer to the pool occurred on the next shift; thus the exposure involver more workers over a longer period. This accident is discussed more fully below.

The accident record of the Navy's Advanced Test Reactor at INL is extensive, but beyond the scope of this report. EDI's reports on the ATR's operation history are available on EDI's website (http://environmental-defense-institute.org/publicatons).

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[62] Federation of Atomic Scientists. http://fas.org/man/dod-101/sys/ship/ssn-585.htm

[63] See: https://en.wikipedia.org/wiki/USS_Scorpion_%28SSN-589%29

[64] Testimony for the U.S. Senate Select Committee on Intelligence Hearing Held 15 August 1992 by Joshua Handler, Greenpeace Nuclear Free Seas Campaign, coordinator pg. 6; "So long as Russian, U.S. and U.K. submarines continue to play cat and mouse games under the water there will [be] the possibility of a fatal disaster taking nuclear reactors to the ocean floor."

[65] Wikipedia, SS Thrasher

It is illegal to lie to Congress (Contempt of Congress); however, representatives of the Nuclear Navy have no problem with giving glaringly false formal testimony and statements to Congress who apparently is not objecting. Then Idaho Governor Cecil Andrus said: "The federal government thinks it's larger than the people, Andrus said, accusing the head of the nuclear Navy of dishonesty. "They're going to be in for a fight if this [waste plan] gets through." [66] Andrus is referring to the Navy's unwillingness to take responsibility for the radioactive waste dumped at INL over Snake River sole source aquifer with the result of significant contaminate migration into the aquifer.

Navy's 2008 Addendum to 1995 Settlement Agreement

The Navy continues to exercise its undeserved national security veil of secrecy and classified military status to protect/cover up what otherwise is a major regional environmental hazard. Access to operational documentation is obstructed by blocking Freedom of Information Act requests along with federal Environmental Protection Agency and state Idaho agencies with oversight jurisdiction over INL operations. EDI continues to battle this information fire wall with limited success. Section V of this Addendum states in part:

"A. All Naval spent fuel shipped to Idaho after January l, 2035, must meet the national security requirements required by paragraph D.1.a of the 1995 Agreement.

"B. Notwithstanding the provisions of paragraph C. l of the 1995 Agreement, after January I , 2035, the **Navy may maintain a volume of Naval spent fuel at INL of not more than nine (9) metric tons heavy metal (MTHM)** for a timeframe reasonably necessary for examination, processing, and queuing for shipment to a repository or storage facility outside Idaho provided:

" 1. No portion of said nine MTHM Naval spent fuel provided for in paragraph V.B of this Addendum, shall consist of or be from shipments of Naval spent fuel arriving at the lNL prior to January I , 2026; and,

" 2. After January I, 2035, the Navy may ship a running average of no more than twenty (20) shipments per year of Naval spent fuel to IN L. The term "running average" shall be defined as set forth in paragraph A. 16 of the 1995 Agreement."

"C. Notwithstanding the provisions of paragraph E.8 of the 1995 Agreement, Naval spent fuel arriving at the IN L after January I , 2017 may be kept in water pool storage for a timeframe reasonably necessary for examination and processing not to exceed six (6) years. All Naval spent fuel located in water pool storage prior to January 1, 2017 must be removed from water pool storage by not later than January 1, 2023.

"D. In addition to the volume of Naval spent fuel provided for in paragraph Y.B above, the **Navy may maintain a volume of not more than 750 kilograms heavy metal of Naval spent fuel** in archival wet or dry storage as necessary for comparison to support fuel designs under development or in use in the U.S. Navy fleet. The archival fuels provided for in this section are not subject to the limitation set forth above in paragraph V.C." [67] The whole text of this Addendum to 1995 Settlement Agreement is available foot note #28 below.

The Navy's spent nuclear fuel shipments to INL are not currently being challenged -- only the non-Navy DOE spent nuclear fuel. The Navy's limited shipments that are allowed (Previous 800 + Current 9 + 750 = 1,559 kilo-gams heavy metal) under this Addendum to the 1995 Settlement Agreement and are not blocked due to DOE's missed milestones articulated by former Governor Andrus. If Penalties can occur if the Navy does not keep its milestones, [68] under Section VI of the

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66 Testimony for the U.S. Senate Select Committee on Intelligence Hearing Held 15 August 1992 by Joshua Handler, Greenpeace Nuclear Free Seas Campaign, coordinator pg. 6; "So long as Russian, U.S. and U.K. submarines continue to play cat and mouse games under the water there will [be] the possibility of a fatal disaster taking nuclear reactors to the ocean floor."

67 Wikipedia, SS Thrasher.

68 "Andrus wants Kemthorne to block Navy's waste plan," Associated Press, Daily News, 7/21/93.

2008 Addendum the Remedies includes the following:

> "If the Navy fails to satisfy the substantive obligations or requirements it has agreed to in this Addendum or fails to meet deadlines for satisfying such substantive obligations or requirements, shipments of Naval spent fuel to INL shall be suspended unless and until the Parties agree or the Court determines that such substantive obligations or requirements have been satisfied.
>
> "In addition to the remedy specified in paragraph VI.A above, in the event that the Navy fails to remove Naval spent fuel from pool storage as provided in paragraph V.C of this Addendum, then subject to the availability of the appropriations provided in advance for this purpose, the Navy shall pay to the State of Idaho $60,000 for each day such requirement has not been met." [69]

Smart for the Navy to get all these concessions so far into the future because its shipments to Idaho would otherwise have cease in 2035 if there was no repository – a high probability given the last several decades over establishing a high-level radioactive waste repository at Yucca Mt. So, the issues are: (1) the Navy's insistence on burying its waste above Idaho's sole source aquifer, not just in the past, but in the future; (2) The lack of a repository to send the Navy's spent nuclear fuel to when the Settlement Agreement says, starting in 2035.

Naval Reactor Facility Mission at INL

Outlying year Congressional funding supports Naval Reactors' core mission of providing proper maintenance and safety oversight, and addressing emergent operational issues and technology obsolescence for 168 reactor plants; this includes 72 submarines (54 attack, 14 ballistic missile, and 4 guided missile submarines), 11 aircraft carriers, 82 nuclear powered war ships, and four research and development and training platforms including land-based prototypes (2 at Bettis and Knolles Atomic Power Laboratories in New York State and 2 in South Carolina). There are 6 shipyards that construct and/or service nuclear powered ships; four of those shipyards do reactor servicing. "Those four shipyards are the Portsmouth Naval Shipyard in Kittery, Maine; Norfolk Naval Shipyard in Norfolk, Virginia; Norfolk Newport News and Newport News, Virginia; and Puget Sound Naval Shipyard and Intermediate Maintenance Facility in Bremerton, Washington. The fuel removed from the reactors by those shipyards is all shipped by rail to the Naval Reactors facility here in Idaho." "Since the late 1950's we [NNPP] have shipped over **800** [reactor core] containers from shipyards around the country to Idaho. Currently, we're shipping about eight containers in a normal year." [70]

The Nuclear Navy represents 45% of the Navy's fleet and more nuclear reactors than are currently in the U.S. commercial nuclear electrical power generator fleet. Due to the veil of secrecy around this large Nuclear Navy military program, the public is not allowed to be appraised of its unregulated operations. The same hazard/public health/waste issues that accompany commercial nuclear power generation equally apply to the Nuclear Navy Propulsion Program (NNPP). Unlike commercial nuclear power reactors that are spread around the country, the Nuclear Navy Spent Nuclear Fuel operations are concentrated at the Naval Reactors Facility (NRF) at the Idaho National Laboratory (INL). NRF waste goes to INL's Radioactive Waste Management Complex, and soon to come online the Remote Handled Disposal Facility dump discussed below. Due to the Navy's significant waste volume and resulting environmental impact, Idahoans must get access to the details of its operations because of Navy's ½ century of contributing to contaminating the Snake River Plain Aquifer.

Former Idaho Senator Kemthorne stated: "No more quick fixes. That's what got us in this fix we are in today. The navy is not the villain and it may in fact be the innocent victim of the federal government's nuclear waste <u>non-policy</u>. The Navy can no longer give its waste to the Department of Energy, and say, 'We've done our job, and we have a great record,' while the Navy's waste sits in one

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[69] Addendum to 1995 Settlement Agreement dated 4th day of June 2008, signed by Admiral K. Donald, C.L. "Butch" Otter, Lawrence Wasden, Frank Jimernez, and David Hill, page 1 & 2.

[70] https://www.deq.idaho.gov/inl-oversight/oversight-agreements/2008-navy-addendum/

facility plagued by corroding containers in unlined pools sitting above one of nation's largest underground aquifers. Even the contractor believes these pools should be shut down. Once the Navy's fuel arrives at INL, it's placed in pools with other nuclear waste.

The Navy's name is still on it, you can't walk away ….just as the people of Idaho can't walk away. No more quick fixes." [Emphasis in original text] [71]

In August 2015, John McKenzie director of program regulatory affairs said project costs for building a new Naval Reactors Facility (NRF) "is actually the low-cost answer, and even that is $1.6 billion." More than $500 million would be spent on construction. The rest would be design, equipment costs and a "management reserve," McKenzie said. Nuclear Navy currently has 81 nuclear powered warships including submarines and aircraft carriers. [72] [73]

"Start of construction on the new Expanded Core Facility [at INL/NRF] M-290 Receiving/ Discharge line-item construction a necessary project for receipt and processing of aircraft carrier spent nuclear fuel." "Construction: Reflects an increase in funds for the Remote-handled low- level Waste Disposal Project [at INL], Prototype Radiological Work and Storage Building, staff building… FY-2012 ($39,900,000); FY-2013 ($49,590,000). " [74]

As discussed below, the Navy's dumping of radioactive waste currently at the INL Radioactive Waste Management Complex (RWMC), [75] will soon be dumped at the new Remote-Handled Low-Level Waste Disposal Project adjacent (south-east) of Advanced Test Reactor Complex (ATRC) that is also in the Big Lost River flood zone. DOE's own assessment of the "Surface Water Features, Wetlands, and Flood Hazard Areas at INL" and DOE's aerial photo shows the location of the new Remote-Handled Low-Level Waste Facility (RHWF) between ATRC and INTE shows flood hazard. Comparing these two maps puts the RHWF in the flood zone which must disqualify it.

DOE's own "Water table Contour Map for NRF" that clearly shows the topography of the NRF in relation to the Big Lost River. Specifically, the elevation contour # 4464 (black dash horizontal lines) runs right through the NRF that shows its vulnerability to floods.

This new remote-handled dump will not solve the Navy's waste disposal problem; it only leaves one thoroughly contaminated site that CERCLA is forcing closed (RWMC Subsurface Disposal Area) and opening a new one further down the river.

Naval Nuclear Propulsion Program Cost (dollars in thousands) [76]

FY-2011	FY-2012	FY-2013	FY-2014	FY-2015	FY-2016	FY-2017
985,526	1,080,000	1,088,635	1,108,391	1,129,186	1,151,021	1,175,975

Current Litigation over Spent Nuclear Fuel Shipments

"On July 13, 2015, *Advocates for the West* submitted initial comments on behalf of former Governors Andrus and Batt to the Department of Energy on its draft Supplemental Analysis for two proposed commercial spent nuclear fuel shipments to INL. *Advocates for the West* Executive Director

71 Addendum to 1995 Settlement Agreement dated 4th day of June 2008, page 2 & 3.

72 U.S. Nuclear Waste Technical Review Board, Summer Meeting, June 29, 2010, Hilton Garden, Idaho Falls ID, pages 100 and 102. Herein after, Nuclear Waste Board.

73 Opening Statement, Senator Dirk Kemthorne, July 28, 1993, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, pages 2 & 3.

74 "Navy officials pitch new $1.6 billion nuclear facility", reported in *Post Register*, August 4, 2015, by Luke Ramseth. As all things INL/Navy there is broad number information sources that conflict in every aspect. In this EDI report we cite all source data with the caveat that the prevailing secrecy blocks any definitive true characterization.

75 Green Peace reported as of 1992, the Nuclear Navy has 126 vessels active and 63 in retirement. The 126 active vessels contain 147 reactors. The 63 retired vessels contain 65 reactors. The Navy has produced, over its history, a total of 600

76 DOE/EIS-0453-D.

Laird Lucas slammed DOE for providing "false and misleading information to the public," including misrepresenting Idaho's willingness to waive the 1995 Batt Settlement Agreement, which prohibits the nuclear waste shipments to INL. Lucas' comments also faulted DOE for avoiding its duty to fully disclose its planned actions and evaluate alternatives under National Environmental Policy Act (NEPA).

"The Governors' comments also pointed out that DOE has failed to provide relevant documents under [Freedom of Information Act] FOIA, which Governor Andrus requested in January [2015]. The DOE has withheld or redacted dozens of pages of documents, effectively stonewalling the public."

The 1995 Federal Court Ordered Settlement Agreement with DOE and the Navy originated with Governor Andrus and later finalized by Governor Batt was over the DOE/Navy refusal to honor commitments over decades to clean-up the extensive radioactive waste dumped at INL. The Agreement stipulates date specific time lines for the removal of the waste to a permanent repository outside the State of Idaho. DOE and the Navy continue to renege on fulfilling their court ordered Settlement obligations; thus the Andrus/Batt litigation.

The State of Idaho has a major role in the waste management end of the Naval Nuclear Propulsion Program. The Addendum to the 1995 Settlement Agreement outlines significant concessions by current Idaho Governor Otter in terms of the Navy's ability to maintain its nuclear program spent nuclear fuel (SNF) waste management needs. Previous Governors' Andrus and Batt (who negotiated the 1995 Settlement Agreement) are legally contesting Governor Otter's abrogation of the original 1995 Settlement Agreement and Consent Order.

"The order by U.S. District Court Judge Harold Ryan prohibited any further shipments of nuclear waste to INL near Idaho Falls until a comprehensive assessment is made of their impact on the environment and public safety. The judge said the Energy Department was not honest with him and failed to keep their word to the state. He said a binding court order was the only way to cure that 'callous disregard for legitimate concrete concerns raised on behalf of the citizens of Idaho.' It appears that DOE is quietly attempting to make INL the nuclear waste repository for the United States and the rest of the world,' Ryan said." [77]

Former U.S Senator Larry Craig (R.-Idaho) Testimony to Congress stated: "We are here today because the Department of Energy in conjunction with the U.S. Navy made a decision not to reprocess Naval Fuel at the Idaho Chemical Processing Plant in April of 1992. At that point the Idaho National Laboratory (INL) became a nuclear waste storage facility. You will hear today that storage was temporary and that the Navy Fuels were to be disposed of in the geological repository. What you most likely will not hear is that such a disposal is intended for the second or third geological repository, not the first. I need not reiterate for this Committee the problems that been experienced in Nevada with evaluating a geological repository for mainly commercial fuels. But, let me tell you there are a few people here who don't plan on allow Idaho's concerns to go ahead. Those concerns are that our state is slowly and quietly becoming a nuclear waste dump because the federal government has shamelessly fallen down on the job. Let me speak for Idahoans here today –THAT IS NOT ACCEPTABLE. I ask that the committee carefully consider the testimony of two Senators and a Governor and a lot of Idahoans watching." [emphasis in original text] [78]

Admiral DeMars Testimony continues: "Over 500 shipments have been made to date [1993] without any accidents or adverse effects on the environment. We anticipate making about 10% more spent nuclear shipments in the next decade than we did in the previous one..." [Ibid Note 28 pg. 1] During the cold war highly enriched uranium was a precious resource, recovered through chemical

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77 Lewiston Morning Tribune, 7/1/93, "Andrus disputes Navy's claim of need for nuclear shipments", pg.13A.

78 Testimony of U.S Senator Larry Craig (R.-Idaho) Before the Committee on Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, 222 Russell Senate Office Building, July 28, 1993.

reprocessing at the Idaho National Laboratory (INL) for subsequent use as fuel for the weapons production reactors. In that era, reprocessing made economic sense and supported the nation's strategic goals. However, reprocessing involves chemical dissolution of the spent fuel, release of fission products, and a seven fold increase in the amount of high level waste at INL. Reprocessing was discontinued in early 1990's, however the ~900,000 gallons of liquid high-level liquid waste remains in buried single shell tanks at INTEC without any treatment path forward. Navy SNF was always preferred in reprocessing due to its highly- enriched uranium fuel.

Environmental Concerns

Regardless the sweetheart deal the Navy got from Idaho for SNF shipments to 2035, more radioactive waste shipped to INL exacerbates the environmental contamination of the aquafer for manila. DOE continues renege on cleanup commitments for mismanagement of the most hazardous waste and missing court ordered stipulated mile-stones. According to the Nuclear Waste Board:

> "A little background information…we [DOE/Navy] started the fuel processing in 1952, early Fifties, continued that reprocessing through 1991, which is a three-step solvent extraction process. The solvents typically were nitric acid based and dissolved the fuel that way. The first cycle, raffinates, were again processed in the Calciner, New Waste Calciner, and converted to the calcine that Ron is working with currently. They also talked about the tank farms, the 300,000 gallon tanks, of which there are eleven. The first seven were the ones that contained the high-level first raffinates, first cycle raffinates, and those were calcined.
>
> "Those tanks have been cleaned to a heal and both the tank and the vaults are now full of grout and closed. So, we have four tanks left. Those four tanks contain the 900,000 gallons of sodium bearing waste. There are three tanks that are in use, they've got approximately 300,000 gallons each, and one tank is empty. Calciner, New Waste Calciner, I think we've covered quite a bit now, and the [calcine] bin sets. Waste management; decon [sic] activities, cleaning up of these first seven tanks, plus cleanup of the reprocessing facilities.
>
> "We've got a lot of decontamination solutions that are high in sodium and, hence, the sodium bearing waste name. [pg.91]
>
> "Speaking of final disposition, as we discussed earlier, sodium bearing waste was determined to be not high-level waste in Idaho. It was other than or incidental to waste processing, and, so, our path forward was to ship these to WIPP in these removable canisters, in a 72-B container. But, for us to go to WIPP now, they will have to change the record permit, and there are talks there if that's the way we go or not. Of course, if it is determined at some later date that this is high-level waste, then we'll be dependent upon the [below regulatory concern] BRC to determine where we're going to send this, and what we'll do with it." [79]

On the surface, a member of the public likely will not appreciate what this all means to them and future generations that will be forced to deal with these current political decisions. The Navy, like commercial nuclear power generators, is ignoring the spent nuclear fuel waste issue. Even Congress ignores the problem of what to do with all of this highly radioactive and therefore hazardous waste. The attempt at a permanent deep geologic repository at Yucca Mt. failed after investing decades and billions of tax-payer money wasted. Still Congress cannot find the political will to initiate a search for a new repository. Neither commercial nuclear power generators nor the Nuclear Regulatory Commission have faced up to what to do with all the non- fuel parts (now called Greater-Than-Class-C low-level radioactive waste) of commercial spent nuclear fuel. See Attachment # 2 below for the listing of this waste as an exemplar of NNPP's problem. [80] The Nuclear Navy has the same problem with this SNF processing waste, except they are largely unregulated.

Specifically, each Navy Spent Nuclear Fuel (SNF) shipment to Idaho National Laboratory (INL) undergoes a process (explained below) that separates the uranium fuel from non-fuel structural parts.

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[79] Nuclear Waste Board, pg. 91

[80] Explanation of Significant Differences Between Models Used to Access Groundwater Impacts for Disposal of Greater-Than-Class-C-Like Waste Environmental Assessment for the INL Remote-Handled Low-Level Waste Disposal Project, page 1, INL/EXT-10-19168, Table 2 citing DOE-EIS-2011 shows the significant volume and curie content generated by reactors.

The uranium is stored for eventual disposal in a high-level waste geologic repository yet to be established. The highly radioactive non-fuel structural parts end up being dumped above Idaho's sole source aquifer. DOE's Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999, lists the 22 radionuclides in the Navy's waste that total 952,986.68 curies. [81]

3. Naval Reactor Facility's Expended Core Facility (ECF)

Final EIS statements confirm the degraded condition of the ECF. Again documents the fundamental inadequacy of the FEIS to exclude specific actions required to mitigate continued significant ECF leaks. "Not a matter of urgency" discloses the Navy's previous decades of disregard for environmental degradation.

> "Major portions of the ECF infrastructure have been in service for over 50 years. The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards. Although water pool surfaces are covered with a <u>fiberglass or epoxy coating,</u> the water pool does <u>not</u> have a liner, creating the potential for water infiltration into the reinforced concrete structure and the potential for corrosion damage of the reinforcing bar within the structure. The capability to detect and collect <u>small</u> leaks, a common feature in modern water pools, is not present for the ECF water pool. Consequently, while the replacement or overhaul of the current water pool is not a matter of urgency that must be done in a very short period, it is something that needs to be planned and started soon." [FEIS Pg. S-6][emphasis added]

ECF leaks "Alternative methods would be to discharge the water from leak testing the pools (up to 18,927,000 liters (5 million gallons)) to the sewage lagoons or to the [Industrial Waste Ditch] IWD during the last year of construction. This discharge would occur over a short period of time (about 6 days) but is not expected to exceed the infiltration capacity or the maximum flow distance (2.9 kilometers (1.8 miles)) previously recorded for the IWD. The permitted annual discharge rate for the IWD of 113,600,000 liters (30,000,000 gallons) would not be exceeded. Section 4.4.3 reflects this potential discharge of water for pool leak testing." [FEIS Pg. 1-21] [82] See Section I.E.1 below for more on NRF.

Expended Core Facility Spent Nuclear Fuel Processing

"As part of the inspection process, [Expended Core Facility] ECF crops off the non-fuel bearing material for disposal as low-level waste, and ships the spent fuel itself to the Chemical Processing Plant where it has been stored in water pits, sometimes for years awaiting reprocessing. [pg. 2]

"Storing naval spent nuclear fuel in water pits eliminates the generation of extra high-level waste. [pg.3] Shipyards that defuel nuclear warships are in six states; Washington, Hawaii, Maine, Virginia, California and South Carolina." [83]

Historically, before regulations prevented it, the NRF SNF was dumped in INL's Subsurface Disposal Area (SDA) in unlined pits and trenches. DOE records show that between 1952 and 1980, 27,707,700 grams or 27,707.700 kilo grams or 27.7 metric tons. [84] NRF is the largest contributor of SNF dumped at INL's dump. See list of SNF generators to the RWMC below. A fully loaded commercial spent fuel cask is about 20 metric tons. The environmental impact of this can perhaps be compared to the inventory acknowledged by the RWMC analyses - with understanding that the migration of contaminates has been manipulated to understate the effects for the first 10,000 years by the selected of assumed migration

[81] Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999, J. Giles.et.al., April 2005, ICP/EXT-05-00833, Table 5, pg. 18.

[82] See EDI's Comments on NRF EIS ; http://environmental-defense-institute.org/publications/EDINNPPFEIS.pdf

[83] Statement of Admiral Bruce DeMars U.S Navy Director, Naval Nuclear Propulsion before Nuclear Deterrence, Arms Control and Defense Intelligence Subcommittee of the Senate Armed Services Committee on Nuclear Spent Fuel Shipments 28 July 1993.

[84] Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89).

characteristics.

INL's Explanation of Significant Differences Between Models Used to Access Groundwater Impacts for Disposal of Greater-Than-Class-C-Like Waste Environmental Assessment for the INL Remote-Handled Low-Level Waste Disposal Project "includes an ` evaluation of the radionuclides inventory, disposal facility configuration and transportation from the facility to a hypothetical receptor via the groundwater pathway." [85] See Attachment # 1 below that shows the proximity to Big Lost River. When this picture is compared to **Attachment 4** aerial photo, it is clear this radioactive waste dump site is in a flood zone which must legally disqualify it in a "normally regulated environment" which tragically INL is NOT.

The Navy has been using Idaho as its dumping ground for over ½ century, with tragic impacts on contaminants migrating into the underlying Snake River Plain Aquifer. This EDI report offers details about the extent of the "known" contaminant in the Idaho's sole source aquifer. Currently, there is a significant deficiency in both air and ground water monitoring on the part of DOE, NRF, EPA and Idaho Department of Environmental Quality (IDEQ). The discontinuation of monitoring is by agreement between DOE/NRF and IDEQ.

The Naval Reactor Facility's (NRF) Expended Core Facility (ECF) at INL receives the whole reactor fuel assembly module. This facility has expanded to include a Dry Cell for cutting larger aircraft carrier reactor cores to accommodate the increased size, volume from refueling and decommissioning. The fuel rods are not easily removed from the rest of the assembly as are most conventional reactor cores. The steel structural core assemblies are designed to withstand combat shocks and maintain fuel rod configuration within the core during combat scenarios.

Naval spent nuclear fuel assemblies have non-fuel-bearing structural components above and below the fuel region to maintain proper support and spacing within the reactor. Generally, these upper and lower non-fuel-bearing structural components are removed in preparation for packaging. Non-fuel structural material is removed in the ECF water pools using an underwater cutting saw in a process known as resizing. This resizing can also occur in the Dry Cell. The non-fuel-bearing structural material removed from naval spent nuclear fuel assemblies is (in EDI's view incorrectly) classified as low-level radioactive waste (LLW). Based upon the radiation levels exhibited by this LLW, this waste should be designated either as high-level or remote-handled (RH) Greater-than-Class C Waste.

To minimize a criticality in the uranium parts of the fuel, "Neutron poison absorbs neutrons to ensure nuclear fission [criticality] does not occur. When necessary to reduce reactivity, neutron poison material is inserted into the naval spent nuclear fuel assembly." [86]

"The ECF water pool area contains various materials handling equipment to support operations, including cranes and transfer carts. This equipment is vital to supporting naval spent nuclear fuel handling operations. Walls and stainless steel gates divide the water pools into smaller work areas, or zones. This partitioning makes it possible to drain a small portion of the total water pool or isolate an individual volume when maintenance or repair is required. The water pool walls and floors are covered with a fiberglass or epoxy coating which is highly resistant to radiation damage, easy to decontaminate, and serves as an extra barrier to water leakage." [87] [DOE/EIS-0453-D pg. 1-6]

According to Thereon Bradley, [88] former Manager of the NRF, explained that the Expended Core Facility (ECF) cuts (or in some cases unbolts) the metal ends from the spent fuel elements

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85 Explanation of Significant Differences Between Models Used to Access Groundwater Impacts for Disposal of Greater-Than-Class-C-Like Waste Environmental Assessment for the INL Remote-Handled Low-Level Waste Disposal Project, page 1, INL/EXT-10-19168, and Table 2 citing DOE-EIS-2011 shows the significant volume and curie content generated by reactors.

86 DOE/EIS-0453-D, pg. 1-4

87 DOE/EIS-0453-D pg. 1-6

88 Thereon Bradley has since died of a brain tumor.

in order to inspect fuel and cladding integrity and evaluate how the fuel survived service in the reactor. [Bradley] Other core structural components are also cut off the spent fuel assembly in hot (dry) cell. "All naval fuel modules have non-fuel bearing metal structures above and below the fuel region to facilitate coolant flow and maintain proper spacing within the reactor. These upper and lower non-fuel bearing structures must be removed to permit inspection of the modules. Removal reduces the storage space ultimately required for the fuel by approximately 50%." [89]

The core assembly components containing the uranium fuel sections were previously sent intact to the Idaho Chemical Processing Plant (ICPP) for reprocessing or storage in ICP-666 water canal. This procedure changed when reprocessing ended and NRF kept the uranium in ECF or dry cask storage. [90] The remaining reactor non-fuel element parts and structural components have always been sent to the INL Radioactive Waste Manage-Management Complex (RWMC) for shallow burial as "low-level" Class A or B waste. Until the mid-1970's this unregulated waste was dumped in the center of pits and trenches while less radioactive waste was dumped around it to provide additional shielding. Post-1970s practice is to use individual unlined holes or "soil vaults" at the RWMC Subsurface Disposal Area (SDA). DOE's shows (in color) where the Transuranic (TRU) and Soil Vaults are located and Diagram of SDA shows the location of the numbered pits, trenches and soil vaults. Currently, NRF dumps this waste in an array of concrete lined vaults at the south end of Pit-20. SDA plot plan and list of Pits/Trenches opening/closing dates and the note for Trench 55 states: "**Trench 55 still available on East end for <u>High Level Waste</u>.**" [Emphasis added]

On some select core assemblies, the Navy does a destructive examination in the water pool or hot cell by cutting the fuel elements for a detailed evaluation of the uranium fuel and its cladding. In the past this process of cutting away the structural components was routine when the fuel was being reprocessed at the ICPP (now called INTEC) and the structural parts had to be separated from the uranium fuel components prior to reprocessing, as was the practice prior to 1990. The ICPP and other spent fuel generating facilities also routinely cut off metal parts of fuel rods on non-Navy fuel that was slated for reprocessing or storage, and sent these metal components to the RWMC/SDA for shallow land burial as "low-level waste."

Navy Acknowledges Expended Core Facility (ECF) Problems

The Navy admits; "Outdated infrastructure designs and upgrades to ECF structures, systems, and components necessary to continue ECF operations in a safe and environmentally responsible manner present a challenge to the continuity of ongoing ECF naval spent nuclear fuel handling operations. Major portions of the ECF infrastructure have been in service for over 50 years. The maintenance and repair burden necessary to sustain ECF as a viable resource for long-term operations is increasing. The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards. The pool does not have a liner, creating the potential for water infiltration into the reinforced concrete structure and the potential for corrosion damage of the reinforcing bar within the structure. The absence of a liner also means the capability to detect and collect small leaks, a common feature in modern water pools, is not present for the ECF pool. Consequently, while the replacement or overhaul of the current water pool is not a matter of urgency that must be done in a very short period, it is something that needs to be planned and started soon (Section 2.3)." [91]

It's tragically ironic that the Navy is finally being honest after decades of denial that any of the

[89] Department of Energy Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact statement June 1994, DOE/EIS-0203-D, @B-10

[90] Reprocessing involves the chemical or pyro-reprocessing to reclaim the enriched uranium/plutonium for nuclear bombs or new reactor fuel.

[91] DEIS Pg. 1-13

above issues exist. This author lost count of the number of times Navy, DOE, Idaho Department of Environmental Quality representatives lied to my face that there were no problems at the ECF. Now when the Navy wants to spent $ on a new ECF they finally talk about the facilities deficiencies that have been contaminating the environment for decades. [92]

Regulations on Nuclear Waste Classification

Title 42 United States Code Annotated 6.427.§ 28.021c states; "Disposal of low level radioactive waste; (a) State responsibilities, (1) Each State shall be responsible for providing, either by itself or in cooperation with other States, for the disposal of (A) low-level radioactive waste generated within the State (other than by the Federal government) that consists of or contains class A, B, or C radioactive waste as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983; (B)low-level radioactive waste described in subparagraph (A) that is generated by the Federal Government except such waste that is (i) owned or generated by the Department of Energy; (ii) owned or generated by the United States Navy as a result of the decommissioning of vessels of the Unite States result of the decommissioning of vessels of the United States Navy; or (iii) owned or generated as a result of any research, development, testing, or production of any atomic weapons…."

The Navy now acknowledges that "some of the structural material exceeds the 10 CFR 61 Class C concentration limits and is being stored in the water pools. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (P.L. 99-240), DOE is responsible for ensuring safe disposal of all Greater than Class C waste in a facility licensed by the Nuclear Regulatory Commission." [93] This is a very recent policy shift by the Navy to even consider this waste Greater than Class C. Still, the Navy continues to ship this waste to the RWMC violating its own policy and DOE continues to receive and bury the waste in shallow holes. Extremely limited storage capacity in addition to DOE's inability to account for this waste in storage further challenges the Navy assertions that Greater than Class C waste is going anywhere but to the burial ground. As recently as 7/12/94 this writer observed a heavily shielded transport canister routinely used by the Navy at the RWMC beside a crane ready to unload. **See Attachment # 8** for a copy a sample of 4 NRF shipping records to the RWMC Subsurface Disposal Area (SDA).

Since this NRF reactor core waste going to the RWMC burial grounds contains long- lived radioactive isotopes due to many years of exposure in the reactor core, it should be classified as high-level waste and treated according to Nuclear Regulatory Commission (NRC) disposal standards. At the very least this waste must be put in NRC Greater than Class C (GTCC) waste category. NRC disposal criteria require that "waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste." [55] Class C waste, must, for this reason, be disposed at a greater depth than other classes, or, if that is not possible, under an intruder barrier with an effective life of 500 years. "At the end of the 500 year period," according to NRC regulations, "remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety." [Ibid.] The adequacy of the EPA, NRC IDEQ regulations is discussed more fully in the waste dumping in this paper; for instance, there is considerable debate over these regulators non-enforcement that allows greater than class-C waste to be dumped in shallow land burial at INL in a flood zone over a sole source aquifer.

DOE data shows that individual NRF waste shipments to the RWMC containing greater than 81,000 curies are not uncommon. The reader must understand only two pages of RWMIS that includes

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[92] Chuck Broscious, Comments on the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Idaho National Laboratory, DOE/EIS-0453D Draft DOE/EIS-0453D, Chuck Brocious, 8/17/15 http://environmental-defense-institute.org/publications/EDINNPPFEIS.pdf Report attachments http://environmental-defense-institute.org/publications/EDINNPPFEISATTCH.pdf

[93] Department of Energy Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact statement June 1994, DOE/EIS-0203-D, @ B-10

more than 12 (10 inch thick) ring binders of printouts are cited. It also should be noted that this waste is currently dumped in shallow unlined holes (called "soil vaults") that would not qualify as a municipal garbage landfill, much less a RCRA Subtitle C hazardous waste disposal site, or an NRC high-level or Greater Than Class C radioactive waste repository. This dumping will continue until the new Remote- Handled Dump is built next to ATR at INL.

Another category of Navy waste is irradiated test specimens. "The irradiated materials program evaluates small specimens of materials for use in naval reactor systems. The specimens are loaded in sample holders, and the holders are placed in test assemblies at ECF. The assemblies are irradiated at [Advanced Test Reactor] ATR, and returned to ECF for disassembly."... "After completion of the final examination, specimens are shipped to ICPP for storage or to the INL Radioactive Waste Management Complex for disposal." [94] Over 4,450 specimen shipments to and from the ECF have occurred to date. [95]

Flooding accident scenarios postulated in the INL Environmental Restoration/ Waste Management Draft Environmental Impact Statement (ER/WM DEIS) of Mackey Dam acknowledges that the dam "was built without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [96] is more significant than the DEIS allows. Specifically, the 16 hour time delineated for the failed dam flood waters to reach NRF is incredible. Flood waters would move considerably faster than 2 miles per hour. show; “Flood Area for the Probable Maximum Flood Indicated Over-topping Failure of Mackey Dam.” [97]

The DEIS inaccurately describes the Borah Peak earthquake as 6.9 when it was actually 7.3 on the Richter scale. This is a significant inaccuracy when DOE analyst Rizzo calculated peak ground acceleration at 0.24. The Special Isotope Separator EIS used a "predicted peak ground accelerations were calculated assuming a 7.25 magnitude earthquake." [98] The DEIS does acknowledge that “this beyond design basis earthquake might have a peak ground acceleration of 0.4 g at ECF" which is twice the 0.24 that the facility could sustain. [DEIS (b) @ B-18] Yet the DEIS fails to explicitly acknowledge that there is a significant seismic hazard. The new ECF replacement facility proposed in 2015 would have a canal liner and be seismically designed to modern standards.

> "The [NRF] Expended Core Facility $44 million Dry Cell Project has a dry shielded fuel handling, disassembly, examination and shipping facility, a decontamination shop, and a shielded repair shop. The Dry Cell contains a semi-automated production line to receive and prepare fuel for shipment to the ICPP for chemical dissolution and recovery of unused uranium. The decontamination and repair shop will be integrally connected to the Dry Cell, and to existing water pits, to allow routine servicing of equipment without removing equipment from a shielded environment. A 10,000 foot extension to the existing facility will be used to house necessary control, receiving, storage and training spaces."
>
> "Core examinations and preparations for shipping and dissolution are currently performed in water pits and hot cells. This method is labor intensive, has notable technical disadvantages, and involves a significant burden of deliberately redundant administrative and physical controls for nuclear safety. The receipt of expended nuclear cores is expected to have increased by 1992. This surge will be compounded because many of these cores will be larger and heavier than those that are currently processed in the water pits. Existing facilities and systems cannot be economically upgraded and automated to meet the projected workload increases. The Dry Cell Project is essential to continued timely handling of expended cores in

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94 Department of Energy Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact statement June 1994, DOE/EIS-0203D, Pg.B-12

95 DEIS @ A-9

96 Department of Energy Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact statement June 1994, DOE/EIS-0203-D, Pg. B-17.

97 DOE/EIS-0453-D, pg. 3-38

98 Final Environmental Impact Statement Special Isotope Separation Project, Idaho National Engineering Laboratory November 1988, U.S. Department of Energy, DOE/EIS-0136, Vol. 1.

support of scheduled Navel nuclear-powered vessel refueling and inactivation's." [99]

The Navy fails to provide seismic analysis documenting that the super structure of the Expended Core Facility (ECF) can sustain design basis earthquake and accident scenarios during transfer of fuel using the ECF bridge crane. Water Pits 1, 2 and 3 were only constructed to earthquake "Zone 2 earthquake requirements which were judged to be appropriate under the USGS's classification of the area at the time [1957] of their construction." Subsequent USGS requirements for INL raised that standard to zone 3.

As discussed earlier, an unreported nuclear fuel accident occurred at ECF that caused evacuation of the building when a transfer cask was not properly positioned over alignment posts. The bottom door cask had holes in it that are designed to receive the alignment posts on the deck above the water pools so that a tight seal is created when the bottom door opened and the fuel dropped into the water pool. In this accident the posts and holes were not aligned and therefore there was no seal. Workers claim that when the fuel was lowered into the pool, a 25 rad per hour beam escaped between the cask and the pool exposing workers in the area. This 25 rad is considered to be understated by many orders of magnitude. The miss-alignment occurred on one shift and the fuel transfer to the pool occurred on the next shift. [100] This type of accident would not occur at the newer INTEC CPP-666 that is equipped with underwater cask loading and unloading capability as well as fully interconnected pools that keep the fuel below the water surface at all times. Because of severe deterioration of the concrete, leaks in the pool walls, and the gate seal leaks, the ECF pools cannot be isolated for band aid epoxy patches NNPP claims they will do to keep ECF in service for the next 3-4 decades.

Navy Waste Characterization

Publicly available summary DOE data recorded between 1952 and 1981 cites the Navy's NRF as dumping 195,000 Curie (Ci) in the RWMC, making the Navy the second largest curie contributor to INL's dump. [101] Yet, DOE's restricted access Radioactive Waste Management Information System Solid Waste Master (RWMIS) Database attributes 187,050,351 curies to Navy's NRF dumping at the RWMC between 1960 and 1981. [102] Between 1960 and 1989 the Navy dumped 188,140,668 curies at the RWMC. [ibid] This figure makes the Navy the largest curie contributor to INL's dump. DOE recently revised these figures claiming a mistake in data entry more fully described below. DOE now claims that there was an entry error in their database that went undetected for 24 years.

DOE/ID recently provided Environmental Defense Institute (EDI) with a copy of EG&G's Radioactive Waste Management Information System (RWMIS) verification process that was initiated because EDI publicized the data of an earlier DOE Freedom of Information request. According to the RWMIS 1/4/88 and 10/24/89 computer runs, there were four waste shipments on 9/15/69 from the Naval Reactors Facility (NRF) to the Radioactive Waste Management Complex (RWMC). The RWMIS lists the times of the four shipments at 820, 830, 840, and 850. The 820 NRF shipments are listed as "metal scrap".

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[99] DOE Budget FY-93

[100] Author's interview with Duane Allen then Oil & Chemical Workers Union, Safety Representative. The ECF cask misalignment accident --- says 25 rem doses. But, when there is gamma radiation from even a portion of a single fuel rod, you can have very high radiation levels. For instance, an Advanced Test Reactor fueled test experiment can shine 1 million rem per hour and be lethal for 100 meters. Time, distance and shielding determine the dose. But when the Navy says the dose was perhaps 25 rem for the misalignment, an analyst will wonder if NRF had any real basis for this dose. It could have been significantly higher. Additionally, the fact that this radiation hazard lasted through two worker shifts, many ECF workers would have been affected.

[101] ID-10054-81@15

[102] RWMIS, P61SH090

Kloss McNeel, Manager of EG&G's Environmental Technical Support Unit who reported to DOE/ID's Paul Allen (9/7/93) on their verification process of the RWMIS, made a correction to the 9/15/69 shipment number 850 entry that originally contained a 1.8 E+8 (180,000,000) curie entry. The correction included a new curie value of 1.8 E+4 (18,000). EG&G's accompanying explanation includes a copy of the Waste Disposal Request and Authorization form ID 124 that describes the waste as "SCRAP INSERT 176 With Dummy Source and S5W Misc. hardware from disposal effort." This description more accurately describes the 9/15/69 820 shipment listed as "metal scrap" in the 1/4/88 and 10/24/89 database runs. The 820 "metal scrap" waste shipments is missing from EG&G's "corrected" RWMIS 9/24/92 data base run.

Mr. McNeel makes no attempt to account for the deletion of the 820 NRF "metal scrap" shipments to the RWMC. The 850 shipment, which earlier was reported to have a curie content of 1.8 E+8 is described as "011 CORE + LOOP COMP." Clearly, the waste description on form ID 124 does not match the RWMIS 850 waste shipment description. Also, there is no explanation why the curie content on form ID 124 is hand written when the other data fields are type written. Do other shipping manifests for that period also contain hand written entries for curie content? Even if one accepts this change in the data, this still shows the Navy dumped nearly three times (8.14 million) more curies than publicly acknowledged total of 3.1 million curies. The Navy's reactor core wastes that have been buried at the RWMC must be exhumed at considerable expense and hazard to workers. The core assemblies are extremely radioactive and require remote handling. Individual NRF shipments to the RWMC of 81,000 curies attest to this hazard. Furthermore, the cores are not packaged in any radiation containment unit. NRF officials only acknowledge that the waste is shipped in a canister from the NRF, and the shipping canister is returned to the facility.

The below Table 3-4: “Waste Comparison Analysis is drawn from Annual Performance Assessment and Composite Analysis Review of the Active Low-Level Waste Disposal Facility at the RWMC FY 20145”, Page 3-11 and 3-12, April 2015, RPT-1356. This DOE report shows a rare glimpse into the “Total Inventory of the Remote-Handled-Low-Level Waste radionuclide Inventory” in the RWMC/Subsurface Disposal Facility burial ground and the projected inventory in 2020. EDI’s total of the below Table 3-4 third column (Total Disposals 1952-9/14) = >8,057,453 curies. The fact that DOE intends to keep RWMC open through 2020 is unconscionable given the evidence of contaminate migration into the aquifer.

Until the mid-1970's the Navy dumped fuel element parts and specimens into the RWMC pits and trenches. Since then, the Navy continues to dump reactor core assemblies at the RWMC in "soil vaults", which are defined as shallow (2 to 6 feet diameter) holes in the ground where the waste is dropped in and covered with 3 feet of soil. As of 1979, there are 1,150 "soil vaults" in 20 separate rows. Currently the RWMC is undergoing environmental restoration under the CERCLA Superfund cleanup process. Remediation projects have been underway for over a decade, starting with Pit 9. Even the most pedestrian of observers can see how ludicrous cleanup activities are when dumping continues in the immediate vicinity creating new future Superfund.

Radioactive Waste Management Information System database printout (RWMIS) of Reactor Fuel Description includes: “Irradiated Fuel, Fuel Rods, Ceramic Fuel, Un-irradiated Fuel, SS Clad Plate Elements, PBF Fuel,, Uranium Fission Fuel, HTGR fuel, ERB-I Mark III Fuel, PBF Pellets, LWR Spent Fuel-I, Spent Fuel, PWR Rods, Fuel Encased in Epoxy, Uranium Rod Scrap, Plutonium Flux Wands, Scrap Elements and Plates, Uranium Element, Scrap Fuel Rods.” [103]

DOE’s Plot Plan drawing the shows the RWMC and SDA burial grounds position and description (date opened/closed) of the pits and trenches. At the bottom of the list of trenches, there

[103] Letter to Richard Poeton, EPA Region 10 from Chuck Broscious 9/26/96. This list – gleaned from FOIA RWMIS print outs - is by no means inclusive, but it gives us a glimpse into to extent of reactor fuel (high-level waste) that DOE officially continues to deny.

is a Notation that states; "Trench 55 still available on east end for high-level waste." [104] The 1985 Low Level Waste Amendment requires DOE take ownership of the NRC licensee of GTCC waste. But as DOE manages its own and Navy LLW it is not required to classify it according to the laws for NRC licensed facilities. DOE does not have to classify its waste as A, B, C except when it wants to send this waste to a state or NRC-licensed facility. See below are exemptions to the Low-level waste law for NRC licensees like commercial power reactors.

For more discussion on NRF see Section IV.K.

Table 3-4. Comparison of composite analysis modeled, actual, and projected disposals (Ci) for all Remote-Handled- Low-Level Waste radionuclides with a half-life greater than 5 years.

Radionuclide	CA Total Inventory Assumed 1952–2009[a]	Total Disposals 1952–9/30/14[b]	Projected Disposals 10/1/14–9/30/20[c]	Total Projected Disposals 1952–9/30/2020[d]	Ratio of Total Projected Disposal to Total CA Inventory Assumed[e]
Am-241	2.30E+05	2.30E+05	4.29E-01	2.30E+05	1.0
Am-242m	**8.96E-06**	**3.19E-03**	**6.35E-03**	**9.54E-03**	**1064**
Am-243	**1.18E-01**	**1.24E-01**	**3.52E-03**	**1.27E-01**	**1.1**
C-14	7.39E+02	7.08E+02	5.84E+01	7.66E+02	1.0
Cl-36	1.65E+00	1.23E+00	1.69E-01	1.40E+00	0.8
Cm-243	**2.36E-02**	**2.59E-02**	**2.93E-03**	**2.88E-02**	**1.2**
Cm-244	4.43E+01	4.47E+01	4.73E-01	4.52E+01	1.0
Cm-246	1.28E-02	1.29E-02	1.62E-04	1.30E-02	1.0
Co-60	3.82E+06	3.48E+06	1.46E+04	3.49E+06	0.9
Cs-137	1.73E+05	1.68E+05	1.26E+01	1.68E+05	1.0
H-3	2.69E+06	2.68E+06	6.07E+01	2.68E+06	1.0
Hf-178m	**1.73E+00**[f]	**1.73E+00**	**3.46E+00**	**5.19E+00**	**3.0**
I-129	1.91E-01	1.65E-01	1.34E-05	1.65E-01	0.9
Nb-94	1.47E+02	1.41E+02	1.11E+01	1.52E+02	1.0
Ni-59	9.48E+03	7.77E+03	9.00E+02	8.67E+03	0.9
Ni-63	1.12E+06	8.97E+05	6.45E+04	9.61E+05	0.9
Pu-238	2.08E+03	2.05E+03	7.15E-01	2.06E+03	1.0
Pu-239	6.41E+04	6.41E+04	8.20E-02	6.41E+04	1.0
Pu-240	1.46E+04	1.46E+04	4.09E-02	1.46E+04	1.0
Pu-241	3.81E+05	3.81E+05	1.05E+01	3.81E+05	1.0
Pu-242	8.59E-01	8.59E-01	3.60E-04	8.60E-01	1.0
Sn-121m	**8.39E-02**	**7.71E-02**	**1.52E-01**	**2.29E-01**	**2.7**
Sr-90	1.37E+05	1.32E+05	9.87E+00	1.32E+05	1.0
Tc-99	4.30E+01	4.09E+01	4.17E-01	4.13E+01	1.0

Above Table 3-4. (Continued).

Note: Bold text indicates radionuclides that are projected to be disposed of at an activity more than 5% above the total inventory assumed in the CA (DOE-ID 2008a).

a. From Table 2-9 of the CA (DOE-ID 2008a).
b. From WILD and IWTS data pull conducted September 30, 2014.
c. Calculated from annual maximum listed in Table 3-2 (6 years total projected).
d. Sum of waste disposed (1952–FY 2014) and projected waste to be disposed of (FY 2015–2020).
e. Divide the fifth column value by the second column value to obtain this value.
f. Not included in CA. Since Hf-178m was not identified in inventory until FY 2012,

[104] Idaho Operations document No. IDO-22056, Drawing No. DWG-1230-825-101-1, Attachment # 7 below.

assume the CA inventory is equal to total disposed of from FY 2012 through FY 2014.

g. No screening threshold available; the screening threshold for Hf-178m will be included in the next revision of EDF-8251. Since the decay half-life is relatively short (31 years) and Kd is relatively large (450 mL/g [Jenkins 2001]), the screening threshold for Hf-178m is expected to be "No Limit," consistent with other radionuclides with similar parameters such as Cs-137 and Sr-90.

CA=composite analysis; FY=fiscal year; IWTS= Integrated Waste Tracking System; WAC=waste acceptance criteria WILD=Waste Information and Location Database

Total of above Table 3-4 third column (Total Disposals 1952-9/14) = >8,057,453 curies.

NRF Expended Core Facility Waste Issues

The NRF EIS talks about a seismic assessment for the current ECF, but addresses the basic concrete --- it does not address leakage etc... It's too complicated to address how they are treating the old current ECF operations. The important thing is that the seismic design for the new facility is the most stringent there is. Detailed very old history on the old ECF doesn't make much difference if they are building the new one. Except, when mismanagement of ECF over the decades resulted in extensive contamination of the area.

The unique nature of the Navy spent fuel assemblies and the Naval Reactor Facility's processing/inspection operations is secret. The highly enriched Navy spent fuel waste poses a significantly greater environmental threat (because of the decay heat) than other conventional low-enriched reactor fuel that goes directly into storage cooling ponds. Additionally, the Navy waste going to the RWMC must be classified as high-level waste and/or Greater-Than-Class C waste by virtue of the fact that it contains reactor core assembly sections contaminated with long-lived radionuclides. The destructive testing can access the uranium section of the rod which means the cutting chips will contain uranium. The extremely high curie content of these waste shipments (called canal trash) attests to this fact.

Institute for Energy and Environmental Research (IEER) book *High-Level Dollars, Low-Level Sense* challenges the NRC radioactive waste disposal standards: "In examining the NRC regulations, one is thus led to believe that the class limits [Class A, B, C, and greater than C] were derived from the requirements imposed by these hazard definitions and time frames.

However, even according to NRC's own definitions of what is 'hazardous' and what is 'acceptable' the time frames of 100 years [Class A] and 500 years [Class C] are logically incompatible with the class limit definitions, raising serious questions about their environmental and public health adequacy." ... "For example, much of the '100 year' waste (Classes A & B), for example, will not decay to NRC-defined 'acceptable' levels in 100 years. Consider nickel-63.

Buried at Class B concentrations levels of just under 70 curies per cubic meter, waste containing nickel-63 would still have concentrations of about 35 curies per cubic meter after the institutional control period of 100 years had elapsed. According to NRC regulations, at this point the waste should have decayed to the point where it 'will present an acceptable hazard to an intruder.' Yet, at 35 curies per cubic meter, the waste, if retrieved from the disposal site and re-buried, would still be classified as Class B waste since it has concentrations levels which are 10 times higher than the Class A limits. As a matter of fact, this waste would take a total of well over 400 years to decay just to the Class A upper limits (at which point the NRC regulations would still define it as hazardous for another 100 years if it were being buried for the first time)." [105]

IEER continues: "This analysis makes an even stronger case against the NRC regulations when applied to the Class C limits, which pertain to 'long-lived radionuclides'. Class C waste contaminated with technetium-99, however, buried at concentrations of just under the Class C limit of 3 curies per cubic meter, will be hazardous according to NRC definitions for far longer than 500 years. It will take

[105] IEER @ 74&75

such waste over the three half-lives - some 640,000 years - just to decay to the upper boundary of Class A levels. The illogical nature of the above regulatory approach is made even more explicit in the NRC's discussion of the 'long-lived' radionuclides in the waste. According to the NRC, in managing low-level waste, 'consideration must be given to the concentration of long-lived radionuclides ... whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures'". [106]

IEER continues: "In essence, there is an admission that the hazard due to long-lived radionuclides 'will persist long after' the controls imposed by the regulations fade away. This is an extraordinary admission of the regulations fundamental inadequacy right in the text of the regulation. The only thing the NRC regulations will apparently do with respect to the long-lived components of low-level waste, is push the hazard into the future, since NRC-mandated controls will, at most, only 'delay the time when long-lived radionuclides could cause exposure'. In the case of many long-lived radionuclides, they will continue to be present in almost exactly the same concentrations when institutional controls have lapsed as when they were first buried."

Summary of Nuclear Navy Waste

Dumped at INL's RWMC SDA Burial Ground 1960 to 1993

Year Dumped	**Curie Content of Waste ***
1960	1,364
1961	6,717
1962 #	20,900
1993	34,933
1964 Navy Knolls Atomic Lab. Reactor Core + Loop Comp.	6,400
1965	517,571
1966	787,300
1967	801,100
1968 #	198,600
1969 #	644,000
1970	3,572,048
1971	54,669
1972	10,577
1973	9,411
1974	5,782
1975	4,911
1976	73,348
1977	144,758
1978	34,962
1979	109,171
1980	39,206
1981	19,219
1982	8,401
1983 1983 NRF S1G Reactor vessel	39,035 5,579
1984	372,614
1985	141,784

[106] IEER(c)

1986	35,928
1987	29,664
1988	6,722
1989 #	126,400
1990 #	74,120
1991 #	102,600
1992 #	49,300
1993 #	27,560
Total 1960 to April 1, 1993	**8,140,668**

Source for above table: [Radioactive Waste Management Information System Master Database, P61SH090, 10/24/89]; [#] [Senate Armed Services Committee, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, Hearing on shipment of Spent Nuclear Fuel, 28 July 1993, Questions and Answers for the Record, @ 25]
Notes for Above Table:
* Curie content of shipments less than 1 curie were not added to the above summary table, therefore, the totals are understated. Also **not included** are Navy contractors, General Dynamics' (Electric Boat Div. and General Atomics Div.) seven shipments of "irradiated fuel" to the RWMC; and General Electric's eleven shipments of "irradiated fuel" and ten reactor "core + loop" assemblies; and Office of Isotopes Specialists' one shipment of "irradiated fuel" to RWMC. DOE and Navy officials publicly deny that spent fuel was dumped at the INL burial ground (RWMC) in direct contradiction to their own data base entries. (See Spent Nuclear Fuel Dumped in Burial Ground that shows 90.282 metric tons of irradiated fuel dumped in RWMC).

Nuclear Regulatory Commission (NRC) requires in classifying a specific waste shipment that the part of that volume that contains 90% of the radioactivity be separated and used to determine the concentration and thereby the waste classification. The Navy and DOE continue to use the entire volume of the shipment to calculate the average concentration. The result is that the radioactive concentration appears low because of dilution. The NRC's Staff Technical Position specifically prohibits this practice of factoring in other material as a means of dropping the average concentration. The Navy is also using total volume averaging to avoid NRC regulations in burial of reactor shells at the DOE Hanford site. An EG&G groundwater sampling report found significant radioactive contaminates at the 600 foot level under the INL burial grounds.

Equally significant are spent nuclear fuel related waste shipments to the RWMC burial grounds. This waste includes spent nuclear fuel parts cut off the fuel elements prior to storage and fuel storage "canal trash" that represents over **9,866,112 curies.** The burial grounds are a shallow disposal area that would not meet municipal garbage landfill regulations.

Navy Waste Characterization
Partial listing of isotopes found in Navy waste dumped at INL

Isotope	Symbol	Half-Life in days	Half-Life in years
Americium-241	Am-241	1.7 E+5	465.7
Antimony-125	Sb-125	877	2.4
Ba-133	BA-133	12	
Cerium-144	Ce-144	290	

Cobalt-58	Co-58	72	
Cobalt-60	Co-60	1,900	5.2
Chromium-51	Cr-51	27	
Cesium-134	Cs-134	840	2.06
Cesium-137	Cs-137	1.10 E+9	30.17
Europium-154	Eu-154	5,800	15.89
Hafnium-181	Hf-181	46	
Iron-55	Fe-55	110	
Iron-59	Fe-59	45	
Iridium-192	Ir-192	74	
Lead-210	Pb-210	7,100	19.4
Manganese-54	Mn-54	300	
Neptunium-237	Np-237	8.0 E+8	2,191,780
Nickel-59	Ni-59	2.9 E+7	79,452
Nickel-63	Ni-63	2.9 E+4	79.4
Niobium-95	Nb-95	35	
Potassium-40	K-40	.50	
Plutonium-238	Pu-238	3.3 E+4	87.7
Plutonium-239	Pu-239	8.9 E+6	24,131
Plutonium-240	Pu-240	2.4 E+6	6,575
Plutonium-241	Pu-241	4.8 E+3	14.35
Plutonium-242	Pu-242	1.4 E+8	383,561
Promethium-147	Pm-147	920	2.5
Radium-226	Ra-226	5.9 E+5	1,616

Ruthenium-106	Ru-106	365	
Silver-110M	Ag-110M	270	
Sodium-22	Na-22	950	2.6
Strontium-89	Sr-89	50	
Strontium-90	Sr-90	10,512	28.8
Technetium-99	Tc-99	7.7 E+7	210,958
Thorium-232	Th-232	5.1 E+12	13,972,600,000
Tin-119	Sn-119	112	
Uranium-233	U-233	5.9 E+7	161,643
Uranium-234	U-234	9.1 E+7	249,315
Uranium-235	U-235	2.6 E+11	712,328,767
Uranium-236	U-236	8.7 E+9	23,835,616
Uranium-238	U-238	1.6 E+12	4,383,561,644
Zirconium-95	Zr-95	63	

Source: USDOE, Radioactive Waste Management Information System Master Solid Database, 10/24/89

The above table shows clearly how Navy waste dumped in the burial grounds contains transuranic waste. [107] One of the reasons for this is the lack of precision in cutting off the structural parts of the fuel element in preparation for reprocessing or storage. Destructive tests of fuel assemblies additionally add to the fissile content of the waste stream via canal trash. In recent DOE documents characterizing the waste streams going to the RWMC they acknowledge presence of, "Irradiated fuel element end boxes that were cut off of the fuel plates in the hot cells. The end boxes may contain some fuel, but generally only activation products". Independent characterization of this waste must be made before more is dumped at the RWMC.

Spent fuel rods from over 40 reactors around the US and the world are being stored at various sites around INL. Current inventory is 1,225 metric tons total mass. DOE plans on considerable expansion (15-20,000 metric tons) of its spent fuel processing and storage. This Plan is called "Directed Monitored Retrievable Storage", which is the product of nuclear electric utilities forcing the government to take possession of spent fuel. Since a high-level waste repository has yet to be built, the utilities do not want to store the spent fuel on their sites.

Shipments of "irradiated fuel" during the same period to the RWMC Transuranic Storage Area

[107] Transuranic (TRU) waste is "radioactive waste that is not classified as high-level radioactive waste contains more than 100 nanocuries (3700 becquerels) per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years.

amounting to 621.549 kilograms, and which also were not included in the Spent Nuclear Fuel EIS. Also see Attachment # 7 that lists Pits, Trenches and notes Pit-55 east is available for high- level waste.

NRF CERCLA Remediation Cleanup Issues and Resource Conservation Recovery Act Violations

Comprehensive Environmental Response, Compensation, Liability Act (CERCLA) a federal law that establishes a program to identify, evaluate and remediate sites were hazardous substances were released to the environment, also called "Superfund." Various INL sites were established as CERCLA sites; NRF was called Waste Area Group (WAG) 8. Within WAG -8 there were 18 Operable Units (OUs) each investigated to determine the extent of the contamination problem and the risk to the underlying aquifer. **Attachment #12** shows an ariel photo with the location of 9 of the more significant NRF cleanup OU's.

The Environmental Protection Agency (EPA) also found that INL violates the Resource Conservation and Recovery Act (RCRA) and "That the presence and/or release and potential release of hazardous waste from USDOE's facility may present a substantial hazard to human health and/or the environment ..." [108] Substantive corrective action has yet to occur because EPA does not have the authority to shut down any INL facility. Consequently violations are interpreted as a peer review without being binding according to a 1989 Government Accounting Office report. [109]

Another major assumption that is extensively evoked in the INL Cleanup Plan is continuous 100 years of DOE monitoring and institutional control of the contaminated sites as a means to ensure restrictive public access in order to justify not cleaning up the contaminates. In real life, when entities break the law, and are required to do major corrective actions in the future, they are generally required to establish a trust fund so that if they again decide to disregard their legal requirements, or are no longer in existence, the funding will be there for the state or local government to do the cleanup job. The state of Idaho should therefore, require the Navy and DOE to establish a monitoring/institutional control trust fund to cover those costs at INL.

An example of where this issue is important is the current designation that NRF is not in the Big Lost River (one mile away) 100 year flood plain. This designation is due to Big Lost River dams that divert flood waters southwest into spreading areas. These dams and their related water channels require regular maintenance in order to provide that flood protection to NRF and other INL facilities such as the new Remote-Handled Dump near ATR. [110]

Prior to construction of the diversion dam, NRF was in the Big Lost River 100 year flood plain. Nuclear Regulatory Commission (NRC) radioactive waste disposal requirements state, "waste disposal shall not take place in a 100 year flood plain." [10 CFR ss 61.50] Institutional control must include diversion dam and water channel maintenance as well as monitoring and fencing of waste.

The NRF Cleanup Plan states: "The Comprehensive RI/FS Waste Area Group 8 represents the last extensive Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) investigation for the Naval Reactors Facility." This Plan is not "comprehensive" because it excludes the Retention Basin (one of the most contaminated waste sites at NRF) from the CERCLA cleanup process. The Retention Basin (OU-8-08-17) is a large concrete tank that temporarily holds liquid radioactive and chemical wastes (presumably to allow short-lived isotopes to burn off) prior to discharge to the various leach pits. The Plan fails to state that the sludge in the basin contains cesium-137 at 192,700 pico curies per gram (pCi/g)(risk- based action level is 16.7 pCi/g) and Cobalt-60 at 20,410 pCi/g. [111] A long history of Basin leaks assures

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108 EPA(a),9/15/87

109 GAO/RCED-89-13, p.3

110 NRF Remedial Investigation/ Feasibility Study (RI/FS@5).

111 NRF Remedial Investigation/ Feasibility Study (RI/FS@H8-8).

significant soil contamination under the basin and therefore should have been included in the Comprehensive Plan but never was.

ECF Canal Leaks Violate Discharge Regulations

The Comprehensive Cleanup Plan's exclusion of the NRF Expended Core Facility (ECF) leaks additionally demonstrates the incompleteness of the so called "comprehensive" Remediation Plan. The ECF, built in 1957, does not meet current spent reactor fuel storage standards that require stainless steel liner, leak containment, and leak detection systems. The ECF should be shut-down for exactly the same reasons the Idaho Chemical Processing Plant (CPP-603) Underwater Fuel Storage Facility was shut-down - it was an unacceptable hazard and did not meet current standards. ECF has been leaking significantly >62,500 gallons of radioactive water over the past decade and the soil contamination around and underneath the basins must be included in the CERCLA cleanup process. The Plan offers no soil sampling data to substantiate exclusion of the ECF from CERCLA action.

The ECF was built in 1957. It has four separate unlined concrete water pools that contain 3 million gallons of water. The ECF does not meet current spent nuclear fuel (SNF) storage or seismic code requirements. NRF workers claim that 16,000 gallons per day are leaking from the pools. In an attempt to slow these leaks, NRF tried injecting grout around the perimeter of the pools. The grouting caused increased hydrostatic pressure that forced some horizontal leakage into the perimeter access corridor around the pools which then must be pumped out. ECF also lacks a leak detection system. All other fuel storage and processing facilities at the INL with similar characteristics have been designated unsafe and scheduled for closure. Therefore, the Navy's claim "that operation of the INL-ECF does not result in discharges of radioactive liquids"
is inaccurate. [112] "[T]hree separate milling machines in the water pools are used to separate spent fuel components into smaller sections for examination in the shielded cells" [113]

NRF suggests that significant contaminates are released to the water in the pools. Contaminates would include cuttings from these milling machines which would be classified either as high-level if parts of the fuel cut or Greater-than Class C Waste. These contaminate generating processes make the uncontrolled leaks uniquely significant.

The Navy fails to provide seismic analysis documenting that the super structure of the Expended Core Facility (ECF) can sustain design basis earthquake and accident scenarios during transfer of fuel using the ECF bridge crane. Water Pits 1, 2 and 3 were only constructed to earthquake "Zone 2 earthquake requirements which were judged to be appropriate under the USGS's classification of the area at the time [1957] of their construction." Subsequent USGS requirements for INL raised that standard to zone 3.

"Between December 8, 1991 and February 6, 1992 significantly more water was added to the [ECF] water pits than anticipated. The detailed investigation of this event identified that and unexplained water loss of 62,500 gallons occurred between December 8, 1991 and February 21, 1992. A leak from one water pit was the expected cause of the water loss. The water pit was drained and the leak location found. The leak was on the south side of the water pit at construction joints of two reinforced concrete canal gate interferences. The joints were repaired by sawing and chiseling the joint area and grouting the joints. A water leak test was performed to confirm the leak as repaired. The release of 62,500 gallons is a conservative maximum estimate. Based on the results of periodic NRF Chemistry analyses of the low level of radionuclides present in ECF water pool water, the estimated quantities of radionuclides released are as follows: 5.2 x 10(-2) curies of tritium, 9.7 x 10(-6) curies of carbon-14, 7.1 x 10(10-6) curies of manganese-54, 1.9 x 10(-5) curies cobalt-58, 4 x 10(-4) cobalt-670,

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112 DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact Statement, June 1994, DOE/EIS-0203-pg. 5.2-12.

113 DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Draft Environmental Impact Statement, June 1994, DOE/EIS-0203-pg. 5.2-12.

6.6 x 10(-5) curies nickle-63, 1.2 x 10(-6) strontium-90, 1.2 x 10(-5) yttrium, and 1.1 curies cesium-137. Thus, total of 5.25 x 10(-2) curies of radioactivity was estimated to have been released. The estimate is considered to be conservative, **because previous leaks from the water pit into observation rooms within the ECF building <u>rarely</u> indicated the presence of radioactive contamination.** The release occurred about 30 feet below ground level." [114] [Emphasis added]

EDI has not found any additional disclosures about the EFC's leak history except the above dated data 1992, which is now ~ 23 years. So how much ECF canal water has leaked in these last 23 years and more importantly what is the contaminate levels in the underlying perched and deep aquifer?

The NRF Cleanup Plan's exclusion of the Sewage Lagoon (NRF-23) from its so called "comprehensive" CERCLA cleanup, again, demonstrates the incompleteness of the Plan. Contaminate levels of arsenic, mercury, and cesium-137 would normally require remedial action. In fact, the Track 1 investigations recommended inclusion of the lagoons into the comprehensive RI/FS primarily due to radionuclides and the risk assessment results showed increased cancer rate of 1 in 10,000 from exposure to the site. [115] The Plan offers no data to substantiate the "risk management decision" to exclude the lagoons.

NRF intends to continue to use these unlined leach pits despite the fact that every gallon of waste water that flows into the pit, leaches more contaminates toward the aquifer below. NRF should be required to close the Sewage Lagoons, remove all contaminated soil, and build new lined ponds that meet current regulations.

ECF Pit Water Analysis at Time of Leaks

<u>Table 5-1 COPCs and Concentration Terms for Unit 8-08-79</u>

Constituent	Estimated Amount Released (Curies)	Concentration (pCi/l) of pit	Concentration Term (pc/l) - Decay-Corrected to 1996
Carbon-14	9.7 x 10-6	41	41
Cesium-137	1.1 x 10-5	46.5	42.3
Cobalt-60	4 x 10-4	1691	930
Manganese-54	7.1x10-6	30	0.8
Nickel-63	6.6x10-5	279	270
Strontium-90	1.2 X 10-6	5.1	4.5
Tritium	5.2 X 10-2	219,791	170,761

The Cleanup Plan offers inaccurate data to support the preferred alternative. The Plan states that the maximum soil concentration at all of the 8-08 Operable Units for cesium-137 is 7,323 pCi/g. [116] Appendix H of the RI/FS however credits the S1W Leach Pit with a maximum detected cesium-137 concentration of 149,759 pCi/g. [117] This contaminate concentration discrepancy is significant because the undisclosed higher amount qualifies under NRC radioactive waste classification criteria in 10 CFR ss 61.55 and the "technical requirements for

[114] DOE/EIS-0203 pg. B-13

[115] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility Idaho Falls, Idaho Page 5-1.Prepared for the USDOE Pittsburgh, Naval Reactors Office Idaho Branch Office Idaho Falls, ID.

[116] NRF Plan@25

[117] Comprehensive NRF RI/FS pg.5-2

land disposal facilities” in 10 CFR ss 61.50. The preferred alternative does not meet NRC requirements.

Actually, DOE’s preferred alternative does not even meet municipal garbage landfill requirements under Resource Conservation Recovery Act (RCRA) Subtitle D which require liner, leachate monitoring wells, impermeable cap, and location restrictions over sole source aquifers. The NRF Plan contains none of these essential features. This Plan effectively shifts the risks, hazards, and ultimate cleanup costs to future generations. The high levels of hazardous materials in the NRF waste qualify it as a mixed hazardous and radioactive waste under the 1992 Federal Facility Compliance and RCRA Land Disposal Restrictions. Hazardous contaminates in the soil include chromium at 2,090 mg/kg and lead at 1,140 mg/kg when the EPA maximum concentration level (MCL) for both is 50. Also, mercury at 56.1 exceeds the MCL at 2 mg/kg.

Under the circumstances, it is difficult to see how the Plan’s preferred alternative can claim to meet all the “Applicable or Relevant and Appropriate Requirements” (ARAR). [118]

1971 Samples NRF Leaching Bed Mud [119]

Table H6-6- Unit 8-08-14 Radioactivity (pCi/gm) Sample Results (pre-1971)

Sample Number	Soil				
	Cs-137	Cs-134	Co-60	Hf-181	Sb-124
1	310,000	42,000 .a·	450,000	4,900	190,000
2	190,000	42,000	42,000	6,200	37,000
3	210,000	7,600	1,300,000	8,700	43,000
4	80,000	14,000	640,000	9,100	ND
5	95,000	20,000	1,000,000	15,000	55,000
6	140,000	42,000	1,000,000	19,000	ND
7	150,000	40,000	1,100,000	20,000	ND
8	140,000	31,000	440,000	8,200	33,000

As the above H6-6 Table shows in 1971 sampling data buried in the Administrative Record show long-term waste mismanagement at the S1W Leach Pit with cesium-137 at 310,000 pCi/g, cesium-134 at 42,00 pCi/g, hafnium-181 at 20,000 pCi/g, and cobalt-60 at 1,300,000 pCi/g. [120]

Algae (accessible to ducks using the pond) sampling show 667,447 pCi/g. [89] By comparison, the risk based soil concentration for cesium-137 applied to this Plan is 16.7 pCi/g. These high contamination levels were due primarily to once through reactor cooling water dumped in the leach pits which was discontinued by 1980. No explanation is offered why the remediation goal applied to Waste Area Group 3 of 0.02 pCi/g for cesium-137 was changed.

NRF and DOE representatives stated at a public meeting in Moscow, ID that the groundwater and aquifer are not at risk because contaminates are absorbed by the soil column. Review of the historical

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118 NRF Plan@14

119 NRF Remedial Investigation/ Feasibility Study (RI/FS) @H6-14

120 NRF Remedial Investigation/ Feasibility Study (RI/FS) @I-59).

deep well sampling data at NRF does not support the Navy's conclusion. The NRF October 1995 Remedial Investigation / Feasibility Study (RI/FS) Appendix K shows Table III Deep Well Sample Results for Wells # 1, # 2, and # 3 at 60, 69, and 44 pico curies per liter respectively for gross beta. The federal drinking water standard for gross beta is 8 pico curies per liter. This deep well sample data confirms the contaminates do migrate, contrary to the Navy's claims. The Plan's "remediation goals" that set risk-based soil concentrations for contaminates of [121] concern (cleanup goals) fail to include inhalation as an exposure pathway. This exclusion represents a major flaw in the Plan. Inhalation is the most biologically hazardous for alpha emitting contaminates of concern listed as americium-241, neptunium-237, plutonium-238, plutonium-244, and uranium-235, yet inhalation is not considered for these isotopes, nor for lead. The wide difference between ingestion of beta/gamma contaminated soil also appears out of balance. For instance cleanup goals for cesium-137 external exposure is set at 16.7 pico-curies per gram (pCi/g) while ingestion of soil is set at 24,860 pCi/g. Additionally, the beta emitter strontium-90 is not considered for external or inhalation exposure but is considered for soil ingestion at 15,416 pCi/g and food crop ingestion at 45 pCi/g.

An integral factor in the Plan's establishing a "remediation goal" is the maximum concentration of contaminates of concern. The Plan acknowledges (pg. 14) that the maximum cesium-137 soil contamination detected at the NRF is 7,323 pCi/g which generated a risk based cleanup goal of 16.7 pCi/g. Again, this must be recalculated using the above cited maximum detected cesium-137 at 149,759 pCi/g "decay corrected to obtain equivalent 1995 results." This significant discrepancy begs the question as to the quality of regulatory review the State and EPA are bringing to the process and whether the "remediation goals" are supportable.

The Navy likes to characterize its operations as a responsible employer and steward of the environment, but the above discussion of NRF's unwillingness to meet even these lax cleanup standards should dispel any such illusion. Before Idaho allows any expansion of NRF, the Navy must first clean up the mess (including its buried waste, calcine HLW, and liquid high level waste) it has already made. The very bottom line is that the Navy must not be allowed to dump any more of its radioactive waste over our sole source aquifer. EDI supports former Governors Andrus and Batt in their challenge to DOE's new shipments of SNF to INL before they follow through with previous Consent Order stipulations to move the high-level and TRU waste out of Idaho. We simply cannot compromise future generations of Idahoans access to the water they will need to survive especially in this era of climate change.

Then Idaho Senator Kemthorne statement to Congress said: "No more quick fixes. That's what got us in this fix we are in today." "The Navy can no longer give its waste to the Department of Energy, and say, 'We've done our job, and we have a great record,' while the Navy's waste sits in one facility plagued by corroding containers in unlined pools sitting above one of nation's largest underground aquifers. Even the contractor believes these pools should be shut down." [122]

The Navy does need to replace the existing leaking ECF pools. And the Navy needs to stop burying its significant quantities of waste above the Idaho Snake River Plain aquifer. The navy and its radioactive waste are here to stay. Idaho lacks strong enforcement of environmental laws due to its economic leverage as the single largest employer. Current environmental laws

regarding these military and DOE operations don't protect human health and the environment.

Exclusion of NRF workers from EEOICPA compensation

Unlike the DOE, the Navy continues to exclude the NRF workers from EEOICPA compensation due to unsupportable assertions about the perfection of NRF's radiation control programs.

"The Energy Employees Occupational Illness Compensation Program Act (EEOICPA) was passed

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[121] NRF Remedial Investigation/ Feasibility Study RI/FS@ pg. H6-13

[122] Opening Statement, Senator Dirk Kemthorne, July 28, 1993, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, pages 3 and 4. Kemthorne later became Idaho's Governor.

by Congress in 2000, and amended in 2004, to compensate American workers who put their health on the line to help fight the Cold War. In the course of doing their jobs, many of these workers were exposed to radiation and other toxic substances and, as a result, developed cancer and other serious diseases. The purpose of this program is to acknowledge the sacrifice of these workers and to compensate them in some small way for their suffering and loss.

As originally enacted in 2000, EEOICPA included Part B (administered by the Department of Labor (DOL)) and Part D (administered by the Department of Energy (DOE)). In October 2004, Congress repealed Part D and enacted Part E of the Energy Employees Occupational Illness Compensation Program Act, effectively transferring responsibility for administration of contractor employee compensation from the DOE to the DOL. The 2004 amendments also created the Office of the Ombudsman for Part E and directed that it be an independent office, located within the Department of Labor, charged with a three-fold mission:

• To conduct outreach to claimants and potential claimants to provide information on the benefits available under this part and on the requirements and procedures applicable to the provision of such benefits;

• To make recommendations to the Secretary of Labor about where to locate resource centers for the acceptance and development of claims;

• To submit an Annual Report to Congress by February 15, setting forth the number and types of complaints, grievances and requests for assistance received by the Ombudsman, and an assessment of the most common difficulties encountered by claimants and potential claimants under Part E during the previous year." [123]

According to risk analyst Tami Thatcher; "Of the hundreds of INL claims submitted over the years, many or most have been denied because the recorded dose and industry-biased estimate of cancer-risk are not claimant favorable. Former NRF employees with illness who submitted EEOICPA claims were denied without dose review simply because they worked at NFR. The "cold war" is over but exposures continue to cause radiation-induced cancers in radiation workers even as they are told that they are being protected from any health adverse effects from their radiation work. This is basic red-white-and-blue-washing of a negligent employer, the Department of Energy, which operates the INL and NRF.

"The recent discovery by NIOSH that radiation protection was inadequate at the INTEC facility at INL has led to the creation of a special exposure cohort which approves EEOCIPA claims despite their recorded dose. Further investigations are ongoing regarding insufficient radiation worker protection at INL especially in earlier decades. Chemical contamination at NRF was also found during CERCLA Superfund characterization and workers may have received chemical exposures that would be covered under EEOICPA that NRF workers are also categorically denied.

"The argument that NRF workers were perfectly protected from a wide variety of radiation and chemical exposure prone activities since the 1950s while the Department of Energy didn't understand how to protect workers at other INL facilities doesn't hold up to any rational scrutiny.

"Facilities at NRF conduct diverse operations with the large potential for inadequately monitored overexposure. The operations have included reactor operation and fuel dissolution, and will still include spent fuel pool operation, transfers of spent fuel to pool and examination areas and airborne contamination from resizing or cutting of irradiation material. The potential for elevated airborne contamination or unplanned loss of shielding has created inadequately monitored and controlled radiation exposures at Department of Energy facilities including those at INL.

"The historically high allowable doses at NRF, the variety and complexity of operations at NRF, the

[123] See 42 U.S.C. § 7385s-15(e).

problems of adequately monitoring internal dose and transient conditions, and the evolving science of radiation health 3and epidemiology of radiation workers 4 showing elevated cancer risks at annual doses less than 2 rem per year point to the unsupportable rationale for excluding NRF workers from compensation. Although it would in many cases be decades late, and the compensation will never compensate for the early deaths of fine people, this exclusion must be removed. By any measure of fairness and honest assessment, the exclusion of NRF workers from EEOICPA act compensation must be removed."

EDI's 1988 Freedom of Information Act (FOIA) request for NRF's worker radiation exposure records (without personal identifiers) was rejected on the grounds of national security. There is no legitimate reason for this and many other FOIA and NEPA denials other than the Navy's fear of having its mismanaged operations exposed.

NRF and INL 2003 -2020 Cleanup Costs

FY-Year	Including NRF/Regulatory Support $	Excluding NRF/ Regulatory Support $	Source
2003		484,709,000	FY-05 P.34
2004	567,310,000		FY-05 P.34
2005		534,600,000	FY-05 P.34
2006		538,083,000	FY-07 P.144
2007		519,604,000	FY-07 P.144
2008		522,838,000	FY-07 P.144
2009		489,239,000	FY-07 P.144
2010		469,168,000	FY-07 P.144
2011		412,000,000	FY-14 P.59
2012		389,800,000	FY-14 P.59
2013		355,766,000	FY-15 P.29
2014		393,593,000	FY-16 P.127
2015		404,929,000	FY-17 P. 121
2016		401,919,000	FY-17 P. 121
2017		370,088,000	FY-17 P. 121
2018	595,198,000		FY-20 P. 29
2019	638,805,000		FY-20 P. 29
2020	553,225,000		FY-20 P. 29
Totals	2,354,538,000	8,640,874,000	
Total 2003-2020		10,995,412,000	

Sources:
Department of Energy FY (for each year + PG.#) Congressional Budget Request Environmental Management, Volume 5. DOE's Budget reports are difficult to obtain monies for the Navy (NRF) INL cleanup.
DOE FY 2014 Congressional Budget Request Environmental Management, DOE/CF-0088, Volume 5
Department of Energy FY 2015 Congressional Budget Request, DOE/CF-0100, Volume 5
Department of Energy FY 2016 Congressional Budget Request DOE/CF-0111 Volume 5
Environmental Management Department of Energy FY 2017 Congressional Budget Request DOE/CF-0123, Volume 5
DOE FY 2020 Congressional Budget Page 28 of 129

MEMORANDUM
Date: December 17, 2013
From: Bob Alvarez
Subject: High Burnup Spent Power Reactor Fuel

Introduction

Since the 1990's, U.S. reactor operators are permitted by the U.S. Nuclear Regulatory Commission (NRC) to effectively double the amount of time nuclear fuel can be irradiated in a reactor, by approving an increase in the percentage of uranium-235, the key fissionable material that generates energy. In doing so, NRC has bowed to the wishes of nuclear reactor operators, motivated more by economics than spent nuclear fuel storage and disposal.

Known as increased "burnup" this practice is described in terms of the amount of electricity in gigawatts (GW) produced per day with a ton of uranium.

Reactor fuel burnups have gradually increased on the average to ~50 GWd/t for Pressurized Reactors (PWR) and 43GWd/T for Boiling Water Reactors (BWR). [1] Projected burnups are estimated to increase. (See Figure 1) The current maximum peak burnup limit is 62MWd/t. Reactor operators would like to increase burnups to 75GWd/t..[2] As of 2008, the NRC allows reactors using uranium fuel to operate at the highest burnup rates of any country in the world.[3]

Inadequate Technical Basis for Storage and disposal

While the move to high burnup in U.S. power reactors has improved the nuclear power sales, it remains a significant impediment to the safe storage and disposal of spent nuclear fuel. For more than a decade the problems and concerns associated with high burnup spent nuclear fuel have increased, while the resolution of these problems remains elusive. For instance:

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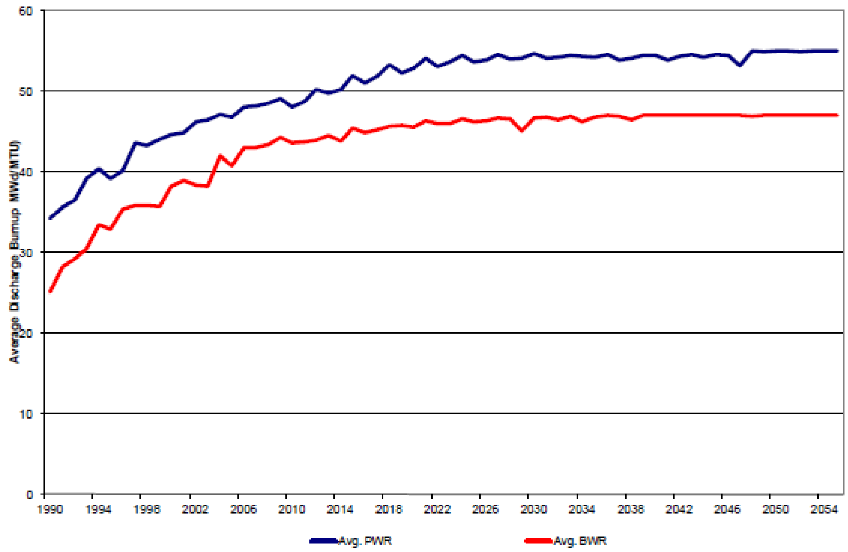
[1] E. Supko, Impacts Associated with Transfer of Spent Nuclear Fuel from Spent Fuel Storage Pools to Dry Storage After Five Years of Cooling, Revision 1, Electric Power Research Institute, August 2012.

[2] V. Jain, G. Cragnolino and L. Howard, A review Report on High Burnup Spent Nuclear Fuel Disposal Issues, Center for Nuclear Waste Regulatory Analyses, San Antonio, Texas, CNWRA 2004-08, September 2004, p.xv.

3 Erik Kolstad, Nuclear Fuel Behaviour in Operational Conditions and Reliability, Prepared for IPG meeting-Workshop on Fuel Behaviour, Argonne National Laboratory, September 2008, p. 10

Figure 1.Historical and Projected Average BWR and PWR Discharge Burnups
(Source: Supko/EPRI 2012)



- In 2000, several years after granting increased burnups for U.S. power reactors the U.S. Nuclear Regulatory Commission admitted, " There is limited data to show that the cladding of spent fuel with burnups greater than 45,000 MWd/MTU will remain undamaged during the licensing period." [4]
- In 2003 the Electric Power Research Institute concluded: "For the most part, the current licensing basis for dry storage of spent fuel is largely based on fuel examinations and dry storage performance demonstrations performed in the 1980s and 1990s. Spent fuel used in the dry storage performance demonstrations had discharge burnups of ~36 GWd/MTU, or less."[5]
- In 2010 researchers at Oak Ridge National Laboratory reported to the NRC that, "the majority of isotopic assay measurements available to date involve spent fuel with burnups of less than 40 GWd/MTU and initial enrichments below 4 wt % 235U, limiting the ability to validate computer code predictions and accurately quantify the uncertainties of isotopic analyses for modern fuels in the high burnup domain."[6]

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4 U.S. Nuclear Regulatory Commission, Standard Review Plan for Spent Fuel Dry Storage Facilities, Final Report NUREG-1567, March 2000. P. 6-15. http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1567/sr1567.pdf

5 Electric Power Institute, Dry Storage Demonstration for High-Burnup Spent Nuclear Fuel Feasibility Study, September 2003, p.5-1.

6 G. Ilas and I.C. Gauld, Analysis of Experimental Data for High-Burnup PWR Spent Fuel Isotopic Validation—Vandellós II Reactor, ORNL/TM-2009/32, p. 1. http://info.ornl.gov/sites/publications/files/Pub22621.pdf

- That same year the Nuclear Waste Technical Review Board reported that: "Only limited references were found on the inspection and characterization of fuel in dry storage, and they all were performed on low-burnup fuel after 15 years or less of dry storage. Insufficient information is available yet on high-burnup fuels to allow reliable predictions of degradation processes during extended dry storage, and no information was found on inspections conducted on high-burnup fuels to confirm the predictions that have been made."[7]
- In 2012, EPRI reported that: "R&D work will continue especially in concert with introduction of new cladding materials" [and] "R&D work will continue especially in concert with introduction of new cladding materials...[and a] Key question: Given what we learned, how does that knowledge support existing –or coming up with new– regulatory guidance?" [8]
- In 2012, the official publication of the National Academy of Engineering of the National Academy of Sciences raised similar concerns about the viability of high-burnup fuel by noting, "the technical basis for the spent fuel currently being discharged (high utilization, burnup fuels) is not well established… the NRC has not yet granted a license for the transport of the higher burnup fuels that are now commonly discharged from reactors. In addition, spent fuel that may have degraded after extended storage may present new obstacles to safe transport."[9]

Impacts

EPRI pointed out in 2005 that: "*Failure to resolve, in a timely manner, regulatory issues associated with interim dry storage and transportation of high-burnup spent fuel would result in severe economic penalties and in operational limitations to nuclear plant operators.* [Emphasis added.]"[10]

Since that time, there remain several issues of concern that impact the storage and disposal of high-burnup spent nuclear fuel. With higher burn up, nuclear fuel rods undergo several potentially risky changes that include:

- Increasing oxidation, corrosion and hydriding of the fuel cladding. Oxidation reduces cladding thickness, while hydrogen (H3) absorption of the cladding to form a hydrogen-

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[7] United States Nuclear Waste Technical Review Board, *Evaluation of the Technical Basis for Extended Dry Storage and Transportation of Used Nuclear Fuel, December 10, 201*0.

[8] Albert Machiels, Electric Power Research Institute, High-Burnup – 10 Years Later, Used Fuel and HLW Management Technical Advisory Committee Washington, DC September 13, 2012

9 National Academy of Engineering, Managing Nuclear Waste, Summer 2012, pp 21, 31. http://www.nae.edu/File.aspx?id=60739

[10] Electric Power research Institute, Application of Critical Strain Energy Density to Predicting High-Burnup Fuel Rod Failure, September 2005, P.vi.

based rust of the zirconium metal from the gas pressure inside the rod can cause the cladding to become brittle and fail;[11]

- Higher internal rod gas pressure between the pellets and the inner wall of the cladding leading to higher fission gas release. Pressure increases are typically two to three times greater.[12]
- During a power release at high burnup cladding can deform and fail.[13]
- Elongation or thinning of the cladding from increased internal fission gas pressure;[14]
- Structural damage and failure of the cladding caused by hoop (circumferential) stress; [15]
- Increased debris in the reactor vessel, damaging and rupturing fuel rods;[16]
- Cladding wear and failure from prolonged rubbing of fuel rods against grids that hold them in the assembly as the reactor operates (grid to rod fretting).[17]
- Oxidation of irradiated fuel pellets during extended storage.[18]
- A significant increase in radioactivity and decay heat in the spent fuel. [19]
- A potentially larger number of damaged spent fuel assemblies stored in pools[20]
- Upgraded pool storage with respect to heat removal and pool cleaning.[21]
- Requiring as much as 150 years of surface storage before final disposal. [22]
- Increased costs for disposal due to decay heat.[23]
- Potential repository criticality [24]
- Increased radiation doses following geologic disposal[25]

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11 U.S. Nuclear Regulatory Commission, Rulemaking Issue, Notation Vote, Memorandum from: R.W. Borchardt, Executive Director for Operations, Subject: Proposed Rulemaking – 10CFR 50.46c Emergency Core Cooling System Performance During Loss-of-Coolant Accidents (RIN 3150-AH42), SECY-12-0034, March 1, 2012, p. 2. http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2012/2012-0034scy.pdf

12 U.S. Nuclear regulatory Commission, Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, October 2000, P. 45. http://pbadupws.nrc.gov/docs/ML0104/ML010430066.pdf

13 Stafano Caruso, c*haracterisation of high-burnup LWR fuel rods through gamma tomography*, ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE, April 2007.

14 Op cit ref. 12.

15 Ibid

16 International Atomic Energy Agency, Impact of High-Burnup Uranium Oxide and Mixed Uranium – Plutonium Oxide Water Reactor Fuel on Spent Fuel Management, IAEA Nuclear Energy Series, No.. NF-T-3.8, June 2011. P. 39. http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1490_web.pdf

17 Ibid.

18 Op Cit Ref. 7.

19 Op. cit ref. 16.

20 Ibid p. 51.

21 Ibid. p.1.

22 Zhiwen Xu, Mujid S. Kazimi and Michael Driscoll, Impact of High Burnup on PWR Spent Fuel Characteristics, Nuclear Science and Engineering, 151, 261-273 (2005), http://ocw.internet-institute.eu/courses/nuclear-engineering/22-251-systems-analysis-of-the-nuclear-fuel-cycle-fall-2005/readings/impact.pdf

23 Ibid.

24 Zhen Xu, Designing Strategies for Optimizing High Burnup in Pressurized Reactors, Massachusetts Institute of Technology, Department of Nuclear Engineering, January 2003.

25 Sitakanta Mohanty, Lynn Tipton, Razvan Nes, and David Pickett, High-Burnup of Spent Nuclear Fuel and Its Implications for Disposal Performance Assessments, Symposium on the Scientific Basis for Nuclear Waste Management XXXVI at the 2012 Materials Research Society Fall Meeting, Boston, Massachusetts, USA, November 25–30, 2012

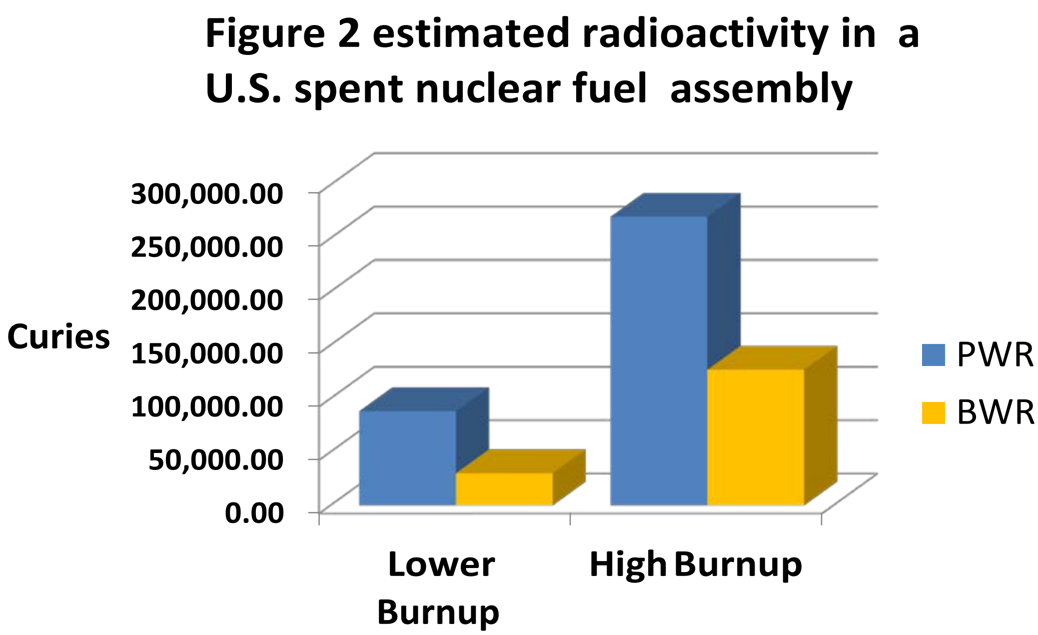
- Swelling and closure of the pellet-cladding gap- increasing cladding stresses, creep and stress corrosion cracking of cladding in extended storage. [26]
- Embrittlement of cladding due to decreases in fuel temperatures during extended storage.[27]

There is growing evidence that as a result of higher burn-ups nuclear fuel cladding cannot be relied upon as a primary barrier to prevent the escape of radioactivity, especially during dry storage. This has not been lost on the nuclear industry and staff of the NRC for several years now. Damage in the form of pinhole leaks, and small cracks that could lead to breaching of fuel cladding is "not explicitly defined in [NRC] Regulations, staff guidance or standards."[28]

Source Term and Decay Heat

Given these uncertainties the U.S. Department of Energy (DOE) and the NRC have provided general estimates of the radionuclide content of spent nuclear fuel based on current and previous burnup assumptions. According to DOE the estimated average long-lived radioactivity for a typical PWR and BWR assembly having lower burnup at the time of geological disposal are 88,173.69 curies and 30,181.63 curies respectively. [29] For current burnups the NRC estimates that the post discharge radioactive inventory of spent fuel for a typical PWR and BWR assemblies are 270,348.26 curies and 127,056.67 curies respectively (See Figure 2). [30]
Approximately 40 percent of the total estimated radioactivity for lower and high burnup is Cs-137.

[26] op cit. Ref 7.
[27] Ibid.
[28] RE Einziger et al., Damage in Spent Nuclear Fuel Defined by Properties and Requirements, U.S. Nuclear Regulatory Commission, Spent Fuel Project Office, June 2006. http://pbadupws.nrc.gov/docs/ML0608/ML060860476.pdf
[29] U.S. Department of Energy, Final Environmental Impact Statement, for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, 2002, Appendix A, Tables A-7, A-8, A-9, A-10, (PWR/ Burn up = 41,200 MWd/MTHM, enrichment = 3.75 percent, decay time = 23 years. BWR/ Burn up = 36,600 MWd/MTHM, enrichment = 3.03 percent, decay time = 23 years.)
[30] U.S. Nuclear Regulatory Commission, Characteristics for the Representative Commercial Spent Fuel Assembly for Preclosure Normal Operations, May 2007, Table 16, p.44-45. http://pbadupws.nrc.gov/docs/ML0907/ML090770390.pdf



Sources: DOE EIS-0250, Appendix A, http://energy.gov/sites/prod/files/EIS-0250-FEIS-01-2002_0.pdf
NRC http://pbadupws.nrc.gov/docs/ML0907/ML090770390.pdf

This substantial increase in spent nuclear fuel radioactivity has also resulted in a commensurate increase in decay heat. After removal, the spent fuel gives off a significant amount of heat as the radioisotopes decay. After removal, the spent fuel gives off a significant amount of heat as the radioisotopes decay(see Figures 3 and 4). The offload of a full reactor core at a PWR is estimated to give off about 42,000 BTU/hr (12,310 watts). [31] Within one year the heat output of the spent fuel diminishes by about ten times. The decay heat for a five-year cooled PWR assembly with a discharge exposure of 55 GWd/MTU is approximately 1,500 watts. [32] The decay heat for a five- year cooled BWR assembly with a discharge exposure of 48 GWd/MTU is approximately 480 watts. [33]

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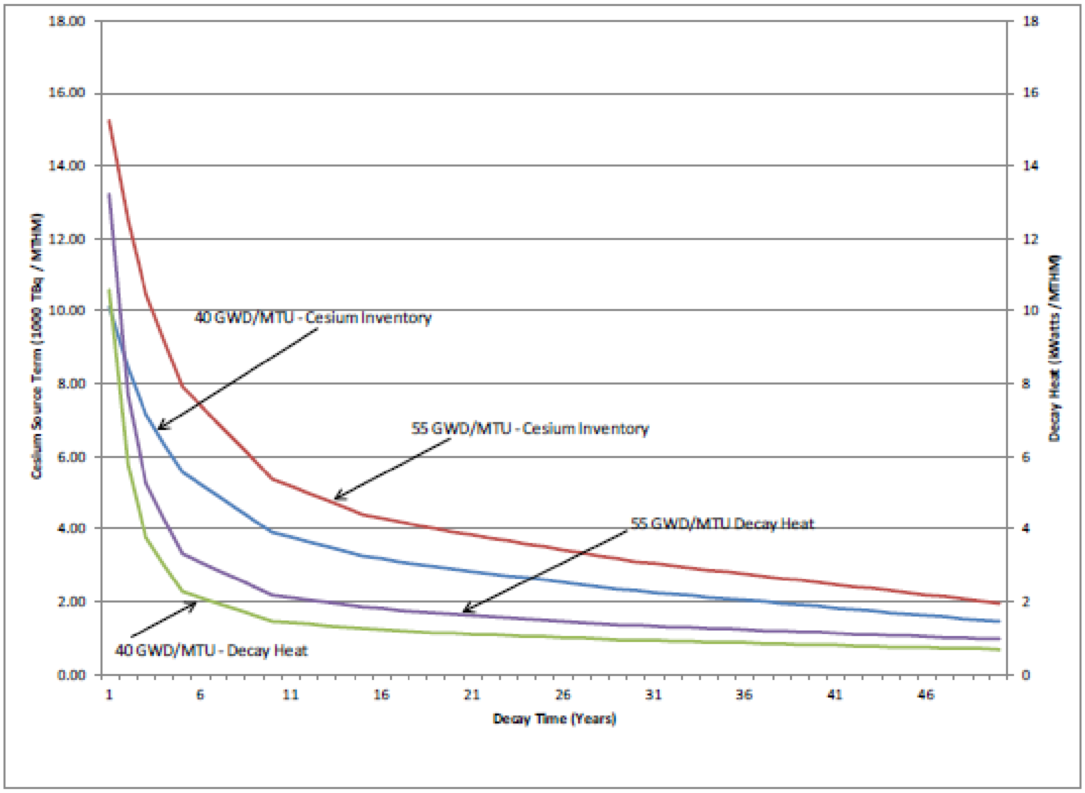
31 U.S. Nuclear Regulatory Commission, Safety Evaluation by the Office of Nuclear Safety Regulation Related to Amendment No. 131 to Facility Operating License No. NPF-10 and Amendment 120 to Facility Operating License No. NPF-15, Docket Nos. 50-361 and 50-362, October 1996, P. 6. http://pbadupws.nrc.gov/docs/ML0220/ML022000232.pdf

32 Op Cit Ref.1.

33 Ibid.

Figure 3 PWR SNF Assembly Decay Heat (right axis) and Cesium Inventory (left axis) as a Function of Burnup and Cooling Time

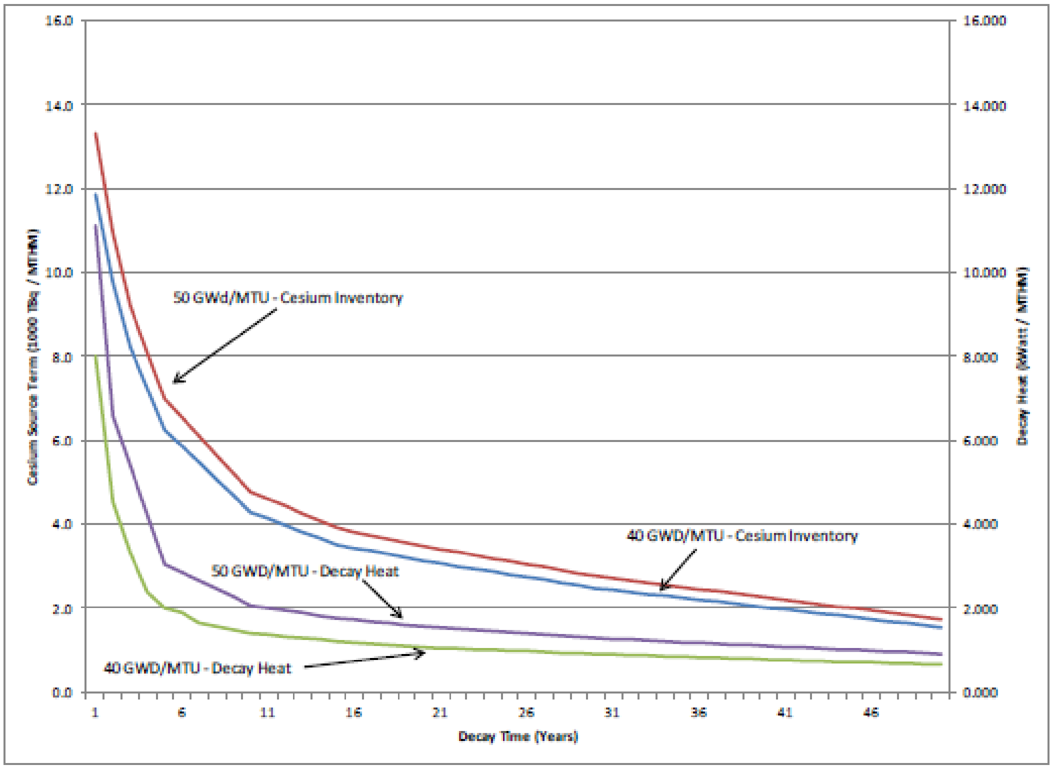


Source: Supko/EPRI 2012

Within one year the heat output of the spent fuel diminishes by about ten times. After 10 years it drops by another factor of ten. By 100 years the decay heat has dropped another five times, but still gives off significant heat.[34] However, the decay heat remains substantially high throughout the operation of the reactors and well after they are closed.

34 Op Cit Ref. 4.

Figure 4 ***BWR SNF Assembly Decay Heat (right axis) and Cesium Inventory (left axis) as a Function of Burnup and Cooling Time [***



(Source: Supko/E{RI 2012)

Control of decay heat is a key safety factor for spent fuel storage and its final disposal in a geological repository. Storage of spent nuclear fuel in pools requires continuous cooling for an indefinite period to prevent decay heat from igniting the zirconium cladding and releasing large amounts of radioactivity into the environment.

Zirconium cladding of spent fuel is chemically very reactive in the presence of uncontrolled decay heat. According to the National Research Council of the National Academy of Sciences the build up of decay heat in spent fuel in the presence of air and steam:

> " is strongly exothermic – that is, the reaction releases large quantities of heat, which can further raise cladding temperatures… if a supply of oxygen and or steam is available to sustain the reactions.. The result could be a runaway oxidation – referred to as *a zirconium cladding fire* – that proceeds as a burn front (e.g., as seen in a forest fire or fireworks sparkler)...As fuel rod temperatures increase, the gas pressure inside the fuel rod increases and eventually can cause the cladding to balloon out and rupture.[original emphasis] "[35]

35 National Research Council, Board on Radioactive Waste Management, Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, National Academes Press (2006), p. 38-39.

The Nuclear Regulatory Commission (NRC) has performed several studies to better understand this problem. In 2001, the NRC concluded:

> "… it was not feasible, without numerous constraints, to establish a generic decay heat level (and therefore a decay time) beyond which a zirconium fire is physically impossible."[36]

In terms of geologic disposal, decay heat, over thousands of years, can cause waste containers to corrode, negatively impact the geological stability of the disposal site and enhance the migration of the wastes.[37]

EPRI points out that radiocesium inventories have greatly increased as well as decay heat. It contends that a return to open-rack cooling of SNF would result in a reduction in the potential source term of 43% to 53% for a PWR and 47% to 48% for a BWR.

Wet Storage Issues

The accumulation of high-burnup spent nuclear fuel in pools adds to the growing concern over age and deterioration of spent fuel pool storage systems. A 2011 NRC-sponsored study, concluded," *as nuclear plants age, degradations of spent fuel pools (SFPs), reactor refueling cavities…are occurring at an increasing rate, primarily due to environment-related factors. During the last decade, a number of NPPs have experienced water leakage from the SFPs [spent fuel pools] and reactor refueling cavities.*[38] The authors of this study also indicate that accurate assessment of aging of spent fuel pools is uncertain because, *"it is often hard to assess their in situ condition because of accessibility problems…. Similarly, a portion of the listed concrete structures are either buried or form part of other structures or buildings, or their external surfaces are invisible because they are covered with liners.*[39] .

High-density racks in spent fuel pools at U.S. power plants pose potential criticality safety concerns associated with the deterioration of neutron absorbing panels that allow spent fuel rods to be more closely packed. Since 1983, several incidents have occurred at reactors around the U.S. with these panels in which the neutron-absorbing materials deteriorated, and in some cases, bulged, causing spent fuel assemblies, containing dozens of rods each, to become stuck in submerged storage racks in the pools. This problem could lead to structural failures in the storage racks holding the spent fuel rods in place.

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http://www.nap.edu/openbook.php?record_id=11263&page=38
,http://www.nap.edu/openbook.php?record_id=11263&page=39

36 U.S. Nuclear regulatory Commission, Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, October 2000, P. ix. http://pbadupws.nrc.gov/docs/ML0104/ML010430066.pdf

37 R. Wigeland, T.Taiwo, M. Todosow, W. Halsey, J. Gehin, Options Study – Phase II ,Department of Energy, Idaho National Laboratory, INL/EXT-10-20439, September 2010. http://www.inl.gov/technicalpublications/Documents/4781584.pdf

38 U.S. Nuclear regulatory Commission, A summary of Aging Effects and Their Management in Reactor Spent Fuel Pools, Refuelling Cavities, TORI and Safety-Related Concrete Structures, NUREG/CR-7111 (2011). P. vxiii. http://pbadupws.nrc.gov/docs/ML1204/ML12047A184.pdf

39 Ibid.

According to the NRC in May 2010:

> The conservatism/margins in spent fuel pool (SFP) criticality analyses have been decreasing…The new rack designs rely heavily on permanently installed neutron absorbers to maintain criticality requirements. *Unfortunately, virtually every permanently installed neutron absorber, for which a history can be established, has exhibited some degradation. Some have lost a significant portion of their neutron absorbing capability. In some cases, the degradation is so extensive that the permanently installed neutron absorber can no longer be credited in the criticality analysis* [emphasis added].[40]

For example, in 2007, South California Edison (SCE) reported to the NRC that Boraflex neutron absorbing panels have deteriorated to the point at the San Onofre Nuclear Generating Station Units 2 and 3 spent nuclear fuel pools where it was doubtful they could be credited to prevent criticality. SCE proposed installing borated stainless steel tube guide inserts, and to add more neutron absorbing boron to the pool water.[41] According to SCE deterioration from erosion, over a period of 15 months, increased the level of particles from disintegrated neutron absorbing panels in the pool water by 134 percent.[42] These particles place an additional strain on pool water cleaning systems.

NRC's response to this problem has been to allow operators to add additional boron to the pool water to compensate for the loss of re-criticality protection from deteriorated neutron absorbing panels. However, boron is implicated in possible deterioration of the reinforced concrete holding the spent fuel pools. Concrete "could be negatively impacted by adverse environments of borated water or where there is the possibility of alkali aggregate material reactivity."[43]

Equipment installed to make high-density pools safe exacerbates the danger of spent fuel cladding ignition, particularly with high burnup spent fuel. In high-density pools at pressurized water reactors, fuel assemblies are packed about nine to 10.5 inches apart, just slightly wider than the spacing inside a reactor. To compensate for the increased risks of a large-scale accident, such as a runaway nuclear chain reaction, pools have been retrofitted with enhanced water chemistry controls and neutron-absorbing panels between assemblies.

The extra equipment restricts water and air circulation, making the pools more vulnerable to systemic failures. The ability to remove decay heat from spent fuel pools to prevent boiling corresponds to the amount of water displaced in the pool by spent fuel and the equipment that allows for its tight packing. High density storage also impacts the ability of water to flow through the pool. If the equipment collapses or fails, as might occur during a destructive

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40 U.S. NRC, Office of Nuclear Reactor Regulation, On Site Spent Fuel Criticality Analyses, NRR Action Plan, May 21, 2010. http://pbadupws.nrc.gov/docs/ML1015/ML101520463.pdf

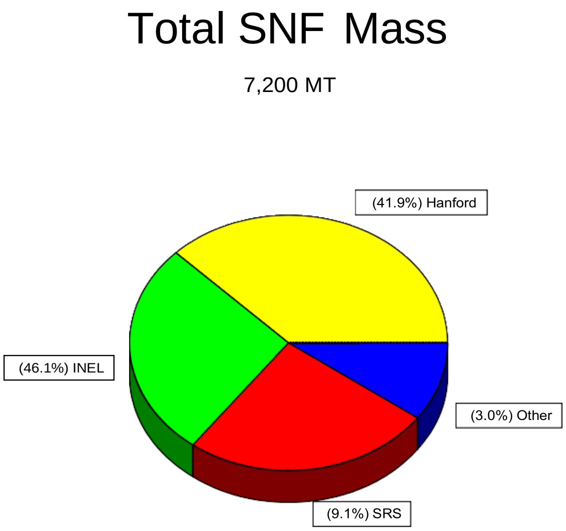
41 South California Edison, Letter to the NU.S. Nuclear regulatory Commission, Subject: Docket Nos. 50-361 and 50-362 Amendment Application Numbers 243, Supplement 1 and 227, Supplement 1 Proposed Change Number (PCN)566, Revision 1, Request to Revise Fuel Storage Pool Boron Concentration, San Onofre Nuclear Generating Station Units 2 and 3, June 15, 2007, Enclosure 2,p. 2. http://pbadupws.nrc.gov/docs/ML0717/ML071700097.pdf

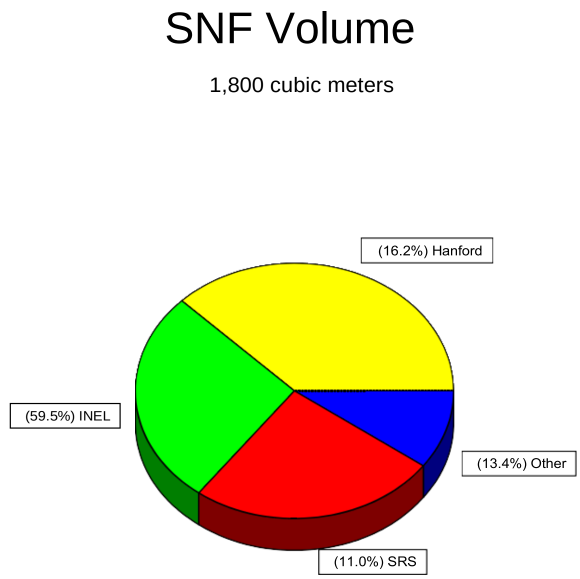
42 Ibid.

43 Op. Cit Ref. 38, p.xiv.

earthquake or terrorist attack, air and water flow to exposed fuel assemblies would be obstructed, causing a fire, according to the NRC's report. Heat would turn the remaining water into steam, which would interact with the zirconium, making the problem worse by yielding inflammable and explosive hydrogen.

DOE Complex Spent Nuclear Fuel Inventory Distribution
by Robert Alvarez

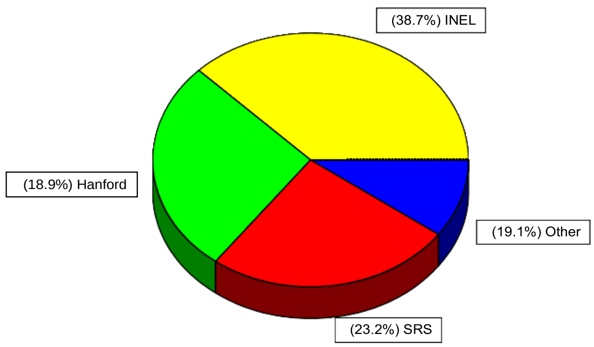




Robert Alvarez is a Senior Scholar at the Institute for Policy Studies in Washington D.C. and an Adjunct Professor at the Johns Hopkins School of Advanced International Studies. He is considered one of the nation's foremost experts on civilian and military nuclear programs. Mr. Alvarez served as Senior Policy Advisor to the U.S. Secretary of Energy during the Clinton Administration, and prior to that was Chief Investigator for the U.S. Senate Committee on Governmental Affairs. Mr. Alvarez is also a member of EDI's Board.

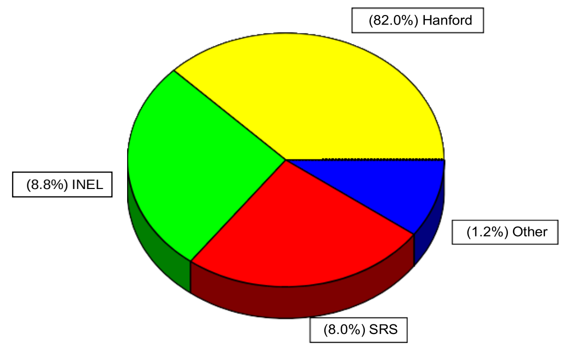
Number of "Assemblies"

74,000 "Assemblies"



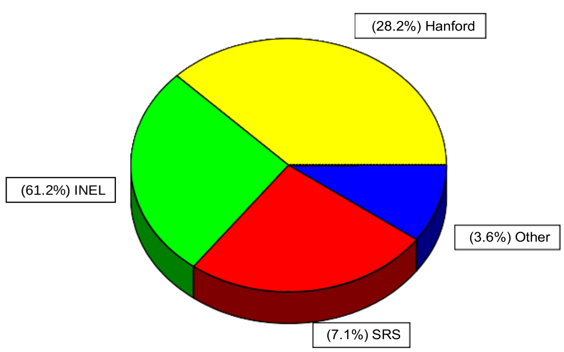
Uranium Mass

2,600 Metric Tons



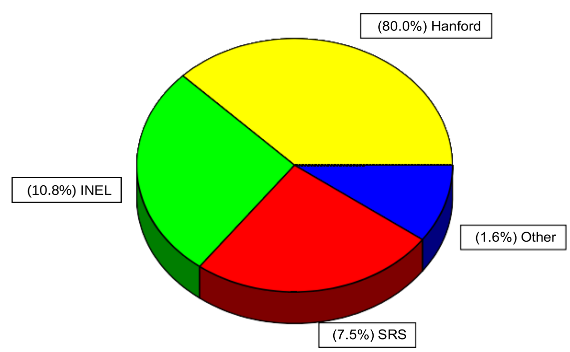
Fissile Mass

100 Metric Tons



Heavy Metal

2,700 Metric Ton Heavy Metal



Section I.G. INL Stack Emissions Hazard

Seven incinerators, Waste Experimental Reduction Facility (WERF), the Process Experimental Pilot Plant (PREPP), ICPP De-nitration Facility (CPP-602), ICPP's solvent burner ,Waste Calcining Facility (WCF), the New Waste Calcining Facility (NWCF), and the Idaho Waste Processing Facility (IWPF) previously operated at INL as part of DOE's national nuclear waste volume reduction program. Additionally, several high-level high-temperature waste "evaporators" (Process Evaporator [PEW], Liquid Effluent Treatment and Disposal [LET&D], High-level Liquid Waste Evaporator (HLLWE) and the Integrated Waste Treatment Unit [IWTU] were added at INTEC in recent years to reduce the volume of high-level liquid waste in the tank farm.

Stack emissions from these INL facilities should be considered in evaluations of health risk assessments due to their radioactive and toxic nature and lack of independent monitoring. Between 1952 and 1989, an estimated 18,564,868 Curies (Ci) were released from INL facilities. [ID-10054-81 @13][ID-10087-85&7 @6][DOE/ID-12119]

The WERF and PREPP incinerators operated at INL without an Environmental Impact Statements being filed. Resource Conservation Recovery Act (RCRA) interim permits were grand-fathered in, and final permits were never reviewed before being forced to shut down. [1] None of the INL incinerators/waste process plants have had "trial burns" that is currently required to demonstrate that emissions meet RCRA regulatory requirements.

Waste Experimental Reduction Facility; After considerable public pressure on the regulators, DOE finally, after decades of operating WERF, conducted a trial burn May of 1997. On May 12 DOE reported that the May 8 trial burn resulted in exceeding regulatory limits for chlorine emissions (hydrogen chloride). WERF operators ignored the monitoring instruments and failed to shut the incinerator down. In March 1997, a 14 inch crack was discovered in the transition area between the primary combustion chamber and the ash ram that allowed waste to run out onto the floor. The crack was a failure to an earlier weld repair. The chlorine emissions resulted in a violation of state regulations. Only non-radioactive emissions are regulated since radioactive materials are not considered a hazardous material under RCRA. But, when hazardous materials are commingled, RCRA covers it as "mixed waste". Radionuclides are virtually always in INL's waste streams. The State of Idaho is currently enforcing RCRA for EPA but is not monitoring for radioactive emissions. RCRA is up for reauthorization and a concerted effort is being made to have Congress include radionuclides as a listed RCRA controlled hazardous waste.

Process Experimental Pilot Plant ; "The primary objective of the PREPP [incinerator] is to process select Transuranic-contaminated waste [radioactive elements heavier than uranium] that were generated in national defense programs. The process is designed to convert the waste into a form acceptable for disposal at the Waste Isolation Pilot Plant (WIPP). During the initial years of operation, the principal PREPP activity was the incineration of mixed radioactive and hazardous waste. Although the facility had the potential to release toxic air pollutants, its application for the IDHW air permit does not specify hazardous waste incineration." [DOE/EH/OEV-22-P,p.3-13]

PREPP completed TRU waste test burns in 1992 and was closed due to public pressure over inadequate radioactive emission controls, to be replaced by a newer incinerator called the Idaho Waste Processing Facility (IWPF) located in the Auxiliary Reactor Area.

The High-Level Liquid Waste Evaporator (HLLWE): Construction for the High-Level Liquid Waste Evaporator (HLLWE) at the Idaho National Engineering and Environmental Laboratory (INEEL) was initiated in 1993 and operation of the HLLWE as a new facility began in 1996. The HLLWE has processed over 4 million gallons of high level radioactive liquid and mixed hazardous wastes without a RCRA permit. DOE is required but has failed to submit an application for a RCRA permit for the HLLWE. The HLLWE has operated at all times without a RCRA permit and without interim status.

[1] EDI filed Notices of Intent to Sue DOE for operating these incinerators without required permits in 2000. The WERF, PREPP and both WCF & NWCF Calciners were subsequently shutdown.

The whole purpose of obtaining state and federal permits for a new facility in advance of construction and operation is to protect the public and environment from the operations of facilities which have not received proper scientific and regulatory scrutiny. The HLLWE has failed to comply with the RCRA requirements for new facilities. DOE failed to obtain a prerequisite RCRA permit 180 days before beginning construction.

Moreover, DOE has never complied with the statutory requirements to have obtained interim status for the HLLWE because the HLLWE was not "in existence" by July 3, 1986, i.e., under construction, in operation, or with unavoidable contractual commitments. Interim status is granted only by statutory compliance. Interim status cannot be conferred by a permitting agency, consent order or by merely listing a facility on the Part A application as DOE did for the HLLWE. [2]

The public has been denied opportunity for notice and meaningful hearings for the HLLWE and LET&D, prior to their construction and operation as new facilities, including the right to review plans, comment, receive written responses, review a draft permit and challenge the draft.

DOE failed to provide proper notice in the Federal Register for the HLLWE, the LET&D and the PEWE, required because they are actions within the floodplain. 10 CFR 1022 et seq. Floodplain requirements mandate an environmental impact statement and consideration of alternatives to constructing hazardous waste treatment, storage and disposal facilities in the floodplain above the Snake River Plain aquifer.

Public notice requirements of RCRA (40 CFR 124 et seq.), the CWA, the CAA, the Administrative Procedures Act (APA) and U.S. Constitution have been openly flaunted by the DOE. DOE conducts secret meetings with the Idaho Department of Environmental Quality in violation of state and federal Open Meetings Act. (5 U.S.C.§ 552b; Idaho Code 67-2341 et seq.).

Numerous protections provided for in 40 CFR Subparts 264 and 265 were denied the public, including but not limited to, characterization of wastes, testing, monitoring, reporting and other technical requirements **prior to** operation of the HLLWE, LET&D and other cited INTEC facilities. Numerous INTEC facilities operate with no RCRA permit.

The Denitration Facility (CPP-602) is where liquid uranium solutions from nuclear fuel chemical extraction processes were converted to a solid in a heated, fluidized bed. The granular product was packaged and stored in an adjacent vault pending shipment to the Un-irradiated Storage Facility. CPP-602's last campaign was in 1994. The Denitration Facility's (ICPP-602) heated fluidized bed burns off the unwanted liquid from dissolved fuel solutions leaving granular uranium trioxide. "Off-gases, after preliminary treatment within the Denitration system, pass through the atmospheric protection system (APS) and are then released to the atmosphere through the ICPP plant stack."... "Gaseous wastes such as process off-gas NOx and ventilation flows are filtered to remove radioactive particles before being handled by the ICPP atmospheric protection system." [EA @ 12]

Incineration of mixed radioactive and hazardous waste has been utilized by DOE for decades as a means of avoiding RCRA regulation. Lax state and EPA enforcement have allowed DOE, through incineration, to separate RCRA listed materials from radioactive materials. The process of incineration burns off the volatile hazardous constituents. The radioactive ash then falls into a non-regulated category and can be buried in shallow trenches at RWMC as "low-level" waste.

In January 1988, the White House issued Executive Order #12580 which blocked the EPA and affected states from having the authority to determine pollution abatement projects for federal agencies under the Superfund Reauthorization Act of 1986. Under intense pressure from these states Congress

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[2] On July 9, 2002 EDI filed a 60 Day Notice of Intent to Sue Over DOE's Failure to Comply with the Resource Recovery and Conservation Act, (42 U.S.C. § 6901 et seq); the Clean Water Act (33 U.S.C. § 1251 et seq.); the Clean Air Act (42 U.S.C. § 7401 et seq.); Safe Drinking Water Act (42 U.S.C. 300 F, et seq.); the National Environmental Policy Act (42 U.S.C. § 4332 et seq.); the floodplain/wetlands requirements of 10 CFR 1021 et seq.; DOE Orders 5400.1, 5400.5; Plaintiffs' rights to Due Process under the U.S. Constitution and the Administrative Procedures Act, 5 U.S.C. §§ 701-706 (APA) in operation of facilities at the Idaho National Engineering and Environmental Laboratory (INEEL) including the High Level Liquid Waste Evaporator.

passed, in 1991, the Federal Facilities Compliance Act (FFCA). This bill removes the federal government's sovereign immunity from compliance with state and federal environmental laws, and gives more state and EPA oversight authority to enforce laws at federal facilities.

As part of the compliance with the FFCA, DOE awarded in December 1996 one of the largest privatization contracts to British Nuclear Fuels (BNFL) Inc. to incinerate waste at the INL RWMC. This $1.18 billion facility would have incinerated mixed transuranic (TRU) waste had it been built. A law suit bought by EDI and KYNF et.al., forced DOE to cancel the incinerator part of the BNFL contract. [3]

DOE claimed it "shifts the operational liability and risk to the contractor through a fixed-priced contract and only makes payment for waste actually treated."... "Privatization of waste treatment is cheaper than the government making a large investment in owning and operating its own treatment facilities." [DOE This Month 1/97] One need go no further than the INL RWMC Pit-9 privatization project to see how the original contract has already been vacated and now DOE is faced with a new contract for twice the original amount. As for shifting liability, the Pit-9 process shows clearly that regardless what they try to call it, the DOE still pays the full costs and ultimately is left holding the bag.

INTEC (ICPP) Emissions; The broad variety of operations at INL result in a proportional variety of radioactive emissions from these plants. Few are benign - otherwise they would have been built in urban areas close to research centers. Normally radioactive gasses are released to the atmosphere via the Main Stack of the Idaho Chemical Processing Plant (ICPP). Between 1952 and 1981, ICPP released 7,512,000 Curies (Ci) of radioactivity to the atmosphere. [ID-10054-81@13] Also see Guide section I.E INTEC for more details.

"Until 1975 all ventilation from process areas was discharged to the stack without treatment."... "Twenty-two individual stacks at ICPP that release radionuclides do not go through the filter system." [ERDA-1536@II-67&70]

Between 1957 and 1977 acknowledged ICPP airborne releases averaged 150,000 Ci/yr. which included 85,000 Ci of Krypton-85 and 2,600 Ci tritium. [ERDA-1536,p.I-2] In later years these gas emissions ran 2,000 curies/day krypton [IDO-14532,p.46], tritium, cesium, strontium-90 and other transuranic. [DOE/EH/OEV-22-P,p.3-20] For krypton alone, the 0.3 micro curie/L at the stack is 100 times maximum permissible level for air. In 1974 ICPP main stack released 259,955 curies that included 8 curies of cesium, 6,036 curies of tritium, and 0.0071 curies of plutonium. [ERDA-1536@II-64] As previously discussed, these figures are believed to be understated.

ICPP's solvent burner off-gases containing plutonium are not filtered. [IDO-14532.p.26] This incinerator burns solvents with plutonium concentrations of 5.7 ugPu/gal [5.7 micro grams Plutonium/gallon] or [1,540,540 Pico grams/liter]. "When solvent is burned at 15 liters per hour the stack gas at stack top is only 3 times maximum air tolerance ..." [IDO-14532,p.46]

Background readings outside the ICPP perimeter fence "generally do not exceed 1 mR/hr." [IDO-14532,p.61] Depending on how long the burner runs, the 1 mRem/hr could add up to a considerable dose (24 mRem/day)(480 mRem/mo) to workers at the ICPP. Later ICPP reports put the plutonium concentration in the solvent burner feed at 150 micrograms per liter. "A program was developed to sample the burner off-gas for plutonium and to burn the solvent during appropriate intervals when atmospheric diffusion conditions were suitable and when there were no personnel working in the adjacent construction area." [IDO-14509 @18]

Integrated Waste Treatment Unit (IWTU) is under construction to incinerate the remaining ~1 million gallons of sodium-bearing high-level waste in the INTEC tank farm produced from reprocessing used spent nuclear fuel to extract highly-enriched uranium for DOE's nuclear weapons program. The plan has been for decades to convert this liquid waste into a form that can be shipped to a permanent geologic repository. The legal driver is a 1995 Federal Court ordered settlement agreement between Idaho and DOE to treat and remove the waste by a date certain. The problem is DOE can't get the IWTU to work. See Section I.E.2 for more details on IWTU.

[3] U.S. District Court for Wyoming, Case No. 99 CV 1042 J.

Fuel Element Cutting Facility Partially filtered air from the ICPP's 603 Fuel Element Cutting Facility (FECF) were released through a 50-foot stack and travels only a short distance before falling to the ground. "Thus, air-born particulate material from the FECF would not travel past the site boundary, and most probably would not spread beyond the immediate area of the FECF."[IDO-14532,p.47]

This admission that radioactive particulates are escaping does not preclude re-suspension every time the wind kicks up the dust. A FECF HEPA filter failure released 1,200 curies of long-lived fission products causing 131,302 square feet area around CPP-603 to be contaminated in 1958 and causing excessive background readings around the Fuel Element Cutting Facility. [IDO-14532,p.61][INL-95/0056,p.2-129]

Failures of CPP-601 Vessel off-gas (VOG) filter, the dissolver off-gas (DOG), and the hydrocarbon solvent burner system were found by Site Survey Branch during the second and third quarter of 1958. [IDO-14471,p.13] The ICPP was evacuated on April 2, 1992 because of radioactive particulate releases. [Daily Operations Brief , 4/3/92]

Idaho Department of Environmental Quality is aware that the INL is burning material contaminated with radioactive isotopes but is reluctant to take a stand and regulate radioactive emissions under Resource Conservation Recovery Act (RCRA). "We have no regulatory authority over high-level waste. No one in the state has looked at it in the past." [Times-News(c)]

Emissions from these incinerators pose a serious health hazard and deserve independent monitoring for radioactive emissions by State and EPA regulators.

"Identified radionuclides that will be released during incineration of transuranic waste include plutonium-239, 240, 241, and 242; americium-241; curium 241; and uranium-233." [DOE/EH/OEV-22-P,p.3-13] Of particular public concern is the effectiveness of the high efficiency particulate arresters (HEPA) filters which are the final stage of INL's three incinerators, Fluorinel and Fuel Storage Facility (FAST), Fuel Processing Facility (FPF), and other ICPP emissions control system. [ENI-217,p.33] The effectiveness of the HEPA filters to control toxic emissions to the environment has been challenged by independent researchers. [Goldfield,p.1] Failure of these filters to actually provide the emission control claimed by DOE would result in additional unplanned toxic releases to the environment. DOE acknowledges, in accident scenarios, that failure of these HEPA filters are the most serious potential release of radioactivity to the general public. [ERDA-1536,p.I-5]

"A radioisotope of antimony, Sb-125, was determined to be escaping ICPP's Fluorinel and Fuel Storage Facility (FAST) ventilation exhaust particulate filters, due to its presence as a stilbene (SbH3) gas. Stilbene gas is unstable and rapidly undergoes chemical decomposition into a particulate form (Sb2O3) in an oxidizing environment."... "Antimony-125 was detected in air at both on-site and off-site monitoring stations in the fourth quarter of 1986 and continues to be detected in 1987. Unlike previous years, in which the isotopes of the noble gases comprised the majority of hypothetical dose to an off-site person from INL, 78% of the calculated dose (0.11 mRem) to a maximally exposed individual in 1986 from routine operations was due to Sb-125." [1986:DOE/INL-12082(86),NTIS] Approximately one curie of Sb-125 was released in 1986, and the annual 1987 release was expected to be at least 10 times higher. [DOE/ID-12111@37]

Two successful law suits against DOE incinerators forced the closure of Rocky Flats and Lawrence Livermore facilities for radioactive and chemical emissions violations. A third lawsuit was been filed April 2, 1996 against DOE's Los Alamos site for radioactive emissions violating the Clean Air Act.[CCNS v. USDOE]

Exhaustive and highly credible scientific reviews have independently cast light on the hazard of DOE's HEPA filter control systems at these other sites. Institute for Energy and Environmental Research's (IEER) Radioactive and Mixed Waste Incineration report cites the findings of Lawrence Livermore National Laboratory internal review panel recommendations against a proposed mixed waste incinerator in California.

The Institute for Energy and Environmental Research report notes: "We have never been comfortable with the EPA's position that incineration of mixed waste to eliminate its chemical toxicity should be the first procedural step and burial of its radioactive residuals the second step. This approach commits to the volatilization of important radionuclides, including tritium, carbon-14, and several isotopes of iodine. Furthermore, the incineration of non-volatile nuclides, including those of uranium and plutonium, leads to a finite, although exceedingly small, probability of radioactivity is emitted from the incinerator's stack. We view incineration as a violation of the cardinal principle of radioactive waste management; namely, containing radioactivity rather than spreading it." [IEER(b) @1]

IEER's report also cites an EPA study of DOE mixed waste incinerators that showed that exposure of the public to tritium and plutonium-239 from this incinerator's emissions could exceed the federal standards for off-site radiation doses, in the latter case by more than 10 times. [IEER(b)]

"The most difficult elements to contain are the highly volatile radioactive elements, namely tritium, carbon-14, and several isotopes of iodine. Pollution control systems typical of most incinerators have no effect on these radionuclides, allowing the total input to the incinerator to exit out the stack, unless special filters are employed."... "The vast majority of less volatile radionuclides such as plutonium and cesium-137, which tend to condense onto particles that remain in the ash or filters following combustion. Radioactive particles that do escape filters, however, are small in diameter and can be carried by winds over long distances. Due to their small size, fine particles (radioactive or otherwise) can more easily be inhaled and lodge in the sensitive inner lining of the lungs than larger particles. Since incineration can disperse radioactive elements, especially those not amenable t filtering it can increase near-term population doses compared to securely storing the wastes." [IEER(b) @21]

Nitrogen Oxides Abatement Facility; DOE's FY-92 budget request for INL included a $40,600,000 Nitrogen Oxides Abatement Facility for the ICPP. This money has been appropriated yet questions remain whether this off-gas system does meet RCRA standards. "At the ICPP, the major source of alpha activity is the solvent burner, which burns the exhausted tri-butyl phosphate and dilute used to extract uranium from spent nuclear fuel elements. This solvent is contaminated with small amounts of plutonium, uranium and mixed fission product nuclide. The off-gas from this combustion process is not cleaned before emission to the atmosphere via the stack." [ENICO-1054 @ 1] Off-gas sampling during solvent burner operation revealed Pu-238 concentrations as high as 27 pCi/cu meter. [Ibid. @ 30] The 40 hr. occupational limit is 2 pCi/cu meter. [Ibid. @ 32] This represents a significant plutonium emission to the atmosphere of nearly 15 fold.

Waste Calcine Facility (WCF) at the ICPP and its replacement, the **New Waste Calcine Facility** (NWCF) were also incinerators that use a fluidized-bed to burn off liquid and combustible solids from reactor fuel reprocessing high-level waste. ICPP reports acknowledge WCF off-gas system was "found to be 83% efficient for the removal of entrained particulates." [IDO-14430@69]

The incineration process releases numerous radionuclides in gaseous and liquid aerosol forms. Major gaseous components of the ICPP off-gas stream include Carbon-14, Krypton-85, Tritium, Iodine-129, Ruthenium-106, Antimony-125, and Tin-119. [ICPP-1187 @ 1] Monitoring at the WCF found Ru-106 in vegetation as far as 16,000 meters from the stack, with a maximum of 2.2 x 10 E-03 uCi/g (2,200 pCi/g) at 1600 meters. [IDO-14661@48] ICPP off-gas sampling results of the Waste Calcine Facility to determine the effectiveness of the filtration systems resulted in the following conclusions:

a. "The total removal efficiency of the silica gel absorbers, High Efficiency Particulate Arresters (HEPA), and the Atmospheric Protection System (APS) for Iodine-129 is less than 30%;"

b. "The low efficiency of the HEPA's and analysis of the sample pre-filter indicate I-129 emitted is predominately gaseous;"

c. "Less than 31% of the I-129 charged to the Calciner vessel as blended feed is emitted to the atmosphere; and 40-60% of the I-129 charged to the vessel is recycled in the scrub solution." [ICPP-1187 @ 19]

Another ICPP off-gas sampling conducted three years later by another contractor produced the same results with the additional conclusion that increased concentrations of I-129 in recycled scrub solutions explain the increased release rate to the atmosphere as a Calciner run progresses. [ENICO-1108@21]

A third analysis of the Calciner emission system found that, "during the shake-down run of the large Calciner the off-gas system was evaluated and found to be 83% percent efficient for the removal of entrained particulates." [IDO-14430 @ 69] At this stage of evaluation (1958), the Calciner off-gas system consisted of: 1) a scalp cyclone, 2) venturi scrubber and knock-out cyclone, 3) condenser, and 4) and AEC positive filter in series. The Calciner off-gas efficiency "lower limit is reached when atomization is excessive and a large volume of fine particles escapes through the off-gas system." [IDO-14430 @ 64&62]

These 1958 Calciner scrubber efficiencies are less than September 18, 1957 data collected that showed 84.8 % efficiency. [IDO-14422 @ 122] The reason for focusing on this efficiency data is because the publicly acknowledged radioactive releases to the environment are based on emission control efficiencies that are not supported by their own internal sampling data. Therefore, it is believed that the radioactive releases are grossly understated.

Intermediate Level Waste Evaporator "Iodine-129 is one of the most environmentally significant radioisotopes emitted from nuclear fuel reprocessing and waste solidification facilities, and all facilities subject to EPA regulations must isolate at least 99.75% of the I-129 in the spent fuel from the environment. The results of an I-129 process distribution study at the ICPP indicated that a significant fraction of the I-129, not volatilized during fuel dissolution, eventually reached the Intermediate Level Waste Evaporator." [WINCO-1001 @ 1] Unfortunately, the evaporator does not have the control mechanism to retain the I-129 [Ibid] nor do the filtration systems have the ability to filter out the I-129. Clearly, this facility is not meeting EPA's 99.75% standard. Other species of iodine which have been volatilized into gaseous aerosols would also likely be escaping at the same rates.

"The discharge of radioiodine to the environment from nuclear fuel reprocessing plants is of particular interest due to the ability of iodine to enter the food chain and subsequently concentrate in the human thyroid. Iodine-129 is the isotope of interest during fuel dissolution and waste solidification since its 17-million-yr half-life makes I-129 a permanent contaminant of the environment."... "Stack monitoring at the ICPP has not detected significant I-129 releases during fuel dissolution, but detectable amounts were released during waste solidification." [ICPP-1187 @16]

Test Area North's Support Facility (TSF) Hot Shop has "no provisions for either the removal of radioactive Iodine or for monitoring of gaseous wastes (e.g. xenon, krypton, and argon)." [ERDA-1536@II-106] TAN's waste evaporator coils leaked and allowed contaminates to get sucked into the steam system. This leak reportedly was never fixed. The Aircraft Nuclear Propulsion (ANP) and the Initial Engine Test at TAN released over 4,635,724 Ci. during its 59 tests. [DOE/ID-12119@A-55][ERDA-1536] Also see Section I(C)(1). The Loss of Fluid Tests (LOFT) Reactors at TAN released up to the year 1977, over 940,225 Ci/yr to the atmosphere and sent 27,100 Ci/yr solid radioactive waste to RWMC. [ERDA-1536@II-118 &II-124]

The Advanced Test Reactor Complex formerly called Test Reactor Area (TRA) previously contained the Materials Test Reactor (MTR), Engineering Test Reactor (ETR), and currently Advanced Test Reactor (ATR) ranks second behind the ICPP for radioactive atmospheric releases. Between 1952 and 1981 TRA released 5,400,000 Ci to the atmosphere. [ID-10054-81@13] Test Reactor Area (TRA) also had a hot cell facility for handling very radioactive materials. Fuel element end sections that are cut off in the hot cell and filter element resins containing 500 Ci/cf are sent to RWMC for burial. [ERDA-1536 @ III-76]

Aerial survey of INL exposure rates in the below 1976 survey table for Cobalt-60 and Cesium-137 were calculated to be 22,118.4 and 10,444.8 uR/hr respectively. [ERDA-1536 @ III-15 to 34] Also this Aerial Survey listing clearly identifies Test Area North and the Auxiliary Reactor Area as the highest radiation emitters. The survey does not state whether the ICPP was processing fuel or whether the ICPP Calciner was operating at the time of the survey, so it is possible that they were temporarily not releasing much radiation. Also, it should be noted that the Central Facilities Area emissions were mainly due to the laundry that washes contaminated (10 mR/hr) worker clothing and respirators. [ERDA-1536@II-161] The second highest reading for the Health Physics Lab is particularly curious. One might expect this lab to be the most conscientious about its emissions.

Aerial Surveys for Gamma radiation were conducted in 1976 to determine radioactive concentrations around INL facilities and are presented below.

None of the TRA reactors have the Nuclear Regulatory Commission (NRC) full containment buildings required for commercial reactors - in fact they are just industrial sheds. No INL reactors are permitted or regulated by the NRC or any other non-DOE entity. Only a federal facility, insulated from the normal regulatory oversight, could get away with such practices. This puts the public at the mercy of an unaccountable agency the manages the most hazardous nuclear operations in the world.

Mismanagement of the Advanced Test Reactor by the previous operation contractor, EG&G, was cited in an quasi-independent DOE safety review released 12/93. The report cited a January 5 automatic reactor shutdown occurred when operators conducted experiment steps out of order; a January 29 planned shutdown for maintenance was extended by two days because workers discovered some pumps had been incorrectly mounted; a June 13 mishap closed the reactor for four days -workers had displaced a safety rod accidentally while removing a tool and subsequently reinstalled it incorrectly; and in September workers found smashed flashlight parts that were dropped by a worker - more parts showed up in later inspections.

INL 1976 Aerial Surveys for Gamma radiation

Facility	Concentration in uR/hr
Test Reactor Area	5,000
ICPP	2,500
ERB-I Reactor	90
Borax Reactor	200
ERB-II	150
OMRE/EORC	3,000
Test Area North / TSF	150
Auxiliary Reactor Area	5,000
Central Facilities Area	1,000
CFA Drain Field	800
Radioactive Waste Management Complex	3,000
Health Physics Laboratory	3,000
Naval Reactors Facility	1,800 [ERDA-1536 @ III-15 to 34]

CDC INL Annual Releases from Test Reactor Area (Curies)

Releases of Radionuclides from TRA (Ci)

	1952	1953	1954	1955	1956	1957	1958	1959
TOTAL ACTIVITY	**1.68E+05**	**3.70E+05**	**2.72E+05**	**4.04E+05**	**1.98E+05**	**7.64E+04**	**1.04E+05**	**1.69E+05**
Radionuclides								
Ar-41	7.53E+04	1.66E+05	1.22E+05	1.81E+05	8.89E+04	3.42E+04	4.65E+04	7.58E+04
Ba-139	8.41E+01	1.85E+02	1.36E+02	2.02E+02	9.92E+01	3.82E+01	5.19E+01	8.46E+01
Ba-140	2.89E-02	6.36E-02	4.67E-02	6.95E-02	3.41E-02	1.31E-02	1.78E-02	2.91E-02
Ce-141	1.84E-03	4.04E-03	2.97E-03	4.42E-03	2.17E-03	8.35E-04	1.13E-03	1.85E-03
Co-60	2.12E-01	4.66E-01	3.42E-01	5.09E-01	2.50E-01	9.62E-02	1.31E-01	2.13E-01
Cr-51	2.79E-02	6.13E-02	4.50E-02	6.70E-02	3.29E-02	1.27E-02	1.72E-02	2.80E-02
Cs-134	1.51E-01	3.32E-01	2.44E-01	3.63E-01	1.78E-01	6.86E-02	9.31E-02	1.52E-01
Cs-137	3.75E-01	8.25E-01	6.06E-01	9.02E-01	4.42E-01	1.70E-01	2.31E-01	3.77E-01
Cs-138	8.90E+02	1.96E+03	1.44E+03	2.14E+03	1.05E+03	4.04E+02	5.49E+02	8.95E+02
Hf-175								
Hf-181								
Hg-203	3.15E+00	6.93E+00	5.09E+00	7.58E+00	3.20E+00	1.43E+00	1.94E+00	3.17E+00
I-129								
I-131	4.09E-01	8.99E-01	6.61E-01	9.83E-01	4.82E-01	1.86E-01	2.52E-01	4.11E-01
I-132								
I-133	3.26E-01	7.16E-01	5.26E-01	7.83E-01	3.84E-01	1.48E-01	2.01E-01	3.27E-01
I-134								
I-135								
Ir-192								
Kr-85	3.60E+02	7.92E+02	5.82E+02	8.66E+02	4.25E+02	1.64E+02	2.22E+02	3.62E+02
Kr-85m	3.40E+03	7.49E+03	5.50E+03	8.19E+03	4.02E+03	1.55E+03	2.10E+03	3.42E+03
Kr-87	1.23E+04	2.71E+04	1.99E+04	2.96E+04	1.45E+04	5.59E+03	7.59E+03	1.24E+04
Kr-88	1.21E+04	2.65E+04	1.95E+04	2.90E+04	1.42E+04	5.48E+03	7.44E+03	1.21E+04
Kr-89								
La-140	4.74E-02	1.04E-01	7.66E-02	1.14E-01	5.59E-02	2.15E-02	2.92E-02	4.76E-02
Mn-54								
Mo-99								
Na-24	8.05E+00	1.77E+01	1.30E+01	1.93E+01	9.49E+00	3.66E+00	4.96E+00	8.09E+00
Nb-95								
Os-191								
Pu-239	2.06E-04	4.53E-04	3.33E-04	4.95E-04	2.43E-04	9.36E-05	1.27E-04	2.07E-04
Rb-88	6.25E+02	1.38E+03	1.01E+03	1.50E+03	7.38E+02	2.84E+02	3.86E+02	6.29E+02
Rb-89	9.86E+02	2.17E+03	1.59E+03	2.37E+03	1.16E+03	4.48E+02	6.08E+02	9.91E+02
Re-188								
Sb-125								
Sr-90	1.57E+00	3.45E+00	2.54E+00	3.78E+00	1.85E+00	7.14E-01	9.68E-01	1.58E+00
Tc-99m	2.45E+00	5.40E+00	3.96E+00	5.90E+00	2.89E+00	1.10E+01	1.51E+00	2.47E+00
Xe-133	1.31E+03	2.89E+03	2.12E+03	3.16E+03	1.55E+03	5.97E+02	8.11E+02	1.32E+03
Xe-135	1.30E+03	2.87E+04	2.11E+04	3.14E+04	1.54E+04	5.93E+03	8.05E+03	1.31E+04
Xe-135m	7.19E+03	1.58E+04	1.16E+04	1.73E+04	8.49E+03	3.27E+03	4.44E+03	7.23E+03
Xe-138	4.04E+04	8.88E+04	6.52E+04	9.71E+04	4.76E+04	1.83E+04	2.49E+04	4.06E+04
Y-91m	1.10E+00	2.42E+00	1.78E+00	2.65E+00	1.30E+00	5.01E-01	6.79E-01	1.11E+00

CDC INL Annual Releases from Test Reactor Area (Curies) Continued

	1960	1961	1962	1963	1964	1965	1966	1967	1968
Totals	**2.3E+05**	**3.4E+05**	**3.5E+05**	**6.0E+05**	**5.7E+05**	**5.2E+05**	**3.3E+05**	**2.0E+05**	**1.3E+05**
Ar-41	1.04E+05	1.50E+05	1.57E+05	2.69E+05	2.55E+05	2.34E+05	1.50E+05	8.89E+04	5.66E+04
Ba-139	1.16E+02	1.68E+02	1.75E+02	3.00E+02	2.85E+02	2.61E+02	1.67E+02	9.92E+01	6.31E+01
	4.00E-02	5.77E-02	6.01E-02	1.30E-01	9.79E-02	8.96E-02	5.75E-02	3.40E-02	2.17E-02
	2.54E-03	3.67E-03	3.82E-03	6.55E-03	6.23E-03	5.70E-03	3.66E-03	2.17E-03	1.38E-03
	2.93E-01	4.23E-01	4.40E-01	7.45E-01	7.17E-01	6.56E-01	4.21E-01	2.49E-01	1.59E-01
	3.86E-02	5.56E-02	5.79E-02	9.93E-02	9.44E-02	8.63E-02	5.54E-02	3.28E-02	2.09E-02
	2.09E-01	3.02E-01	3.14E-01	5.38E-01	5.12E-01	4.68E-01	3.00E-01	1.78E-01	1.13E-01
	5.19E-01	7.49E-01	7.79E-01	1.34E+00	1.27E+00	1.16E+00	7.46E-01	4.41E-01	2.82E-01
Cs-138	1.23E+03	1.78E+03	1.85E+03	3.17E+03	3.01E+03	2.76E+03	1.77E+03	1.04E+03	6.68E+02
	4.36E+00	6.29E+00	6.55E+00	1.12E+01	1.06E+01	9.76E+00	6.27E+00	3.71E+00	2.37E+00
	5.66E-01	8.16E-01	8.50E-01	1.46E+00	1.39E+00	1.27E+00	8.13E-01	4.83E-01	3.07E-01
	4.50E-01	6.50E-01	6.76E-01	1.16E+00	1.10E+00	1.01E+00	6.47E-01	3.84E-01	2.44E-01
Kr-85	4.98E+02	7.19E+02	7.49E+02	1.28E+03	1.22E+03	1.12E+03	7.16E+02	4.26E+02	2.70E+02
Kr-85m	4.71E+03	6.80E+03	7.07E+03	1.21E+04	1.15E+04	1.05E+04	6.77E+03	3.99E+03	2.56E+03
Kr-87	1.70E+04	2.46E+04	2.56E+04	4.39E+04	4.16E+04	3.81E+04	2.45E+04	1.45E+04	9.25E+03
Kr-88	1.67E+04	2.41E+04	2.51E+04	4.30E+04	4.08E+04	3.74E+04	2.40E+04	1.42E+04	9.06E+03
Kr-89									
La-140	6.56E-02	9.46E-02	9.85E-02	1.69E-01	1.61E-01	1.47E-01	9.43E-02	5.59E-02	3.56E-02
	1.11E+01	1.61E+01	1.67E+01	2.87E+01	2.72E+01	2.49E+01	1.60E+01	9.46E+00	6.04E+00
Pu-239	2.85E-04	4.11E-04	4.28E-04	7.34E-04	6.98E-04	6.38E-04	4.10E-04	2.42E-04	1.55E-04
Rb-88	8.66E+02	1.25E+03	1.30E+03	2.23E+03	2.12E+03	1.94E+03	1.24E+03	7.37E+02	4.68E+02
Rb-89	1.36E+03	1.97E+03	2.05E+03	3.51E+03	3.34E+03	3.06E+03	1.96E+03	1.16E+03	7.40E+02
Sr-90	2.17E+00	3.13E+00	3.26E+00	5.60E+00	5.32E+00	4.87E+00	3.12E+00	1.85E+00	1.18E+00
Tc-9m	3.34E+00	4.90E+00	5.10E+00	8.74E+00	8.31E+00	7.60E+00	4.88E+00	2.89E+00	1.84E+00
Xe-133	1.82E+03	2.62E+03	2.73E+03	4.69E+03	4.44E+03	4.07E+03	2.62E+03	1.55E+03	9.89E+02
Xe-135	1.81E+04	2.60E+04	2.71E+04	4.65E+04	4.41E+04	4.04E+04	2.60E+04	1.53E+04	9.82E+03
Xe-135m	9.96E+03	1.44E+04	1.50E+04	2.56E+04	2.43E+04	2.23E+04	1.43E+04	8.47E+03	5.40E+03
Xe-138	5.59E+04	8.06E+04	8.39E+04	1.44E+05	1.36E+05	1.25E+05	8.03E+04	4.75E+04	3.03E+04
Y-91	1.52E+00	2.20E+00	2.29E+00	3.93E+00	3.73E+00	3.41E+00	2.19E+00	1.30E+00	8.27E-01

Total CDC above tables TRA Radioactive Air Releases 1952 to 1968 = 4,981,400 Curies
[Source: CDC INEL Dose Reconstruction, Reported Annual releases estimates from the TRA in curies.]

Oil Chemical & Atomic Workers (OCAW) Union additionally charged EG&G with 10 safety violations during this period that put workers at risk. [AP(h), 12/14/93] Unfortunately none of these reviews carry any enforceable authority and are summarily ignored by DOE.

Radiological Monitoring Data in INL Region [ERDA-1552-D @E-3 to 13]

Monitor Site	Date	Concentration	Isotope
ID Falls	2/65	24 pCi/L	Sr-90
Butte, MT	7/66	15 "	Sr-90
Butte, MT	3/65	125 "	Cs-137
ID Falls	3/66	45 "	Cs-137
Preston, ID	8/65	88 "	Gross Beta
Preston, ID	7/66	6 "	Gross Alpha
La Barge, WY	10/71	5 "	Gross Alpha
ID Falls	5/65	29 pCi/Kgm	Sr-90
ID Falls	2/65	140 pCi/Kgm	Cs-137

As a part of DOE's INL monitoring activities, milk samples were taken and tested primarily for Iodine-131. The current MCL for I-131 is 3 pCi/L, Sr-90 is 8 pCi/L, Cs-137 is 200 pCi/L. Milk sampling around INL in 1958 notes that the I-131 activity was below the, then, permissible level of I-131 in water which was 3 x 10^{-5} uc/ml (30,000 pCi/L). [IDO-12082(58)@76]

Compared to current standards, the preceding milk iodine concentrations represent extremely high numbers. The following are acknowledged contamination concentrations in milk sampled from dairies and farms around the INL region. [DOE/ID-12119@E-34-48]

Iodine-131 Milk Samples in INL Region

Year	Month	Amount pCi/L	Month	Amount pCi/L
1958	Feb.	980	Mar.	2,250
	May	1,780	Oct.	5,600
1959		1,500		
1960	Jan.	1,400	Aug.	188
	Mar.	700	Oct.	400
1961	Jan.	200		
1962	Sept.	200	Oct.	140
	Nov.	320	Dec.	200

[DOE/ID-12119@E-34-48]

Monitoring Data on Food Stuffs in INL Region

Year	Food Stuff	Concentration
1960	Milk I-131	2 x 10^{-6} uCi/ml [2,000 pCi/L]
1961	Milk I-131	1 x 10^{-7} uCi/ml [100 pCi/L]
1963	Milk Sr-90	230 uuCi/L [230 pCi/L]
1963	Wheat Sr-90	170 uuCi/Kgm [170 pCi/Kgm]
1963	Wheat Cs-137	800 uuCi/Kgm [800 pCi/Kgm]
1963	Wheat Manganese-54	560 uuCi/Kgm [560 pCi/Kgm]

[Monitoring Reports 9,10,11,12 and 13; Environmental Monitoring Data Annual Guides][Cited by Blain @ 22 to 25]

I.G.1 Incomplete Summary of INL Episodic Radioactive Releases to Atmosphere as of 1998

Facility	Date	Curies Released	Source
Naval Reactor Facility*	6/18/55	305	A @ A-203
ICPP*	10/58	1,200	B @ C-3
ICPP*	10/16/59	367,717	A @ A-99
ICPP*	1/25/61	5,200	B @ C-5
SL-1*	1/3/61	1,128	A @ A-196
BORAX-1*	7/22/54	714	A @ A-203
Test Reactor Area	1952-1968	4,981,400	C
Aircraft Nuclear Propulsion*	1956-66	4,635,724	see ANP table Section I.C.1
Other INL Operational Release	1952-89	13,552,880	A @ A-189
Total Episodic Air Incomplete Release	1952-98	~18,910,544	

Sources: (A) DOE/ID-12119; (B) ERDA-1536; (C) CDC INEL Dose Reconstruction, Reported Annual releases estimates from the TRA in curies.]

* Significant episodic releases not included in general INL operational releases to the atmosphere. Curie releases less than 0.1 were not added in this summary and are considered understated due to lack of information.

For Test Reactor Area See CDC table above; Total TRA Radioactive Air Releases 1952 to 1968 = 5.47 E + 06 = 4,981,400 Curies

See Section I.C.9 for more details on INL atmospheric releases

Section I.H. Snake River Aquifer Contamination

The Snake River Plain Aquifer (SRPA) underlies the INL, and is a critical regional sole water resource in southeastern Idaho high desert extending approximately 320 km (200 mi) from Ashton, Idaho in the northeast to Hagerman, Idaho on the southwest where it empties into the Snake River at Thousand Springs. The aquifer consists of a series of basalt flows with inter-bedded sedimentary deposits and pyro-classic materials. The SRPA was designated as a sole source aquifer by the EPA in 1991 because it is the only viable source of drinking water for most communities on the Snake River Plain. [1]

"Radioactive, inorganic, and organic wastes releases from active and inactive waste sites have resulted in contamination of the Snake River Aquifer." [DOE/EH/OEV-22-P,p.3-166 + 115] "Some of the injection wells, such as at Test Reactor Area, Power Burst Facility, Test Area North, and INTEC (ICPP), disposed of the wastes directly into the Snake River Aquifer." [2] This practice of injecting radioactive waste water to "hot" to dump in open percolation ponds because of high radiation fields, was wide spread despite the fact that nearby aquifer wells were used by workers for drinking water. DOE knew the potable well water was contaminated but continued the practice until ID Governor Andrus forced them closed ~1982.

Significant spills and leaks have frequently occurred over INL's history. "Most spills have been the result of line and tank failures, leaking valves, and equipment and tanks overfilling. [Spill and/or leak] volumes range up to 45,000 gal.." [Ibid. @3-116]

"It should be noted that rather large quantities of chemicals were routinely disposed of via the ICPP disposal well." AEC documents acknowledge discharging on average "4.5 times the maximum permissible concentrations as given in Handbook 52". [IDO-14334 @12]

"The average level of activity discharged to the water table by the approximate 30 million gallons of water per month is on the order of 10^{-5} micro curies/milliliter [10,000 Pico curies per liter]. Ordinarily, the radionuclides which approach [1960] drinking water tolerance in the disposal well are iodine-131 and strontium-90. Radioactive decay is relied upon to reduce the iodine-131 to permissible levels and adsorption to reduce the concentration of strontium-90 should either of these radionuclides momentarily exceed drinking water tolerances during discharge." [IDO-14502 @10-11]

Other INL documents acknowledge ICPP injection well discharges exceeding 0.22 beta except for 7 curies of I-131 per million gallons. [IDO-14532 @13] "Chemicals used at ICPP such as metallic sodium and metallic potassium were disposed of by "pumping the solution on the desert." [ERDA-1536@II-102]

Idaho Division of Environmental Quality in April 1998, acknowledged that the ICPP drinking water wells were contaminated with the chemical TCE requiring DOE to install special treatment process before it went into the system. During a tour of the RWMC in 1996, the author found all the restroom sinks with signs warning not to drink the water. [3]

The State of Idaho in the late 1980s persuaded INL to stop injecting radioactive and chemical wastes into the aquifer. Currently, the wastes including plutonium, are dumped into unlined ponds and ditches. Waste discharged to these ponds continues to percolate into the aquifer. [Statesman/3/79] ICPP discharge rates range from 1 to 2.6 million gallons per day. [DOE/EH/OEV-22-P,p. 4-188] The large volumes are a deliberate attempt to dilute the contamination. The State mostly convinced DOE to phase out the use of percolation ponds, but only at the slow rate that DOE and NRF considers building new lined evaporation ponds.

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[1] 56 Federal Register 50634, October 7, 1991

[2] INEEL Subregional Conceptual Model Report, Vol. 3 September 2003, INEEL/EXT-03-01169 Rev.2, pg. 3-1.

[3] Snake River Plain Aquifer at Risk January 2019 Revision No. 40 http://environmental-defense-institute.org/publications/AquiferRPT40.pdf

INL Radioactive and Chemical Waste Injection Wells

Injection Well	History	Contamination	Status
Test Area North			
Technical Support Facility (TSF-05)	Drilled 1953 used to 1972 305 feet	Radioactive and Volatile Organic	Now used as extraction well for groundwater remediation
Initial Engine Test (IET-06)	Drilled 1953 used to1978 329 feet IET Engine coolant and fuel	Radionuclides and chemicals	Converted to a monitoring well 1982
LOFT-04	Drilled 1957 used to 1980s	Cold waste water	Converted to a monitoring well 1980s
WRRTF well (WRRTF-05)	Drilled 1957 used to 1984 313 feet	50 mCi Cobalt-60 212 liter (56 gal) Turbine Oil	Abandoned 1984
Test Reactor Area (TRA-05)	Drilled 1964 used to 1982	Radionuclides and chemicals + Chromium	Converted to monitoring well 1982
Test Reactor Area (USGS-53)	Drilled 1960	Radionuclides and chemicals + Chromium	Converted to monitoring well 1964
INTEC (ICPP)			
(CPP-23)	Drilled 1952 580 feet	21,302 Curies of Rad. And chemicals	Pressure grouted closed 1989
(USGS-50)	Drilled 1960 Used to present	Radionuclides and chemicals	Currently used for emergency disposal (CPP-23 failure)
Auxiliary Reactor Area			
(PBF-15)	Used 1972 to 1984	Sulfuric acid, Sodium Hydroxide & chromium	Capped in 1979
(PBF-05)	Used 1972 to 1984 Discharge reactor coolant	Radionuclides and chemicals	Capped in 1984
MFC/ANL-W ANL-10 ANL-15 ANL-17	Discharge reactor coolant		

[ICPP RI/FS] [USGS Report 00-4222, DOE/ID-22168][INEEL/EXT-03-01169 Rev.2, pg. 3-1to 9.]

"Major discrepancies were discovered between recorded volumes of water pumped from the aquifer for [ICPP] production use when compared with water used and disposed or lost from February 1990 to December 1990. Approximately 20 million gallons were unaccounted for in June 1990 alone." "Since 1988, water level in a perched body of water approximately 370 feet below the tank farm rose nearly six feet. Measurements were taken in a well about 500 feet southwest of the tank farm." [IDEQ Oversight 92 @17] Also see Section IV(H) for more discussion on ICPP groundwater contamination.

The utter disregard for onsite workers using wells for drinking water is seen in this DOE document quote: "The service waste activity is allowed to average no more than three times drinking water tolerance in any isotope with the exception of very short-lived ones like iodine-131."[IDO-14532,p.49]

The Operable Unit (OU) 3-14 Feasibility Study is for the high-level waste tank farm soil and groundwater located at the Idaho Nuclear Technology and Engineering Center (INTEC):

> "Concentrations of strontium-90 (Sr-90), technetium-99 (Tc-99), iodine-129, and nitrate-N currently exceed State of Idaho groundwater quality standards (maximum contaminant levels [MCLs]) in the Snake River Plain Aquifer (SRPA). The baseline risk assessment [BRA] concluded that Sr-90 concentrations in the SRPA would exceed MCLs beyond the year 2095 and that cesium-137 concentrations in the soil will exceed risk-based levels after 2095. It also concluded that the other aquifer contaminants will meet MCLs by 2095.

> "The BRA concluded that cesium-137 (Cs-137) concentrations in the soil will continue to exceed risk-based levels after 2095 for soil inside the tank farm boundary but will meet risk-based levels before 2095 for the two sites outside the boundary. The groundwater beneath INTEC currently exceeds State of Idaho groundwater quality standards at one or more monitoring wells for strontium-90 (Sr-90) and iodine-129 from the former injection well and for technetium-99 and nitrate measured as nitrogen from historical tank farm releases. Modeling results predicted that Sr-90 concentrations in the SRPA would continue to exceed the State of Idaho groundwater quality standard beyond the year 2095, but all other contaminants would meet the standards before 2095. Remedial action objectives and preliminary remediation goals are defined in the FS based on the BRA predictions.
>
> "**In summary, the revised INTEC groundwater model predicts that, absent any remedial action, all contaminants except Sr-90, will be below Idaho groundwater quality standards by <u>the year 2095.</u> Contaminants that are highly retarded, such as Pu-239 and Pu-240, which also have long half-lives, and mercury, were modeled out to their peak concentration, <u>which was well beyond the year 2095</u>.**" [4] [emphasis added]

Radioactive Waste Management Complex (**RWMC)** "One test well emitted organic gas levels 30 times the safe worker exposure limit and had to be sealed. Samples from the Waste Management Complex show the presence of tetrachloride and other organic compounds." [DOE/EH/OEV-22-P,p.3-166] An on-site drinking water well became so contaminated that it had to be shut down. [DOE/EH/OEV-22-P,p.ES-3] Purgable [sic] organics exist in concentrations 200-800 times maximum safety levels in perched aquifers. [Olsen Notes,7/31/89]

In addition to hundreds of thousands of gallons of bulk chemicals dumped in the SDA Acid Pit, containerized chemicals were dumped in other pits and trenches such as Pit-9 where 23,600 gallons were dumped.[EGG-WM-9966 @Apendix. A] The Acid Pit at the RWMC received 160,000 gallons of radioactive and chemical liquids between 1954 and 1961. [WMP-77-3 @2][IDO-22056 @9][Oversight(c), 1/6/96][INEL-94/0241][EGG-WM-10903@2-7] [5]

EPA and State regulators went along with DOE on a no-action (no cleanup) Record of Decision even though the risk assessment showed Pad-A would be contaminating ground water in excess of drinking water standards within 100 years. [EGG-WM-9967 @ 7-2]

Test Area North's (TAN) waste injection wells contaminated their own drinking water wells with trichloroethylene (TCE) at levels three times the drinking water standards. Other contaminates injected into the aquifer were PCE's, plutonium 238, 239, 240, Americium 241, cesium 137, cobalt 60, strontium 90 and tritium. [INL Oversight 7/91]

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[4] Operable Unit 3-14 Tank Farm Soil and Groundwater Feasibility Study May 2006, DOE-ID-11247

[5] Also see; EG&G-WM-10903; A Comprehensive Inventory of Radiological and Non Radiological Contaminates in Waste Buried In the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983,June 1994, Lockheed.

EGG-WM-9973; Remedial Investigation Feasibility Study Central Facility Area Motor Pool Ditch Oak Ridge National Laboratory, June 1992

EGG-9967; Remedial Investigation/Feasibility Study For Pad-A, Operable Unit 7-12 Waste Area Group 7 Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Volume 1 of 2, V. Halford, et. al., EG&G Idaho.

EG&G-M-24884; Investigation of the Subsurface Environment at the INEL, Radioactive Waste Management Complex, B. Russell et al., 1985.

EG&G-WM-10090; Sampling and Analysis Plan for RWMC Subsurface Disposal Area, EG&G Idaho April 1992.

EG&G-WM-10903; A Comprehensive Inventory of Radiological and Non Radiological Contaminates in Waste Buried In the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983,June 1994, Lockheed.

EG&G-WTD-9438; A Brief Analysis and Description of Transuranic Wastes in the Subsurface Disposal Area of the Radioactive Waste Management Complex at INEL, Arrenholtz and Knight, Remedial Investigation Feasibility Study, RWMC, Administrative Record, EG&G Idaho, August 1991.

INEL-94/0241; Preliminary Scoping Track 2 Summary Report for Operable Unit 7-01, December 1994, Lockheed Martin, Idaho National Engineering Laboratory.

INEL-95/0310; (Formerly EGG-WM-10903) Rev.1; Volume 3; August 1995; A Comprehensive Inventory of Radiological and Non-Radiological Contaminates in Buried Waste in the Subsurface Disposal Area of the INL RWMC During the Years 1952 – 1983, Volume 3.

WMP-77-3; Waste Management Program, History of Buried Transuranic Waste at INEL, W. M. Card, EG&G Idaho, Idaho Falls, Idaho, March 1977.

TAN-TSF-05 injection well

- * " Inventory of waste is estimated as ranging from 350 to 35,000 gal of TCE. Records of TCE use at TAN show that 25,670 gal were used from 1955-1972.
- * " Suspected discharges of heavy metals.
- * " From 1972 to the early 1980s, the well could have been used for overflow, but no records are available.
- * " Release of contaminants from the secondary source sludge has been modeled.
- * " Additional research is being performed through and in support of remedial activities." [6]

The LOFT reactor at TAN alone contributed 150 Ci/yr. to the peculation pond. [ERDA-1536@II-120] See Section IV (C) below for more details on TAN contamination issues.

Test Reactor Area (TRA) contains the Materials Test Reactor, Engineering Test Reactor, Advanced Test Reactor, ATR Critical Facility, TRA Hot Cell Facility, Advanced Reactivity Facility (2 reactors), and three other research labs. Currently the only reactors operating are the Advanced Test Reactor and the ATR Critical Facility. TRA leads all other INL areas for radioactive waste discharges. Between 1952 and 1981 50,840 curies were released through percolation ponds or injection wells, or 83% of INL's total liquid discharges for the period. [ID-10054-81] Beta-Gamma radioactivity concentrations in wastes dumped in the ponds was 1.1 x 10^{-2} uCi/ml [11,000,000 pCi/L]. [ERDA-1536@II-147]

The soils at INL are very porous. DOE studies on the transmissivity of contaminates in INL soils show that tests in the vicinity of TRA showed transmissivity as high as 18,000,000 gal/day/ft. and porosity of the aquifer as high as 15%. [EGG-ER-8644 @ 35] A February 1999 USGS study put the aquifer transmissivity under INL in a range as high as 32,000 feet per day (6.06 miles/day). [DOE-ID-22155] This means contaminate in the aquifer can move rapidly down gradient in the direction of the Snake River.

Four TRA percolation ponds, received 80.39 billion gallons of waste. [TRA ROD @ 5] Between 1952 and 1974 these ponds alone received 41,049 Ci of radioactivity. [ERDA-1536@II-109,150,III-61] The reason for the high volumes of water was the once through cooling for the reactors requiring dilution. TRA pond algae registered 100 mR/hr. Migrating ducks (usually 25 at any one time) using the pond registered radionuclide concentrations in tissue samples. [Ibid. @ III-75-76] Also see Section IV(B) Test Reactor Cleanup Plans for the Warm Waste Pond. Chromium used to retard corrosion in the reactors was dumped in concentrations of 500 ppm when the standard in 1974 was 0.05 ppm, or 10,000 times over regulatory standards.[Ibid. @III-79] Also see Section IV(B). TRA radioactive dumping migrated to the perched water under the site in the following Pico curie per liter (pCi/L) concentrations: [Administrative Record Analytica-ID-12782-1]

Plutonium-239,240, and Pu-238 in Test Reactor Area leaching ponds were found in net plankton in concentration ranges (CRs) from 40,000 to 400,000. [DOE/ID-12111,P.39] Plants and animals concentrate these contaminants within their systems. Current monitoring of the Snake River Aquifer by the USGS indicates the presence of tritium, sodium, strontium-90, chloride, nitrate, and iodine-129 contamination plumes". [DOE/EH/OEV-22-P,p.3-167]

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[6] INEEL Subregional Conceptual **Model Report** Volume 3: Summary of Existing Knowledge of Natural and Anthropogenic Influences on the Release of Contaminants to the Subsurface Environment from Waste Source Terms at the INEEL September 2003 INEEL/EXT-03-01169 Rev. 2, Pg 3-4.

Contaminates in TRA Perched Water

Nuclide	Concentration	Nuclide	Concentration
Cobalt-60	12,200,000 pCi/l	Cesium-137	21,000,000 pCi/l
Americium-241	16,700 pCi/l	Strontium-90	18,000 pCi/l
Tritium	3,940,000 pCi/l	Cesium-134	62,400 pCi/l

[Administrative Record Analytica-ID-12782-1]][Also see Section IV.D ATR Cleanup Section for a full listing]

Between these TRA reactors there are 15 radioactive waste tanks, some of which have leaked. Two injection wells were also used to dispose of radioactive coolant water which contained hazardous chemicals. Injection well No. 53 received 3.89 x 10^{+9} (3.89 billion) gallons containing 31,131 lbs. of carcinogenic hexavalent chromium. Well No. 05 received 2.2 x 10^{+8} (220 million) gallons between 1964 and 1982. Between 1952 and 1972 the three TRA reactors discharged 55,353 lbs. of Cr(VI). [Administrative Record Analytica-ID-12782-1 Aniliticia @F-4-25&6]

The high water volume was due to once through coolant for the reactors and the fuel storage canal. Collective TRA waste water disposal volumes to ponds and injection wells are 84.5 billion gallons. [TRA ROD@5] Currently the injection wells are not used, but the percolation ponds are in use. INL dumped huge quantities of chemicals into pits and in sub-surface leach fields. 600 tons of sulfuric acid, 300 tons of sodium hydroxide, and 50 tons of sodium chloride were dumped in the TRA waste ponds. [ERDA.@II-79&80] See Section IV (A) below for more details on TRA contamination issues.

The following representative figures show that chemical contamination is equally a significant part of the problem at INL. Chemicals included tributyl phosphate, Hexone Methyl Isobutyl ketene. [Ibid.@E-8]

Hazardous Chemicals Dumped at INL (1975-76)

	1975	1976
Surface Chemicals Disposed	3,053,000 gal.	2,989,000 gal.
Sub-Surface Chemicals Disposed	1,550,000 gal.	1,508,000 gal.

[ERDA -1536 @ E-8]

> "The results of the groundwater risk assessment are presented in Table 1-3. The groundwater currently exceeds MCLs in one or more aquifer monitoring wells for strontium-90, technetium-99, iodine-129, and nitrate measured as nitrogen. However, there are no receptors because workers are provided drinking water from wells located upgradient of INTEC. The groundwater model predicts that strontium-90 concentrations will continue to exceed MCLs beyond the year 2095. Strontium-90 was identified as the primary contaminant from the OU 3-14 tank farm sources that could adversely impact groundwater quality beyond the year 2095. The model predicts that the SRPA will meet drinking water standards before 2095 for all other contaminants from INTEC sources. Although the model underpredicts current technetium-99 concentrations in two aquifer wells (measured concentrations are three times the model prediction), the concentrations are predicted to be 10 times below the MCL before 2095. Assuming that all peak contaminant concentrations occur at the same time, the maximum cumulative risk to a future resident from all carcinogens would be 3E-05. The hazard index is 0.05 for noncarcinogens (mercury and nitrate).
>
> "Workers and the public are assumed to be provided safe drinking water until 2095. After 2095, it is assumed that hypothetical future residents living outside the industrial use area can drill wells and be exposed to contaminated water." [pg.-21] [7]

[7] Operable Unit 3-14 Tank Farm Soil and Groundwater Feasibility Study May 2006, 1.3.10 Groundwater Risk Assessment, DOE-ID-11247. "However, there are no receptors because workers are provided drinking water from wells located upgradient of INTEC," is not a true statement because the contaminate plumes show they extend

The above DOE predictions use gross underestimates of the speed of groundwater movement and the soils ability to filter contaminates. See below Aley 1980 study of ground water movement. All of these predictions rely on institutional control for 100 years which is absurd. The State of Idaho is barely 100 years old! These contaminates have a biological impact long past their half-lives. The bottom line is workers and future generations are being condemned to contaminated water. DOE is relying on putting soil caps over its contaminate sites to limit the migration into the aquifer.

> "Capping to meet [remedial action objective] RAOs I and II would require reducing infiltration rates sufficiently that Sr-90 concentrations after 2095 would not exceed applicable groundwater quality standards in the SRPA. Given that RI/BRA base case modeling indicated <u>that Sr-90 concentrations will remain above the maximum contaminant level (MCL) until 2129,</u> the cap is assumed to have to remain effective at controlling infiltration for at least 117 years. The required areal extent of an infiltration control cap to meet RAOs I and II is discussed in Section 4. [Pg. 3-21]
>
> [BUT]
>
> "Because the predicted peak concentrations from each non-CERCLA source are much less than the MCL of 900 pCi/L <u>and occur post-2095</u>, and the peak predicted concentration post-2095 from CERCLA sources (10 pCi/L) is also much less than the MCL, there would be no concerns for cumulative risk, even if the maximum predicted concentrations from the non-CERCLA INTEC sources occurred at the same place and time and were summed." [8] [pg. 1-20]

DOE and the commercial nuclear industry have consistently discounted the health impacts of tritium contamination. However, a growing body of independent research has challenged this position. Dr. Charles Huver, a retired University of Minnesota biology professor who studies tritium for the Minnesota Pollution Control Agency, says the 20 Pico-curies per milliliter tritium standard is at least 1,000 times too high because of tritium's "chromosome-breaking ability". [Spokesman (a)] Tritium from INL dumping has migrated the 50-miles via the aquifer to the Snake River. USGS 1994 to 1999 spring discharges to the Snake River sampling data show significant tritium concentrations near Twin Falls and Hagerman areas. [DOE/ID-22180]

Also, 1993 USGS monitoring found Iodine-129 from the ICPP 3.4 square mile ground water plume, with concentrations of 0.25 pCi/l, in two wells eight miles south of the INL boundary near Big Southern Butte. [Environmental Science Foundation July 1997] The INL DEIS also acknowledges the tritium and I-129 plumes have migrated off-site. Iodine-129, a byproduct of the fission of uranium, is of concern because of its 15.7-million-year half-life. Because of this it is considered by EPA to be a permanent environmental pollutant and the drinking water standard for I-129 is set at one pCi/l.

Government estimates do not consider the effect of irrigation when predicting the speed with which contaminates migrate. Agriculture in the INL region is expanding rapidly. As a warm desert ecology, farming relies solely on irrigation to produce high yield products. Idaho uses 22 million gallons per day - second highest amount of water used for agriculture in the nation. [UIWR]

On a total per capita water usage basis, Idaho ranks first in the nation with 22,000 gallons/person/day - with second place going to Wyoming at 13,052 gal/person/day. [UI WR # 887] So much water is being drawn from the aquifer that the water table has dropped three feet in the late 1980's. [AP(a),1/1/89] Municipal water for 41 communities also adds to the drain on this aquifer. [UI WR # 887] Three years of drought have exacerbated these conditions requiring even greater demands on the aquifer. [AP(a),1/1/89] Drought conditions continue with June 1992 Snake River average flow of 3.7 billion gallons per day. The previous low was in 1977 at 5.2 billion gallons per day. [Times-News(d)] USGS studies show Snake River Plain Aquifer draw-down in excess of recharge is 410,000 acre feet/yr. [Times News (f) 7/19/92] Recharge from the 1996-1997 winter show pack run off halted this trend but it is unclear whether previous loses were completely made up.

Snake River Aquifer springs feeding the Snake River provide the entire river flow west of Twin

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upgradient of water wells used by INTEC and many workers use water down gradient of INTEC such as CFS/RWMC.

[8] DOE-ID-11247, pg. 1-20 and Pg. 3-21.

Falls. The river flow east of Twin Falls is almost entirely diverted for irrigation. Irrigation of over 3 million acres of farm land is drawn from the Snake River Aquifer. [UI WR # 887] Rapidly growing agriculture and municipal water needs may pull INL's pollution back to the surface much faster than predicted. Reduced recharge and aquifer lower volume may increase the concentration level of INL contaminates.

A six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes that move water rapidly through the aquifer and exit at Thousand Springs on the Snake River. The Big Lost River that flows onto the north end of the Snake River Plain totally disappears into the underlying soils.

Earlier DOE studies of aquifer contamination plume movement from ICPP to Central Facilities Area (CFA) between 1953 to 1958 document a seven foot/day or one-half mile/yr. Contaminate travel time from surface disposal to the aquifer is approximately 4-6 weeks or 10 feet/day. [ERDA-5316@II-120&III-81]

Because the aquifer is not a homogenous geologic structure, but rather a very heterogeneous mix of different strata, and therefore, no generalized characterization about water movement within the aquifer is valid. For instance, the entire volume of the Big Lost River literally disappears into the porous Snake River Plain. The significant gradient change from 200 feet in the north east to 600 feet in the south west aids the water movement through the aquifer.

As previously noted, a 1993 US Geologic Survey water sampling has disclosed Iodine-129 in wells south of the INL boundary. [AP(e) 2/13/93] Well number 11 located 4 miles south of INL and 3.5 miles west of Big Southern Butte contained concentrations of I-129 of 1×10^{-5}. Well number 14 located 8 miles south of INL and 6 miles southeast of Big South Butte has I-129 concentrations of 3×10^{-5}. [Phone conversation with Oversight 2/18/93]

DOE announced in 1990 that radioactive chlorine-36 from the ICPP has also been detected off-site in concentrations of 0.2% of the drinking water standard. [Environmental Science and Research Foundation, July 1997] "Our computer modeling has predicted for years that these contaminants would be detected off-site," according to Brad Bugger, INL spokesman. [AP (e)Daily News 2/14/93] These are significant DOE admissions which contrast decades of denials that INL contamination would migrate off-site.

In a 1994 study of sorption of radionuclides in basalt and interbed materials of the Snake River Plain found breakthrough of Sr-90 of 43%; Cs-137 of 94%; U-233 of 89%; Pu-239 of 33.5%; Am-241 of 9%; and Co-90 of 0.9%. [Goff] This study contradicts DOE's contention that the basalt underlying the INL is a good filter for radionuclides and the aquifer is not at risk from migration of contaminates dumped into percolation ponds and injection wells. INL's Health and Safety Division found:

"A tracer study using fluorescein dye and a 'slug' amount (10 tons) of common salt was initiated during October [1958] for the purpose of determining the rate of movement of the underground water. The dye was detected in four wells at distances up to 900 feet. A maximum rate of movement of approximately 100 feet per day was indicated."..."On December 9, 1958, an unidentified source at the CPP began discharging liquid waste at levels which averaged ten times the maximum permissible concentration for Strontium 90, in addition to other fission products. Traces of this material began to appear in the monitoring wells at a distance of 700 to 800 feet on December 15 which substantiated the flow rate as determined by the tracer." [IDO-12082(58)@60]

A 2001 USGS report confirms the above contaminate migration prediction. Plutonium-238, 239/240, Americium-241, and Cesium-137 were detected in wells 20 miles south of the INL boundary. The report shows Plutonium concentrations of 0.01 pCi/l in Grazing Well # 2, and Grazing Service CCC # 3. [DOE/ID-22175]

The Snake River flows into northern Idaho where it turns west at Lewiston, Idaho and joins the Columbia near the Tri-Cities, Washington. Any radioactive and chemical wastes which INL puts into the Snake River Aquifer may eventually reach northern Idaho, southern Washington, and northern Oregon. The affected water pathway populations studied may need to be extended beyond the immediate vicinity of the INL site with special emphasis on down-gradient populations of the Snake River Aquifer. Oregon's

Health Division found in studies of the State's surface waters that after the Hanford reactors were shut down and ended direct reactor coolant dumping into the Columbia, that the Snake River contributed the highest levels of radioactivity to the Columbia River. [Oregon @ 1]

Snake River Aquifer Water Sampling

INL's southern boundary is about 53 miles from the Rupert area and about 110 miles from the Hagerman area (see map below). INL over the past five decades has dumped vast quantities of radioactive waste into shallow pits, trenches, and unlined percolation ponds. Billions of gallons of radioactive waste water was also injected directly into the aquifer until the early 1980's when then Governor Cecil Andrus forced the federal government to end the practice. A 1995 U.S. Geological Survey report notes:

> "In the past, wastewater containing chemical and radio chemical wastes generated at the INEL was discharged mostly to ponds and wells. Since 1983, most aqueous wastes have been discharged to infiltration ponds. Many of the constituents in the wastewater enter the aquifer indirectly following percolation through the unsaturated zone." [DOE/ID-22130,p.3]

The following table shows U. S. Geologic Survey (USGS) 1989-1996 water sample data from 33 of the 55 monitoring wells in the Snake River Aquifer south of INL between Rupert on the east and Hagerman on the west. These monitoring wells are in the Magic Valley group of wells checked by USGS in three sampling campaigns (1989, 1990-92, and 1994-96). The sample data show gross beta and alpha radioactivity over the period and is used as a screening method to determine if additional testing is needed.

The comparative water sample data is a means of identifying trends in the migration of radioactive contaminates. The USGS emphasizes that the Magic Valley monitoring wells remain below the Environmental Protection Agency maximum concentration level (MCL) standard for drinking water. If increasing trends are confirmed, then additional isotope specific tests may be needed to identify the source of the contamination.

The following two tables compare gross beta and gross alpha particle radioactivity, which is a measure of the total radioactivity given off as beta or alpha particles during the radioactive decay process. USGS instruments were calibrated for dissolved cesium-137 (gross beta) and dissolved thorium-230 (gross alpha). The concentrations of gross beta/alpha particle activity are for reference only and do not imply that the radioactivity is attributed to these specific isotopes. The numbers in the table are the mean or middle number between an analytic plus or minus (±) uncertainty range published in USGS reports.

Snake River Aquifer Water Sample Data
Gross Beta (dissolved Cesium-137)(pCi/L)

Well #	1989	1990-92	1994-95	1996-98	1999-00
MV-01	7.8 ±1.21	7.3 ±1.65		6.86 ±1.76	10.7±2.4
MV-02	10.65 ±1.65	7.57 ±2.01	7.64 ±1.58	11.1±4.3	8.09 ±2.68
MV-03	4.88 ±0.77	4.33 ±1.28	4.58 ±2.91	5.84 ±1.36	
MV-04	6.54 ±1.2	7.38 ±1.67		5.83 ±3.11	7.43± 2.6
MV-05	7.36 ± 1.29	6.69 ± 1.51	12.0 ± 5.38	6.99 ± 1.89	
MV-06	6.12 ± 1.02	8.01 ± 1.63	7.93 ± 4.86	6.12 ± 1.61	
MV-07	4.62 ± 0.77	4.00 ± 1.26	6.49 ± 4.24	7.1 ± 4.2	
MV-09	10.6 ±2.0	8.96 ±2.31		10.2±4.2	17.34 ±5.36
MV-10	10.60 ± 1.7	9.67 ± 2.23	9.93 ± 1.96		8.31 ±3.43
MV-11	11.50 ± 1.90	13.40 ± 2.85	8.20 ± 3.5	8.2 ± 3.5	9.67 ±5.18

MV-12	7.26 +1.25	7.34 +1.78		7.22 +1.89	3.72 +4.68
MV-13	9.31 + 1.5	7.50 + 1.54	10.1 + 5.9	8.24 + 1.72	
MV-14	5.36 +1.17	3.56 +1.12		5.78 +1.89	5.79 +2.6
MV-15	8.25 + 1.39	10.60 + 2.22	8.12 + 2.07	8.12+2.07	4.65 +4.85
MV-16	4.39 + 0.73	3.99 + 1.26	4.66 + 1.15	7.6 + 4.1	5.06 +2.46
MV-17	4.64 + 0.79	4.15 + 1.24	7.01 + 4.14	5.10 + 2.84	
MV-18	7.73 +1.38	7.51 +1.86		6.24+2.6	8.5 +4.93
MV-19	6.8 +1.07	4.7 +1.4	6.5 +1.44	3.2+3.9	4.61 +2.42
MV-20	6.17 + 1.01	4.51 + 1.14	5.48 + 1.27	7.4 + 4.1	5.36 +2.05
MV-21	4.98 +0.8	4.6 +1.29		4.43+1.13	5.01 +1.39
MV-23	9.37 + 1.53	8.41 + 1.89	4.39 + 1.04	8.83+3.45	7.69 +2.65
MV-24			11.0 +2.39		
MV-24-A				8.38+3.62	11.4 +3.65
MV-25	22.21 +2.85	9.13 +2.08	10.5 +2.2	11.5+ 4.4	
MV-26	5.99 + 0.92	5.40 + 1.26	9.02 + 4.63	4.44 + 1.47	7.81 +2.63
MV-27	6.81 + 1.04	6.73 + 1.51	9.57 + 5.18	6.06 + 1.54	
MV-29	5.43 +0.9	3.96 +1.2	4.68 +1.36	4.11+1.12	1.13 +4.3
MV-30	7.16 +1.22	6.25 +1.62		6.59+3.19	7.93 +4.93
MV-31	6.80 + 1.22	7.32 + 1.55	13.1 + 4.37	9.53 + 1.64	8.02 +3.39
MV-32	8.38 + 1.38	8.15 + 1.91	9.45 + 1.9	7.5 + 4.2	
MV-33	4.82 + 0.78	3.27 + 1.06	4.39 + 1.04	4.39 +1.04	5.74 +1.79
MV-36	5.44 + 0.91	4.80 + 1.18	7.03 + 4.22	4.2 + 1.05	
MV-37	6.83 +1.07	4.75 +1.45		3.75+1.21	2.93 +4.36
MV-38	3.65 + 0.69	3.87 + 1.21	4.71 + 3.85	3.93 + 1.06	
MV-39	8.56 +1.52	7.81 +1.88		5.26 +3.08	7.34 +2.73
MV-40	5.93 +0.9	4.11 +1.19	4.13 +1.18	5.4+4.0	4.67 +4.44
MV-41	6.39 + 1.04	7.33 + 1.89	7.24 + 1.81	7.0 + 4.2	6.89+2.41
MV-42	6.00 + 0.94	0.71 + 0.58	8.65 + 4.36	6.03 + 1.18	
MV-43	10.1 +1.71	9.17 +2.13		6.68 +3.32	8.91+5.06
MV-45	4.69 + 0.78	4.45 + 1.30	6.10 + 4.19	4.0 + 3.9	
MV-46	4.49 +0.73	4.17 +1.25	4.21 +1.24	4.08 + 1.03	3.49 +1.67

MV-47	4.82 ± 0.76	4.07 ± 1.06		3.6 ± 3.9	5.06 ±1.8
MV-49	3.62 ± 0.7	2.52 ± 0.87	3.15 ± 0.95	4.2 ± 3.9	4.79 ±2.43
MV-50	7.51 ± 1.25	8.75 ± 1.77	9.43 ± 1.87	4.95 ±3.1	8.96 ±3.39
MV-51	8.06 ± 1.53	7.22 ± 1.83		11.2 ± 4.4	3.96±4.7
MV-52	9.56 ± 1.44	8.93 ± 1.88	8.44 ± 1.68	8.4 ± 4.2	8.81 ±3.42
MV-53	9.43 ± 1.58	9.94 ± 2.06	9.57 ± 5.4	10.7 ± 2.23	
MV-54	8.82 ± 1.52	9.19 ± 2.12	9.40 ± 2.05	8.4 ± 4.3	10.37 ±4.88
MV-55	4.80 ± 0.92	3.55 ± 1.10	8.46 ± 4.25	6.04 ± 1.37	
MV-56	4.89 ± 0.86	4.73 ± 1.32	5.21 ± 1.24	3.8 ± 3.9	0.48±4.33
MV-57	4.11 ± 0.67	2.81 ± 0.85	3.48 ± 1.06	3.25 ± 1.03	
MV-59	5.35 ± 0.83	4.37 ± 1.24	6.13 ± 2.37	8.44 ±2.75	2.78±4.53
MV-61	4.65 ±0.85	4.70 ±1.35		6.13 ±2.37	-.55±4.28

Gross Alpha (as dissolved thorium-230) (pCi/L)

Well #	**1989**	**1990-92**	**1994-96**	**1997-1998**	**1999-2000**
MV-03	2.62 ±0.65	2.0 ±0.76	0.218 ±1.2	4.48 ± 2.89	
MV-05	4.65 ± 0.85	2.22 ±0.8	3.56 ± 2.96	5.26 ± 3.39	
MV-06	1.88 ± 0.5	1.67 ± 0.65	4.22 ± 3.11	6.23 ± 3.36	
MV-07	2.46 ± 0.62	1.51 ±0.63	3.36 ± 2.71	2.17 ± 2.48	
MV-10	2.87 ± 0.65	3.35 ± 0.97	3.22 ± 2.14	2.3 ± 2.7	0.62 ±0.85
MV-11	3.05 ± 0.65	3.91 ± 1.04	5.79 ± 3.79		1.88 ±2.59
MV-12	2.7 ±0.66	2.28 ±0.79	2.56 ±1.98		6.08 ±3.62
MV-13	5.12 ± 0.97	2.15 ± 0.72	4.20 ± 3.09	4.55 ± 3.07	
MV-15	2.30 ± 0.54	2.58 ± 0.82	4.84 ± 2.86		3.39 ±3.24
MV-16	2.32 ± 0.66	1.95 ± 0.73	1.42 ± 0.95	1.1 ± 2.1	1.33 ±1.47
MV-17	1.07 ± 0.59	1.31 ± 0.06	0.103 ± 1.82	5.1 ±2.84	
MV-20	1.08 ± 0.52	1.92 ± 0.074	3.02 ± 1.62	5.5 ± 3.0	1.19 ±0.78

MV-23	1.85 ± 0.48	2.39 ± 0.79	3.54 ± 2.77		-.21 ±2.43
MV-26	2.32 ± 0.62	1.59 ± 0.65	2.22 ± 2.36	0.96 ±2.35	0.81 ±1.26
MV-27	4.09 ± 0.8	2.62 ± 0.82	2.56 ± 2.73	4.83 ±3.12	
MV-31	3.04 ± 0.72	2.31 ± 0.77	10.9 ± 4.65	9.22 ±3.8	1.42 ±1.73
MV-32	6.00 ± 1.04	3.75 ± 1.05	2.85 ± 2.06	3.9 ± 3.1	
MV-33	0.68 ± 0.46	2.29 ± 0.81	1.19 ± 1.3		0.72 ±0.52
MV-36	5.12 ± 1.0	2.10 ± 0.70	4.54 ± 3.08	2.64 ±2.34	
MV-37	4.75 ±0.99	4.15 ±1.06	1.94 ±1.61		4.05 ±3.37
MV-38	1.86 ± 0.51	1.19 ± 0.58	1.62 ± 2.26	4.58 ±2.73	
MV-41	4.76 ± 0.98	5.24 ± 1.15	7.21 ± 3.16	4.3 ± 3.2	3.13 ±3.2
MV-42	2.08 ± 0.55	3.18 ± 0.93	3.21 ± 2.72	2.76 ±2.46	
MV-43	5.01 ±0.92	4.58 ±1.13	4.49 ±3.01		4.64 ±3.25
MV-46	1.82 ±0.53	1.10 ±0.54	0.73 ±0.79	4.4 ± 2.62	1.23 ±0.66
MV-45	18.70 ± 2.4	1.27 ± 0.54	3.96 ± 2.85	2.1 ± 2.2	
MV-47	1.66 ± 0.51	2.02 ± 0.73	0.8 ±1.9		0.3 ±0.54
MV-49	0.00 ± 0.7	1.56 ± 0.63	3.04 ± 1.49	2.8 ± 2.4	1.36 ±1.51
MV-50	7.74 ± 1.33	3.09 ± 0.87	2.12 ± 2.09		1.95 ±1.35
MV-51	2.92 ± 0.67	3.15 ± 0.93	3.2 ±3.0	3.2 ± 3.0	5.15 ±3.45
MV-52	3.80 ± 0.73	4.00 ± 1.02	4.15 ± 2.2	2.8 ± 2.8	2.16 ±1.92
MV-53	3.25 ± 0.69	2.89 ± 0.87	1.55 ± 1.27	8.95 ± 4.2	
MV-54	3.87 ± 0.75	2.38 ± 0.84	4.51 ± 2.6	4.4 ± 3.5	2.18 ±2.97
MV-55	2.38 ± 0.65	1.57 ± 0.63	0.80 ± 1.44	3.33 ± 2.79	
MV-56	1.97 ± 0.59	1.48 ± 0.66	1.11 ± 1.01	2.1 ± 2.3	2.05 ±2.83
MV-57	0.03 ±0.29	1.34 ±0.058	1.71 ± 0.93	-.12 ±1.78	
MV-58	2.08 ±0.54	1.02 ±0.5	0.58 ±1.03	-.12 ± 1.83	
MV-59	0.31 ± 0.26	1.76 ± .67	2.19 ± 2.0		2.56 ±2.91
MV-61	11.2 ±1.6	2.97 ±0.95	3.68 ±2.43		

Sources for above tables from USGS: DOE/ID-22124, DOE/ID-22130, DOE/ID-22133, DOE/ID-22141; DOE-IDO-22161; DOE/ID-22152; DOE/ID-22169; DOE-ID-22176

The above table unit's abbreviation - pCi/L - stands for pico curies per liter or one trillionth of one curie per liter. The maximum contaminate levels (MCL) for selected radioactivity and selected radionuclides in drinking water are established by the Environmental Protection Agency. For comparison, the MCL for the beta emitter strontium-90 is 8 pCi/L, and the MCL for cesium-137 it is 120 pCi/L based on an average concentration assumed to produce a total body or organ dose of 4 millirem per year. The MCL for gross alpha particulate radioactivity is 15 pCi/L.

It is important to recognize that staying just below the MCLs will probably not protect human health. Public health goals are typically 0 for radionuclides. For a listing of beta emitter limits in pCi/L to equal 4 mrem/yr for an individual radionuclide, see Thatcher's report table referenced below. [9]

Tritium, although a beta emitter, is considered separately with MCL 20,000 pCi/L. Gross alpha is limited to 15 pCi/L, excluding uranium, Uranium is limited to 30 micrograms/L, and combined Radium-226/-228 is limited to 5 pCi/L.

As with all water sampling techniques, there is a range of uncertainty from instrument and sampling procedure variation. So the sample concentration is stated as the mean or middle of the uncertainty range which in turn is stated as plus or minus (±). A slight increase or decrease in different samples from the same well may be a result of this analytic uncertainty or variation. A major component of uncertainty is the standard deviation which varies with each sample. USGS uses a factor of two times the sample's standard deviation to identify the uncertainty range which is noted as a plus or minus number after the mean concentration number. The USGS uncertainty range appears to vary widely between sampling periods.

For instance the average uncertainty in 1989 and 1990-92 sample campaigns was about 21 percent whereas the average uncertainty in 1994-95 was nearly 60 percent. More detailed testing of a broad range of isotopes may be needed to identify the sources of this well contamination. The State INL Oversight Program, Idaho State University, and the Environmental Research Foundation are also doing testing, however their instruments are according to USGS, a thousand times less sensitive than the USGS's National Water Quality Laboratory. The usefulness of the above tables is to demonstrate trends in contaminate levels in the Snake River Aquifer south of the INL and factor this information into waste management decisions.

For more information see "Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters, Environmental Defense Institute Special Report, By Tami Thatcher, December 31, 2016 (updated January 2017) available on EDI's website including the following Thatcher reports:

* "The Hidden Truth About INL Drinking Water, A Long Legacy of Aquifer Contamination at INL;" http://environmental-defense-institute.org/publications/INLdrinkwaterR1.pdf
* INL Contamination and the Snake River Plain Aquifer – The Essentials"; http://environmental-defense-institute.org/publications/aquiferRev4.pdf
* "An Alarming Change in the Status of Technetium-99 in the Vadose Zone and Aquifer at INL"; http://environmental-defense-institute.org/publications/alarmingtc2.pdf
* "Important Long-Lived Contaminants at INL's RWMC Not Remediated." http://environmental-defense-institute.org/publications/RWMCunrem.pdf

9 Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters, Environmental Defense Institute Special Report, By Tami Thatcher, December 31, 2016 (updated January 2017) http://www.iem-inc.com/information/tools/maximum-contaminant-levels-for-water .

Section I.I. General Accounting Office Report

The DOE's mismanagement of its INL nuclear operations has a very long history. Investigations finding violations are so common and frequent, yet no fundamental changes in sue because there is no accountability that deals with the underlying causes. DOE contractors responsible just consider fines as a "cost-of-doing-business" that are factored into the contract fees and passed on to the taxpayer. This scenario will keep repeating until criminal charges are included on responsible management for violating laws that impact worker and the public health and safety.

The INTEC formerly Idaho Chemical Processing Plant (ICPP) was temporally shut down in 1989 for Resource Conservation Recovery Act (RCRA) violations. Despite the loss of its mission of extracting highly enriched uranium from spent reactor fuel, DOE plans to rebuild the ICPP to current standards so that it can maintain its nuclear materials production capacity. See Section II(A). Responding to public concerns, Senator John Glenn (D-OH) requested that the Congressional General Accounting Office (GAO) conduct a study on INL.

Environmental Problems at DOE's Idaho National Engineering Laboratory (GAO-RCED-91-56) was released April 15, 1991. "The Energy Department faces immense cleanup and environmental compliance problems at INL," stated Glenn. "Although DOE and its contractors recognize the scope of this problem, their continued failure to meet compliance deadlines could harm the health and environment of our citizens as well as our national security." [Glenn(a), 4/15/91]

According to the GAO report: "there are releases of radioactive and hazardous contaminates into the soil, groundwater and drinking water at INL. Tons of hazardous substances, such as chromium, were directly injected into the Snake River Plain Aquifer - an important fresh-water source for the region. [Ibid.]

"The Idaho Chemical Procession Plant [ICPP], which manages spent nuclear navy reactor fuel, has been shut down since July of 1989 due to costly replacement of 6,000 feet of radioactive waste pipes and 11 large-scale underground waste tanks. The shut-down was triggered after INL officials discovered that an underground pipe had corroded through -- leaking unknown quantities of high-level radioactive waste to the environment. According to GAO, the pipe failed because it was `incompatible with corrosive waste it carried' and lacked a secondary containment as required by federal environmental law." [Glenn (a)]

"Currently, DOE has identified over 200 inactive waste sites at INL, which, according to the GAO, `could be a continuing source of contamination to the Snake River Plain Aquifer.' Large quantities of plutonium wastes were dumped at INL that have migrated as far as 110 feet toward groundwater. Four injection wells disposed large quantities of trichloroethylene that have contaminated drinking water wells above federal and state limits." [Glenn (a)]

"Another major [Resource Conservation Recovery Act] RCRA-related containment problem involves waste storage tanks. Of most concern are eleven 300,000 gallon underground waste storage tanks at the chemical processing plant's tank farm. These stainless steel tanks are used to store the highly radioactive acidic wastes resulting from the nuclear fuel reprocessing operation before the wastes are calcined into a solidified granular form. The tanks were cited for incompatible secondary containment because of a June 1989 EPA inspection at the plant. The tanks have a form of secondary containment because they are encased in individual concrete vaults designed to contain leaks. Yet, EPA determined that the vaults do not meet secondary containment standards because of material incompatibility with liquids stored in the tanks." "...five of them [tanks] are considered especially vulnerable. This is because their containment vaults consist of several concrete panels, grouted at the seams that are more likely to leak or breach in a major earthquake than the six other tanks.”

"At both the Chemical Processing Plant and the Radioactive Waste Management Complex, as well as at other INL locations, DOE has identified problems associated with storing its mixed wastes. The problems involve, among other matters, the storage of (1) mixed wastes without having EPA-approved treatment technologies available, (2) stored nuclear fuels that may qualify as mixed wastes subject to RCRA requirements, and (3) mixed transuranic wastes in configurations that do not meet RCRA storage requirements. According to several DOE officials, these issues could ultimately result in RCRA related lawsuits and/or shutdowns of other INL facilities if they are not resolved." [GAO (b) @ 5-6]

"A second RCRA-related storage issue at INL involves nuclear fuels that may contain hazardous constituents. Under RCRA, DOE was required to seek permits to continue various operation involving the handling, treatment, storage, and disposal of hazardous wastes. DOE did not include the nuclear fuel storage operation at INL in its permit applications because it did not identify the fuels as mixed wastes subject to RCRA -- these fuels are classifiable as special nuclear materials under the Atomic Energy Act. In this regard, DOE did not originally consider any of the materials in the fuels to be subject to RCRA, even though some of the fuels stored at INL contain hazardous constituents such as cadmium, silver, metallic sodium, or metal carbides." [GAO(b) @ 6-7]

"DOE has not estimated the total costs that would be involved in cleaning up all of INL's inactive waste sites, but partial estimates indicate the cost will be substantial." [GAO @ 9]
"Included in the [GAO] report are 113 environmental findings related to air and water protection, waste management activities, cleanup of inactive hazardous waste sites, protection against toxic and chemical materials, National Environmental Policy issues, quality assurance, and other issues ... including an additional 317 safety and health findings." [GAO (b)@ 19]

Then Idaho Governor Andrus stated that, "Nationally, the DOE's waste management practices remind me of a credit card consumer who is nearing the $1000 limit on his charge card. DOE has charged $999, but now wants to make another purchase. Unfortunately, we have reached the limit on waste and it's time to pay the bill. We must, as a nation, come to grips with the problem, address it honestly and solve it. Unless and until the waste dilemma is solved all new projects are in jeopardy and DOE will encounter increasing reluctance on the part of the public and public officials to support open ended assurances that waste management is really being addressed."[Andrus(b)]

Idaho Health and Welfare has identified 27 violations of State environmental laws at INL. Although unenforceable, the fines would add up to $115,000. Violations included air, water, hazardous materials handling, waste tanks, waste percolation ponds and trenches. [IDH&W Notice 6/5/91] In a more recent notice of violation (3/21/96), the State Division of Environmental Quality levied enforceable fines on INL totaling $317,300 for 61 violations of the Hazardous Waste Management Act.

Battelle Energy Alliance was fined $412,500 for violations of quality assurance requirements and occupational radiation protection by the Department of Energy. The fine, which stemmed from two 2011 incidents involving worker radiation exposure, was announced Thursday. It was included in a letter from John S. Boulden III, director of the DOE's Office of Enforcement and Oversight, to lab Director John Grossenbacher.

Alex Stuckey reports 11/7/12 in the Idaho Falls Post Register: “Start-up delays at the sodium-bearing waste treatment facility on the Department of Energy's desert site have caused the DOE to miss two Site Treatment Plan milestones. The DOE also will miss a milestone on the 1995 Idaho Settlement Agreement because of these delays. "We've had technical issues (with the treatment of this waste)," DOE spokesman Brad Bugger said. "We will eventually complete these milestones."

The Site Treatment Plan was established by the Federal Facility Compliance Act, which requires federal facilities to develop a plan outlining how to handle the generation, storage, treatment and disposal of mixed waste. The DOE is required to submit this plan to the Idaho Department of Environmental Quality every year. Because the DOE missed the milestones, the Department of Environmental Quality could fine the DOE up to $10,000 per day per violation until the milestones are met, Department of Environmental Quality spokesman Brian Monson said.

The delays came in June when nonradioactive material clogged a filter at the Integrated Waste Treatment Unit, which would process the sodium-bearing waste. Sodium-bearing waste contains a low level of radiation, the leftovers from reprocessing high-level radiation spent nuclear fuel. The settlement agreement required the removal of 900,000 gallons of sodium-bearing waste by Dec. 31. The waste is located in tanks at Idaho National Laboratory's Idaho Nuclear Technology and Engineering Center.

One missed milestone is for the date when sodium-bearing waste treatment at the Integrated Waste Treatment Unit must begin. The other is the date when the DOE must submit a schedule identifying the time required for processing the waste in storage. The DOE has asked for an extension on both milestones into 2013. The department will not be subject to a fine until the final determination is made.

Alex Stuckey reports in the Idaho Falls Post Register: “Battelle Energy Alliance was fined $412,500 for violations of quality assurance requirements and occupational radiation protection by the Department of Energy.

“The fine, which stemmed from two 2011 incidents involving worker radiation exposure, was announced Thursday. It was included in a letter from John S. Boulden III, director of the DOE's Office of Enforcement and Oversight, to lab Director John Grossenbacher.

“The letter said the exposure incidents were of "high safety significance." Grossenbacher is president of Battelle Energy Alliance, the contractor that runs the INL facilities on the DOE site west of Idaho Falls. "We agree with the findings and we will pay the fine," Grossenbacher said.

“In an email, INL spokesman Ethan Huffman said the fine will be paid from Battelle corporate funds, not taxpayer dollars. "Our system failed and we came very close to hurting some people," Grossenbacher said. "We were lucky, but we don't operate this place on luck."

“The DOE's preliminary notice of violation cited violations committed by Battelle, including failure to identify processes needing improvement, failure to effectively train personnel to perform their assigned work and failure to perform real-time monitoring.

“The incidents for which Battelle was fined happened: On Aug. 30, 2011, when an operator received an elevated radiation dose to his right hand while processing fuel samples at the Materials and Fuels Complex's Hot Fuel Examination Facility.

“On Nov. 8, 2011, when 16 workers were exposed to plutonium radiation at the building that once housed the Zero Power Physics Reactor at the MFC. At least one worker inhaled the radioactive substance.

“The DOE letter said both incidents involved deficient work control documents and failure to perform work consistent with approved procedures. "Clearly the (November) event was unfortunate and doesn't meet our standards," said Phil Breidenbach, the MFC's mission support director.

"In order to comply with the DOE's recommendations, the MFC has a list of nearly 80 corrective actions it must enact to improve work planning, procedures and training. About 75 percent of the corrective actions already have been put in place, Breidenbach said.

"The DOE has not made public the list of corrective actions. INL officials said none of the 16 workers exposed in the November incident would experience adverse health problems as a result of the radiation exposure. They said the workers exposed to plutonium-239 in November had received radiation that was within the DOE's annual regulatory limit.

"According to the U.S. Environmental Protection Agency website, "internal exposure to plutonium is an extremely serious health hazard. It generally stays in the body for decades, exposing organs and tissues to radiation, and increasing the risk of cancer. "Plutonium is also a toxic metal and may cause damage to the kidneys."

"INL officials, citing the Health Insurance Portability and Accountability Act of 1996, would not release each worker's individual dosage rate. In discussing the November incident, INL officials said that over the past 11 months, more than 1,400 analyses were performed on 228 different biological samples. A solubility study also was performed to determine the rate at which the inhaled radiological material is dissolving and exiting the body.

Section I. 1. Tiger Team Report on INL

To show how poorly DOE managed INL, former DOE Secretary Watkins established a special investigative "Tiger Team" comprised of environmental, health and safety experts to evaluate the DOE sites. The Tiger Team investigated INL in July 1991 and characterized the site as an extremely complex entity with a diverse multi-program mission. This diversity of organizations/contractors and the fact that programs at the INL are sponsored by several offices at DOE Headquarters, has contributed substantially to the overall complexity of the Tiger Team assessment. The following deficiencies were cited in 1991:

1. "The programs required to achieve full compliance with current Environmental, Safety, and Health (ES&H) requirements and to ensure progress towards excellence have not been developed and implemented at the INL.
2. Of particular concern is the lack of oversight of construction, EG&G Idaho's semi-autonomous departments and a particularly deficient radiation protection program, and a pervasive lack of attention to detail at the Chem Plant.
3. No environmental expertise was on staff within the Argonne Area at INL and that several deficiencies that related to the validity of data produced or used by the Radiological and Environmental Sciences Lab for the calculation of dose to members of the public from radiological releases.
4. There is doubt about the ability to accurately measure emissions and calculate dose as a result of unplanned releases.
5. Staff and management training and experience in the recognition of OSHA hazards are severely lacking at the INL.
6. INL has a lack of a comprehensive, cohesive management approach, and virtually no independent ES&H oversight program.
7. INL operations office lacks an arms-length relationship with the contractors resulting in

ineffective management of the process of awarding of fees which are several areas fundamental to successful operations at the INL but for which the performance level is deficient.

8. Both the large number and the significance of the non-compliance found throughout INL and its contractors are particularly troubling considering that the overall Tiger Team initiative has been underway for more than two years." [Tiger Team]

Section I.2. Inspector General's Audit of INL

DOE's Inspector General conducted an audit of INL's construction projects in October 1995 which revealed that $26.4 million in construction projects were unneeded. The audit report states that, "[INL] continued to pursue and budget for these projects because it did not (1) consistently verify the need for these projects; (2) independently identify and evaluate alternatives; (3) reassess the need for these projects in light of the Laboratory's current and foreseeable mission requirements." [WR-B-96-03 @ 5]

The auditors randomly selected 52 projects out of a total of 290 projects at the INL. Seven of those 52 randomly selected projects were found not to be needed due to downsizing at the site. The 52 projects represent a high (18%) random sample rate that is statistically more reliable than a lower sample rate. Those seven projects represent a 13% problem rate that is statistically significant. The auditors do not acknowledge this important fact and recommend a more extensive review be conducted on the other 238 projects. Is there an unstated basis for not recommending a complete construction audit?

The report specifically cites DOE/ID and Lockheed Martin reassessment deficiencies as the cause of $26.4 million in unneeded construction spending. If DOE/ID is not conducting adequate independent verification of need in the construction projects, it stands to reason that problems in other areas of operations may also exist. The report fails to recommend any additional audits in other operational areas.

The auditors recommended canceling the $1.3 million parking lot upgrade project at the Naval Reactors Facility because it was not needed. Why is funding for these Defense Programs coming out of DOE's Environmental Management (EM) budget in the first place, is the real question that needs to be asked. Also see Section III(A).

While it is indeed heartening to see the Department continuing to exercise management control over its field operations, one need only review the August 1991 Tiger Team Assessment of INL to see that little has changed. Clearly, the Department needs to develop a new and effective management process, otherwise the old culture will continue to thumb their noses at headquarters. To his credit, former DOE Secretary Admiral Watkins understood that the field offices were out of control and initiated a more centralized management structure. Secretary O'Leary appears not to understand the mistakes of the past and is attempting to decentralize again (back to the DOE Secretary Harrington era) before the old culture is changed. This is a fundamental mistake in our view.

The audit also found that the Department's Project Management System (Order 4700.1) was violated when a $3.3 million construction project was split into three separate projects in an attempt to circumvent line item budget requirements. Field offices "...are responsible for ensuring the proper classification of all construction projects. Specifically, this Order requires the Department's field elements to classify all projects exceeding $2.0 million as line item construction projects, and to obtain approval from Congress before initiating these types of projects." [WR-B-96-03 @ 13]

The audit found, however that a Westinghouse Idaho Nuclear Company official split into three other projects a $3.3 million voice paging and evacuation system upgrade project "...because he believed the Department would not approve the entire project as a single line item." ... "The Office of Inspector General believes that Idaho's internal controls are weak in detecting and preventing future instances of project splitting. Accordingly, the Idaho Operations Office should also consider this condition when preparing its year end assurance memorandum on internal controls." [WR-B-96-03 @ 13, 14]

Despite the Inspector General's audit, DOE headquarters awarded Lockheed Martin a bonus of $14.15 million on top of operating costs for a job well done in 1995. [AP(d), 1/4/96] The Government Owned Contractor Operated (GOCO) system DOE uses together with cost plus contracting is fertile ground for abuse. Fines imposed on contractors are simply factored in as a cost of business that also offers the government fig leaf cover to any challenge to its inadequate oversight.

Section I. J. Earthquake & Volcanic Hazard

A major hazard that INL faces is "Climate Disaster" that looms within the next decade over nuclear operations. The time imperative of one-two decades of sea/river rise and storms/hurricanes/tornados that are a product of "Climate Disaster" must be included in the calculous of "natural" disaster. DOE's delays in completing nuclear waste cleanup will be severely impacted because regular life on the planet will become nearly impossible.

As the Associated Press said: "As reactors melt down and release radiation in the wake of a 9.0 earthquake in Japan, it's natural to wonder about the safety of the nuclear facility near Idaho Falls, 100 miles upwind of Jackson Hole.

"The Idaho National Laboratory sits in the middle of a seismically active area where more than 9,300 quakes occurred between 1972 and 2007, according to its website. The largest of those quakes was the 7.3-magnitude Borah Peak temblor in 1983, which killed two children in Challis, caused an estimated $12.5 million in damage and lifted the state's highest peak by 7 feet.

"Although there are fault lines in the surrounding ranges, the nuclear lab is located in the Snake River plain, where only minor quakes — less than 2.0 in magnitude — have been recorded since the monitoring system was installed, according to the facility's website."

The AP reported in 2008"Scientists watch unusual Yellowstone quake swarm [just east of INL]: Scientists are closely monitoring more than 250 small earthquakes that have occurred in Yellowstone National Park since Friday. Swarms of small earthquakes happen frequently in Yellowstone. But Robert Smith, a professor of geophysics at the University of Utah, says it's very unusual to have so many over several days. The largest tremor was Saturday and measured magnitude 3.8. Smith says it's hard to say what might be causing the tremors but notes that Yellowstone is very geologically active. An active volcano there last erupted 70,000 years ago." [Scientists watch unusual Yellowstone quake swarm, Associated Press CHEYENNE, WY December 29, 2008]

DOE continues to understate the geologic risks at the INL. The Arco and Howe seismic faults shown in the 1991 New Production Reactor Draft Environmental Impact Statement (DEIS) maps are not consistent between maps. (DEIS(a)Vol. 2, 4-59 and 4-60) The faults shown seem to mysteriously disappear under the INL site and then reappear on the other side of the site. Moreover, if the DEIS 4-59 and 4-60 seismic maps are superimposed on the 4-57 Volcanic Rift Zone map one can easily see that the faults match the rift zones.

A rift, as defined by the American Geologic Institute dictionary is: "a long, narrow continental trough that is bounded by normal faults; a graben of regional extent. It marks a zone along which the entire thickness of the lithosphere has ruptured under extension." This dictionary also states that rift zones have associated volcanic activity. Therefore, a rift zone by definition contains faults, very deep seated ones that have the potential to erupt lava. [Schlak]

A 1977 EIS of INL found that, "Faults near Arco and Howe extend south and southeast toward the INL. The Arco Fault is 30 miles from ANL-W and the Howe Fault is 20 miles distant. Other INL studies postulate subsurface extensions of these faults to within six miles southeast of ANL-W." [ERDA-1552 @ I-56]

Idaho's former Governor Andrus criticized the Department of Energy's (DOE) seismic risk assessment process. "To provide the state of Idaho with a better understanding of the seismic risk assessment process, we have repeatedly requested technical observer status on the panels that are determining seismic hazard assessments. To date, the state has been denied access to the assessment process. We believe that impartial state representation would promote greater confidence in seismic findings." [Andrus(a)]

INL had an earthquake zone 3 rating prior to a 1982 that gerrymandering of the site reduced to a zone 2 (See Idaho Earth Quake Risk Figure). Zone 3 is the same seismic category as San Francisco. The strongest earthquake in United States recorded history, the Yellowstone quake, occurred in 1959. This quake had its epicenter only 137 miles from INL. The largest earthquake on the Centennial Tectonic Belt in Idaho (7.3) occurred in 1983 along the western flank of Borah Peak (Lost River Range) approximately 40 miles northwest of Arco. The largest earthquake within the Inter-mountain Seismic Belt (7.5) occurred in 1959 near Habgen Lake, 90 miles from the site. As a result, a new seismic zone of 4 was created adjacent to the INL site. In January through June 1994 a swarm of earthquakes hit Soda Springs, ID 60 miles south-east of the site - the largest reached 5.8 on the Richter Scale according to USGS. Among the 1994 quakes included the Draney Peak earthquake of 3 February 1994 (5.9) and Challis earthquake of 7 June 1994 (5.1) on the Richter scale.

A limited review of INL's 1979 to 1981 Quarterly Seismic Reports revealed that DOE contention in INL Environmental Impact Statement that the Snake River Plain is "aseismic" is unjustified. The following quakes were registered on or originated on the Snake River Plain: [RE-P-79 to 82 series]

Seismic Activity on Snake River Plain 1979-81

Year	Number of Quakes	Magnitude Richter Scale
1979 2nd Quarter	100	(5) greater than 3.0
1979 4th Quarter	68	0.1 to 1.1
1980 2nd Quarter	2	1.0
1980 4th Quarter	116	0.5 to 3.3
1981 1st Quarter	91	0.1 to 2.8
1981 4th Quarter	120	0.4 to 3.5

[RE-P-79 to 82 series]

Four rift zones and their related faults underlying INL from southwest to northeast

Rift Zone	Fault
Arco	Lost River Range
Howe East Butte	Lemhi Range
Lava Ridge/Hells Half Acre Circular Butte/Kettle Butte	Beaverhead Range

The 1988 Final Environmental Impact Statement for the Special Isotope Separator (SIS) did a seismic analysis of the INL site. "Based on the proximity to the INL and the likelihood of generating sizable earthquakes, the faults considered to be of most significance to the proposed SIS are the range front faults located along the western flanks of the Lost River, Lemhi, and Beaverhead Ranges." ... "It is apparent from extensive geologic investigations as well as historic evidence that the Lost River, Lemhi, and Beaverhead Faults are capable of producing large Magnitude 7 - 7.5 earthquakes in the future." [SIS@3-19]

"Detailed work on the Arco segment of the Lost River Fault indicates an average slip rate of 0.1 - 0.12 meters per 1000 years during the past 160,000 years. The fault has not ruptured in the past 30,000 years."... "If the slip rate has been constant, the fault has a potential strain accumulation of 3 meters (9.8 feet). Since characteristic earthquakes along the Lost River Fault produced less offset than this, it could be concluded that the Arco Segment is overdue and should have ruptured 10,000 - 20,000 years ago." [SIS@3-21]

"If an earthquake does occur, it seems most likely that it will be epi-centered approximately as far away from the INL as was the Borah Peak Earthquake, and that it will have approximately the same magnitude." ... "In the less likely event that an earthquake would occur on the Arco or Howe Segments during the lifetime of the SIS, ground motion would be stronger."... "Predicted peak ground accelerations were calculated assuming a 7.25 magnitude earthquake on either the Arco or Howe Segments approximately 30 kilometers (18 miles) from the proposed SIS site. Utilizing attenuation curves calculated for the INL by Tera Corp .... a peak horizontal ground acceleration of 0.22 g is predicted." [SIS@3-19] [ERDA-1552@I-57]

If DOE's geologists had applied an equivalent earthquake magnitude of the Borah Peak (7.3) to their calculations, the ground acceleration might well approach or exceed the structural strength of the ICPP high-level waste tanks of .24 g. (See Sec.I(E)(2) "Five of them [tanks] are considered especially vulnerable. This is because their containment vaults consist of several concrete panels, grouted at the seams that are more likely to leak or breach in a major earthquake than the six other tanks." [GAO (b) @4-5]

The State of Idaho commissioned a limited study by Boise State University seismologist James Zollweg, and University of Idaho seismologist Kenneth Sprenke, who found that "if a large earthquake struck, the biggest worry would be those tanks." Zallweg's assessment was endorsed by U.S. Geological Survey's Larry Mann who said, "that would be a catastrophic release. It could not be intercepted before reaching the aquifer." Zollweg calculated that, "if an earthquake of 7 on the Richter scale hit the fault closest to the tanks, a ground acceleration of about 0.24 g could hit the vaults". [Statesmen (b)]

A catastrophic risk exists with these forty-year-old tanks which DOE refuses to address. The tanks are 400 feet above the Snake River Plain Aquifer that provides drinking water for over 275,000 Idahoans. Scientists also believe that if the tanks fail, then the acids in the tanks will react with the concrete in the vaults, releasing large amounts of radioactive gases into the atmosphere.

Zollweg and Sprenke's 1995 report titled *Review of INEL Seismographic Networks and Seismic Hazard Program*, also challenged DOE's seismic monitoring and characterization. DOE's seismic instruments are set so high that only two earth quakes were registered in the last 20 years.

Zollweg notes that in 1994 alone there were five earthquakes with magnitude greater than 5 within 150 km of INL that were not recorded on DOE instruments yet were felt on INEL. These unregistered quakes include the 5.9 Draney Peak earthquake of 3 February 1994 and the 5.1 Challis earthquake of 7

June 1994. [OPTR 95-01@52]

Consequently the available data understates the seismic activity in the region and draws into question DOE's claim that the INL lies in an aseismic zone. The report further criticizes DOE for not including multiple fractures within a given seismic event as is more common. The researchers emphasize the current knowledge gained from "surprises" such as the 1994 Los Angles and the 1995 Kobe, Japan quakes because these cities sit on alluvial sediments (like INL) which earlier were thought to attenuate or cushion shocks from underlying ruptures, but which actually magnify the shocks at the surface. Zollweg further challenges DOE censure of their own seismologist Ivan Wong's subsequent work for political reasons, because the department did not like Wong's findings. Zolweg and Sprinke's conclusions list the following safety issues:

"1.) Characterization of the maximum credible earth quake (MCE) on the southern Lemhi and Lost River faults. It is our opinion that the Mw 7.0 MCE chosen in [DOE's] Wong et al. (1992) is not sufficiently conservative in view of the faulting behavior of typical large Basin and Range province earthquakes. We recommend the Lemhi fault MCE be chosen on the basis of simultaneous rupture of three to four segments, and the Lost River fault MCE be chosen on the basis of rupture of the entire length of the Lost River fault south of the southern terminus of the faulting in the 1983 Borah Peak earthquake. Directivity effects should be considered as part of the analysis, since rupture propagation on these faults in the general direction of INEL could potentially produce larger ground motions at INEL than bilateral rupture or unilateral rupture away from the INEL.

"2.) Amplification characteristics of the basalt-sediment inter-beds underlying the northern part of the INEL. Theoretical modeling suggests that the inter-beds may attenuate surface motion, but this work has largely been based on 1-dimensional calculations and we believe that 3-D effects have not been adequately modeled. We recommend that the inter-bed effects on seismic waves be directly measured, taking advantage of an existing deep borehole which is known to penetrate into the rocks below the inter-bedded stratigraphy." [OPTR 95-01@69-70]

Complete seismic monitoring, documentation and analysis must be independently developed by the State in addition to a study that addresses the recurrence rates of these large earthquakes and the impact on INL facilities such as the high-level waste tanks. Seismic analysis of INL reactors also documents non-compliance with current codes.

Also see Section I.J.1 NRF FEIS Incomplete Seismic Vulnerabilities page 38 for more information on NRF Seismic hazards.

The Advanced Test Reactor (ATR) vessel "spacer bolt loads and support skirt radial bolt loads exceeded allowable values." Loads on the support skirt bolts were calculated at 76 kips and the yield load of the bolts was 43 kips. [RE-A-78-038 @ 16&18]

The ATR's Emergency Firewater Injection System (EFIS) would be inoperable during a design basis earthquake. The purpose of the EFIS is to inject firewater into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during reactor operation or shutdown.

The ATR was built in 1963 in accordance with national building code standards applicable at that time, but it was not built to earthquake standards. Because the EFIS does not meet current seismic codes and because of the potential firewater piping hanger failure, engineers declared the system technically inoperable. This means the system is functional but documentation does not support operability for the full range of intended safety functions (i.e. earthquakes). [OE-95-35]

The ATR and its SNF storage canal also has no containment building currently required around commercial nuclear reactors to contain radioactive releases in the event of an accident. The Navy is claiming the ATR is exempt from NRC standards. The ATR continues to operate today - primarily conducting materials testing for the Nuclear Navy.

"The problem has been that the analysis to assure that equipment is adequately designed typically has not been followed through end-to-end. The more frequent seismic events, say one-in-one-hundred-year events, generate smaller forces for equipment to withstand. Only the essential equipment for assuring safety need meet seismic design criteria. Low hazard facilities need only be designed to withstand these

lower intensity earthquakes. The Advanced Test Reactor is a DOE hazard category I reactor.3
"It is required to withstand a higher intensity earthquake, analogous to a commercial reactor because of its releasable curie inventory. Equipment essential for safety during or following a seismic event is required to be capable of withstanding a large seismic event, the size of which is determined by the INL's seismic characterization for ATR's precise location and DOE regulations." [1]

"The Engineering Test Reactor (ETR) now closed, primary coolant system was designed in the late 1950's with no consideration for seismic loading. The system was designed according to standard piping practices of that time and presently does not meet certain criteria in the ASME Boiler and Pressure Vessel Code." [ER-E-77-102 @ 1] The Materials Test Reactor (MTR) also closed spent fuel storage facility has been cited by DOE investigators as extremely vulnerable to seismic activity. [Spent Fuel Working Group 11/93]

Analysis of the ETR building revealed that it also did not meet structural code. Among many violations was a concrete block wall that was over-stressed by a factor of 2.5. [RE-A-77-027@21]

None of INL's reactor buildings can contain radiation in the event of an accident. Current NRC standards require a sealed reinforced concrete containment building with the structural capacity to withstand explosions and contain radiation emissions from the reactor vessel and/or related equipment. Both the ETR and the MTR have been D&D but operated in unsafe condition for decades putting the public at risk.

The ICPP Calcine silos are also at risk according to a 1977 INEL Environmental Impact Statement. "The occurrence of an earthquake of magnitude near 7.75 (Richter Scale) with an epicenter at the Arco Scrap fault, about 20 mi. west of the ICPP, would produce a maximum credible ground acceleration at the storage area of above 0.33 g (the design basis earthquake)." ... "The bin anchor bolts possibly might shear, and with anchor bolt failure some damage may be inflicted on bin vent piping above the bins." ... "No damage would be anticipated- if the ground acceleration was 0.18 g." [ERDA-1536@II-95] These bins must be continuously cooled due to the heat generated by the radiation which the cooling coils keep at 480^0. Bin Set # 1 is in the worst shape and must be prioritized for D&D.

An October 1992 DOE report prepared by Westinghouse Nuclear has generated an investigation about the safety of key facilities used to store high-level radioactive waste at INL. The report questions the ability of the ICPP-603 Underwater Fuel Storage Facility to withstand an earthquake. In the event of a quake, heavy corrosion in the facility could create leaks into the environment, the report said. Corrosion on the fuel storage baskets and the yokes they hang from may cause a criticality (an accidental uncontrolled nuclear chain reaction). Because the facility outlived its design life, equipment failures were frequent and costly. Under pressure, DOE finally emptied the CPP-603 SNF storage pool but the decades of leaks from the unlined pool significantly contaminated the underlying aquifer.

WINCO's Standing Root Cause Committee Report 6/14/93 compiled by S.P. Gearhart outlines over 20 years of knowledge of ICPP-603 safety/criticality SNF storage problems. The report even documents many remediation projects to correct the same problems that were funded but the work was never done; and the government never followed up to confirm completion of the work. "Even when the operating contractor was able to secure funding, the funds were spent on FDP startup and other fuel reprocessing facilities, and fuel storage did not receive much priority." [SPG-31-93 @ 15]

Irradiated Fuel Storage Facility; Though DOE has moved the spent fuel out of the CPP-603 pools, the Irradiated Fuel Storage Facility in CPP-603 remain in use as a dry fuel storage area. Public pressure forced DOE in 1998 to construct a concrete sheer wall in CPP-603 along with some modifications to the overhead cranes that move the fuel from trucks to the storage space but there is no

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[1] Tami Thatcher, May 2015 Volume 26 Number 4 *Weakest Link Matters in Seismic Assessment*, Hazard category I with a class A reactor is the highest Department of Energy hazard designation. But don't ignore Hazard category II facilities—they span the gamut of releasable hazard but cannot be categorized as higher than category II because they are not nuclear reactors.
The Advanced Test Reactor is Department of Energy regulated and U.S. Nuclear Regulatory regulation and oversight do not apply. The Defense Nuclear Facility Safety Board visits some INL facilities when their mission is deemed to involve defense material. DNFSB currently deems ATR outside its scope.
http://www.environmental-defense-institute.org/publications/News.15.May.Final.pdf

mention of any modification to the inadequate ventilation or fire suppression systems. Old SNF represent a significant hazard due to deterioration of cladding caused by irradiation.

DOE's 1995 seismic analysis of existing facilities postulates an earthquake magnitude of 7 on the Richter scale generating an acceleration of 0.24 g. However, a DOE's 1995 Natural Phenomena Hazards Mitigation Conference in Denver generated a contradictory report by Ivan Wong titled *Microzonation for Earthquake Ground Shaking at the INL* which shows accelerations as high as 0.30 g on their probabilistic seismic hazard map contour through the RWMC, TRA, and NRF. [Wong @ 27]

These findings are more in line with the previously discussed Zollweg and Sprenke conclusions. These differences in interpretations are not just an academic exercise when catastrophic radioactive releases into the environment are at stake.

Building 607 at INL's Test Area North previously held the core debris from the wrecked TMI reactor in pools of water yet the building did not meet current standards for seismic performance, compliance with electrical code, ventilation and filtration systems, and other requirements which would be applicable to the storage of nuclear fuels. The pool now closed, built in 1954, was also unlined and had no leak detection system. Because of these deficiencies, it was stipulated in the 1995 court settlement that the Three Mile Island fuel in the pool be moved out by 2001.[DOE/EA-1050@4-5]

The Naval Reactors Facility Expended Core Facility built in 1957 does not meet current seismic building standards. Water Pits 1, 2, and 3 were only constructed to "Zone 2 earthquake requirements which were judged to be appropriate under the USGS's classification of the area at the time [1957] of their construction." [INL DEIS @ B-18]

Subsequent (1979) USGS requirements for INL raised that standard to zone 3, then in 1982 INL was gerrymandered back to a zone two. As previously discussed, it is an open debate as to whether the zone three should be reinstated. Since the superstructure of ECF was built in 1957, it too does not meet code requirements.

Earthquakes in INL Region between 1900 and 1973*

Distance in Miles from INL Site

Magnitude Richter Scale	50 - 60 Miles	60 - 70 Miles	70 - 80 Miles	80 - 100 Miles
5.8 to 4.9	0	0	0	3
4.8 to 3.8	1	2	3	15

*** 1983 Borah Peak quake with its epicenter 40 miles from INL registered 7.3, the 1994 Draney Peak of 5.9 and the 1994 Challis with 5.1 on the Richter Scale within 60 miles.**

Naval Reactor Facility (NRF) Seismic Vulnerabilities

The EIS failed to adequately assess the Expanded Core Facility (ECF) seismic vulnerabilities.

The FEIS states: "**The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards.**" [2] [Pg. S-6]

Despite this statement, NRF intends to continued use of the ECF for decades and does not specify exactly what modifications will be made and what independent seismic assessment will be made to demonstrate compliance.

FEIS states: "Seismic Hazards Refurbishment Period: There would be **moderate** impacts from

[2] Final Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling, October 2016, DOE/EIS-0453-F, Pg. S-9, herein after referred to as FEIS.

seismic hazards until refurbishment activities are complete. Activities during the refurbishment period would improve the building's ability to withstand vibratory ground motions from seismic activity. Post-Refurbishment Operational Period: There would be small impacts from seismic hazards since the refurbishment actions would improve the building's ability to withstand vibratory ground motions from seismic activity." [Pg. S-33]

FEIS states: "Seismic Hazards: Differences in impacts from seismic hazards from the alternatives are related to the ability to withstand vibratory ground motions under each alternative. Since there would be no additional refurbishment or upgrades to ECF for the No Action Alternative, the facility and supporting infrastructure **would continue to degrade for a period of 45 years**. During the refurbishment period of the Overhaul Alternative, **to the extent practicable,** infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions. "During the **construction and transition periods** of the New Facility Alternative, **there may be upgrades or refurbishments to ECF,** to ensure operations continue in a safe and environmentally responsible manner**.** [Pg.S-72]

What do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously, this is slippery non-committal language that has no business in this FEIS and must raise RED flags to EPA/IDEQ regulators.

The above FEIS statement contradicts the fact that NRF intends to continue ECF operations for over 3 additional decades. Additionally, the FEIS fails to offer requisite detail on what exactly these ECF "upgrades" will be.

"During the **refurbishment period** of the Overhaul Alternative**, to the extent practicable**, infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions."

Again, what do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously, this is slippery non-committal language that has no business in this FEIS and must raise RED flags to regulators. Repeating a false statement over and over does not make it true.

FEIS states: "During the construction and transition periods of the New Facility Alternative, there may be upgrades or refurbishments to ECF, to ensure operations continue in a safe and environmentally responsible manner. During the transition and new facility operational periods, the structures, systems, and components in the new facility would be designed to the **appropriate natural phenomena hazard category to withstand vibratory ground motions."** [FEIS Pg. S-72]

Only careful reading reveals that only the NEW Facility portion covered in this EIS will be built to "appropriate natural phenomena hazard category to withstand vibratory ground motions" cleverly giving the impression that the ECF is included.

B. Seismic Vulnerability of Storing Highly Enriched SNF in ECF

The FEIS states: "Naval nuclear fuel is highly enriched (approximately 93 weight percent to 97 weight percent) in the isotope uranium-235 (235U). As a result of the high initial uranium enrichment, very small amounts of transuranic radionuclides are generated by end of life when compared to commercial spent nuclear fuel." [Pg.1-3]

This Navy high burnup SNF ECF is the most hazardous material in the world requiring deep geological disposal for hundreds of thousands of years due to the long-lived radio-isotopes produced in nuclear reactors. The current ECF inventory of ~400 assemblies constitutes a significant unregulated hazard in the event of accidental loss of canal coolant water.

"Since the 1990's, U.S. reactor operators are permitted by the U.S. Nuclear Regulatory Commission (NRC) to effectively double the amount of time nuclear fuel can be irradiated in a reactor, by approving an increase in the percentage of uranium-235, the key fissionable material that generates energy. In doing so, NRC has bowed to the wishes of nuclear reactor operators, motivated more by economics than spent nuclear fuel storage and disposal. Known as increased "burnup" this practice is described in terms of the amount of electricity in gigawatts (GW) produced per day with a ton of uranium." [3]

"Given these uncertainties the U.S. Department of Energy (DOE) and the NRC have provided general estimates of the radionuclide content of spent nuclear fuel based on current and previous burnup assumptions. According to DOE the estimated average long-lived radioactivity for a typical PWR and BWR assembly having lower burnup at the time of geological disposal are 88,173.69 curies and 30,181.63 curies respectively. 29 For current burnups the NRC estimates that the post discharge radioactive inventory of spent fuel for a typical PWR and BWR assemblies are 270,348.26 curies and 127,056.67 curies respectively.[4] **Approximately 40 percent of the total estimated radioactivity for lower and high burnup is Cs-137**." [5] [emphasis added]

The FEIS ECF accident source terms do not list Cs-137.[6] This represents another significant deficiency in this FEIS. The Navy uses zirconium clad fuel that adds to storage hazards.

"Zirconium cladding of spent fuel is chemically very reactive in the presence of uncontrolled decay heat. According to the National Research Council of the National Academy of Sciences the buildup of decay heat in spent fuel in the presence of air and steam: " is strongly exothermic – that is, the reaction releases large quantities of heat, which can further raise cladding temperatures… if a supply of oxygen and or steam is available to sustain the reactions. The result could be a runaway oxidation – referred to as *a zirconium cladding fire* – that proceeds as a burn front (e.g., as seen in a forest fire or fireworks sparkler)...As fuel rod temperatures increase, the gas pressure inside the fuel rod increases and eventually can cause the cladding to balloon out and rupture.[original emphasis]" [7]

The FEIS states: "Naval spent nuclear fuel consists of solid metal and metallic components that are nonflammable, highly corrosion-resistant, and neither pyrophoric, explosive, combustible, chemically reactive, nor subject to gas generation by chemical reaction or off-gassing. Naval spent nuclear fuel is primarily from pressurized water reactors (PWRs)." [FEIS Pg. 1-3]

C. Seismic Vulnerabilities of ECF Degraded Concrete Basin

There are some crucial unknowns the FEIS failed to assess.

1. Is the ECF basin concrete already to degraded to allow continued operation?
2. What radiation cumulative level has the ECF basin been exposed to now and in 10 years? 10 x E 10 rad? More? Less?
3. Will the fuel in the ECF (or some fraction of fuel) melt/burn if water is removed and the fuel is uncovered?
4. Will the concrete or structural materials above the ECF actually fail if temperatures rise because of fuel heat up? Interesting that it has not been brought up as an issue before, but perhaps that is because the fuel melting temperature of fresher fuel assured fuel melt before such structural damage.

Defense Nuclear Facility Safety Board conducted a review of the newer INL/INTEC CPP-666 SNF Basin concrete foundation. "The [Fuel Storage Area] FSA Pool Structures is a passive design feature of the FAST facility. **Additional calculations performed to increase the allowable floor loading to support the FSA Reracking Project indicated that the original design objective to allow an empty**

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[3] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, citing : Foot Note 29: U.S. Department of Energy, Final Environmental Impact Statement, for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, 2002, Appendix A, Tables A-7, A-8, A-9, A-10, (PWR/ Burn up = 41,200 MWd/MTHM, enrichment = 3.75 percent, decay time = 23 years. BWR/ Burn up = 36,600 MWd/MTHM, enrichment = 3.03 percent, decay time = 23 years.)

[4] Alvarez citing: U.S. Nuclear Regulatory Commission, Characteristics for the Representative Commercial Spent Fuel Assembly for Pre-closure Normal Operations, May 2007, Table 16, p.44-45. http://pbadupws.nrc.gov/docs/ML0907/ML090770390.pdf

[5] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, Pg. 5

[6] FEIS Pg. F-35

[7] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, December 17, 2013, pg. 8.

pool to be adjacent to a water filled pool resulted in overstresses during the [Design Basis Earthquake] DBE.” [8] [DFNSB Pg. A-4]

FEIS fails to fully analyze the ECF refurbishing part that includes empting sections so epoxy leak prevention remediation can proceed. Calculations of shifting ECF SNF on the concrete degraded basin foundations ability to withstand the “overstress” concurrently with a DBE are absent.

It is highly likely that the ECF concrete walls have received an aggregate gamma ray dosage far in excess of that necessary to severely degrade the concrete, thus increasing seismic vulnerabilities. Maintaining ECF water levels should a significant seismic event (earthquake) occur are problematic. The FEIS fails to fully analyze these fundamental issues in the Hypothetical Accident 4.13.2.2.

For continuously wetted concrete (no stainless steel liner) an aggregate dose of 10 x E10 rad (10 x E8 gray) is the limit. For dry concrete the limit is not known. The few pieces of data available from the X10 reactor in Oak Ridge, Tennessee and the Temelin reactor in the Czech Republic suggest that the allowable dose to avoid structural degradation and failure is 500 to 2,000 times lower than for wetted concrete (i.e., 5 x 10E6 rad).

The catastrophe hazard from an ECF basin drain down event is more than extreme. Such an event must be prevented at any cost. Once a drain down begins it cannot be stopped. Once the fuel is exposed no human or robotic response is possible - of any kind. A current example is Japan’s Fukushima reactor/SNF storage disaster.

The accident will then proceed to its ultimate termination independent of human intervention. Temperatures inside the ECF structure will likely rise to levels sufficient to cause the concrete to fail and the building to crumble in on itself. The human exclusion zone for direct radiation exposure will likely be 1-2 km in all directions. No access will be possible in this zone for decades. Once fuel fails and radioactive atmospheric releases that zone will be pushed farther out (likely much farther out). Access to respond to the event may not be possible in or through that zone for centuries.

FEIS must provide independent engineering assessments of ECF basin concrete. Alternatively, using civilian fuel (since Navy fuel details are classified) as a surrogate; what is the concrete heat profile and rad profile of used civilian fuel? How far is it from the walls and floors of the basin? Then do some estimates of shielding and voile you have estimates of dose. Doing that correctly requires details about the fuel, and a complex set of radiation calculations that have a lot in common with optics problems. Gamma rays are light after all. The fuel is opaque to it, as are the water and concrete. Some of it is absorbed and heats the fuel, water and concrete. Several different interactions occur that shift the energy spectrum and generate secondary radiation. The most accurate way to assess all of this is to actually measure it.

What you will likely find is that the surface of the concrete probably exceeded 10 x E10 rad after 10-20 years. It is likely now that the concrete 6-10 inches in has exceeded that same dose. The concrete 'paste' likely has little to no strength in 6-10 inches from the surface.

The temperature issue is different. So long as there is some cooling and the fuel is over 20 years old, there is not much heat to remove. If the basin water is lost, during an earthquake or severe leak, the rad field can be extreme. That prevents human entry. Lacking human entry the systems fail. When ventilation is lost heat then builds up having only convective and radiative cooling to keep things under control. [9] With limited ventilation, the temperatures inside the structure will rise substantially. If newer fuel is present, this could get out of hand quite quickly creating a second barrier (after the lethal rad fields) to human entry. The potential then is that following a basin drain down that uncovers the fuel that the accident progresses of its own accord to complete loss of control of the basin and failure of the fuel. It is likely that no recovery will ever be possible at that point. The accident proceeds to final completion

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[8] DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Pg. A-4.

[9] A DNFSB review of the newer INL/INTEC CPP-666 Fuel Storage Area (FAST) water basin found “[T]he Confinement Ventilation System is degrading due to facility aging. This degradation could result in future operational downtime, radiological contamination and personnel exposure.” DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Executive Summary.

(whatever that is) entirely outside of human ability to influence it.

The concrete dose serves to heat the concrete failing it prematurely. This is well known. And it served to hide the insidious damage to the concrete, as that is waived away as being all thermal damage, and then assessing that the concrete in the basin hasn't seen high heat, so it will not fail. For instance, the rad dose damage gets ignored. There are also an equally large but still handful of data points for dry concrete exposed to radiation. That data was thrown out in developing the standards for what radiation dose concrete can withstand. The data was discarded on the presumption that the early weakening was attributable to heat. The experience at Temelin and X-10 show that to be wrong. The concrete wasn't heated.

Another way to think about this is that at a microscopic scale, absorbed radiation heats the concrete at nearly the atomic level. The heat damage is then limited to a small volume. But continue doing this over 50 years in a large SNF ECF basin and the problem becomes a stochastic one of adding up all of the random little damages into one large failure. This can lead to a large uncontrollable leak and extended loss-of-coolant.

Yet another way to consider it is that the radiation serves to boil out the water from the cement paste that forms the backbone of concrete. When the concrete is moist there is water immediately available to cool the local heating and/or to replace the lost water. When the concrete is dry (< about 11% water) these effects are not enough and waters of hydration are lost from the paste to migrate out of the concrete. The paste then chemically changes and falls apart as damage accumulates.

One of the papers on this considered two different dose rates and times to accumulate the same aggregate dose or different doses. What they observed was very interesting. The time until the concrete was weakened remained the same despite the differing dose rates. In other words, the effect seemed to be caused by some critical radiation insult and then the passage of time. This is hugely concerning as it brings into question the entire safety basis and the possibility that the damage is essentially done in the first few days. It then just takes time for the basin concrete to fail. The FEIS acknowledges ECF basin concrete degradation.

Section I.J.2. INL Volcanic Hazards

There are also volcanic hazards at INL. Craters of the Moon, a large volcanic flow, next to the INL site was formed 2,000 years ago - a mere blink of an eye in geologic time. Volcanic cones also exist on the INL site. A complete analysis of the potential for silicic ash-flow sheet volcanism in the INL region was not incorporated in 1995 INL EIS studies. Silicic ash-flow sheets represent a sizable portion of the geologic history of the Snake River Plain and are characterized by the most violent eruption histories. INL is in the middle of the Snake River Plain (SRP). Flying over the SRP, the volcanic flows dominate hundreds of square miles making it look like a moonscape.

To put these seismic and volcanic hazards into perspective, two time frames and facility categories should be analyzed: short-term earthquake hazards on structurally deficient reactors and high-level radioactive waste storage facilities; and long-term hazards of volcanic activity on permanently buried radioactive waste much of which have a half-life of 24,000 years. The eruption of Mt. St. Helens in the 1980's along the Oregon/Washington border along with the Borah and more recent Challis earthquakes would give any reasonable person concern over the wisdom of leaving such radioactive hazards at INL. A National Park Service and US Geological Survey sponsored a study conducted by John Byrd and Bob Smith who said " It looks like the Teton Fault is either on schedule or considerably overdue for a major ground-rupturing earthquake." The quake would measure at least 7.0 and not more than 7.6 on the Richter Scale. [Idaho State Journal(b),AP 12/7/93]

Section II. New Plans for Supersite INL

A. ICPP/INTEC Spent Reactor Fuel Plan

DOE's 1992 *Draft ICPP Spent Fuel and Waste Management Technology Development Plan* (SFP) presented to then Governor Andrus by DOE Undersecretary Leo Duffy generated considerable public concern because it showed DOE's long-term intent to continue spent fuel reprocessing. Processing spent fuel generates large quantities of high-level liquid wastes. These wastes are then incinerated in the ICPP Calcine Facility. This plan outlines an elaborate program for expanding the ICPP into a mass incinerator for foreign, domestic commercial, Navy, and DOE's complex wide spent reactor fuel. [SFP @16&53] Research and development costs, not including any construction, were projected in 1992 to be $467.7 million over six years. [SFP @4] That turned out to be grossly under estimated. DOE's Budget just for FY2017 "Waste Stabilization" dropped $16.8 million from $202.3 in 2016 to $185.5 million that shows dramatic reduction in funds needed to appropriately manage the growing inventory of 267 MT of SNF with projections for additional 22 MT through 2027. [1]

Ostensibly, a primary driver for the ICPP Spent Fuel Plan is the Nuclear Waste Policy Act's Land Disposal Restrictions listed in 40 CFR 268. As of May 8, 1992, DOE was violating the law by continued production of high-level radioactive liquid waste and calcine (residuals after incineration). DOE received an extension of the deadline by demonstrating that they are processing waste for ultimate disposal. Between 15,000 and 20,000 metric tons of foreign and domestic spent fuel is slated for the program. The timing of the shipments is controlled by the 1995 Settlement Agreement between Governor Batt and DOE.

Another driver for the Plan is waste volume reduction to minimize the high cost of future permanent repository space. DOE claims that calcine/incineration offers a volume reduction of seven times [SFP@7], but Jim Werner, former Senior Engineer for the Natural Resources Defense Council disputes that claim. Werner states that:

> "DOE operating records indicate that the ICPP produced 132 gallons of high-level liquid waste per kilogram of [spent fuel] uranium feed. Operating the [ICPP] Fuel Processing Facility, now under construction, to replace the current facility [CPP-601], will generate approximately 380 gal. of high-level liquid radioactive waste for each kilogram of U-235 processed - almost three times the rate documented in 1963. Based on specific gravity of the U-235 of 10.96, approximately 5,000 cubic meters of high-level waste is produced from each cubic meter of U-235 processed. If the calcining process reduces the volume of this high-level waste by a factor of six, then the increase in volume of the U-235 before reprocessing in the ICPP is still more than 900 times. Processing INL's current inventory of 109,198 kilograms of uranium in spent fuel will generate 41,495,350 gallons of high-level liquid waste." [Werner, NRDC Memo, 1/21/92]

EDI concurs with former Governor Andrus that the most appropriate management of DOE, Navy, and foreign spent fuel is to keep it at its current location in dry storage. At some future time if/when a safe permanent high-level nuclear waste repository is developed, the spent fuel could then be shipped directly to that site. EDI considers the new Spent Fuel Plan for processing huge amounts of reactor spent fuel an unacceptable hazard for the residents of Idaho and neighboring states. Andrus's comments on the Plan bring up other important and unaddressed issues.

"The Plan proposes to process the spent nuclear fuels and high-level radioactive wastes into forms that are acceptable for permanent disposal in a geological repository. However, the criteria for determining what forms of waste are acceptable for such disposal have not been established pursuant to the Nuclear Waste Policy Act of 1982."... "The absence of those criteria means that neither the Department [DOE] nor the state of Idaho can be assured at this juncture that the technologies to be developed and applied will process the spent nuclear fuels and high-level radioactive wastes into forms that are acceptable for permanent disposal in a geological repository." [Andrus(b) 6/10/92]
Andrus further challenges that should the acceptance criteria allow spent fuel in "as-is" condition, it makes little sense to process it. "I believe the Department has more than enough graphite spent fuels in storage at INL to develop technologies for processing them for disposal. The Plan does not establish

[1] FY 2017 DOE EM Budget Request to Congress, pg. 121

that the Department requires additional spent fuels from [Ft. St. Vrain] FSV or any other source to conduct this program." [Andrus(b) 6/10/92 @3] "The Department also must provide binding assurances that the Plan will not be used to turn INL into either an interim or permanent nuclear waste repository. Idaho already has assumed its share of nuclear wastes; hence, it should not be required to accept any additional wastes." [Andrus(b) 6/10/92.@5]

A possible explanation for what appears on the surface as an illogical Plan, is that DOE's hidden agenda in this Plan is to rebuild its nuclear weapons materials production capacity under the guise of waste processing. Currently, DOE's old production facilities including the ICPP are violating environmental laws and must be either shut-down or extensively upgraded. Congressional funding and public acceptance will be radically different if DOE was candid about its true mission for the ICPP. Therefore, DOE's subterfuge might be a well-planned ploy to build new nuclear materials production capacity while publicly they claim it is a waste management project.

A clear indication of DOE's hidden agenda can be seen in the Spent Fuel Plan's replacement of high-level waste storage tanks. Four new 500,000 gallon tanks are planned to replace five existing 300,000 gallon tanks. Current storage capacity with eleven 300,000 gallon tanks is 3,300,000 gallons. Removing five old tanks yields a net old tank capacity of 1,800,000 gallons. Four new tanks (2,000,000 gallons) will generate a new capacity of 3,800,000 gallons. This gives a net increase of 500,000 gallon capacity over existing capacity. Existing capacity was adequate for full scale ICPP fuel reprocessing and facility decontamination for nearly fifty years. As of 1997, DOE has put this plan on hold, however the Department retains this option for future production capacity. The fact that as of 2020, INL still has not been able to developed a high-level liquid waste treatment facility. See Guide Section I.E.C for more detail on high-level waste management at INTEC. This means the >67 year old HL waste tanks still have ~1 million gallons with the accompanying leak issue. So the new tanks are a good back-stop if, like Hanford, the HL waste tank leaks are now a critical hazard with not treatment facility in view.

Former Governor Andrus, seeing no other options, filed a suit in US District Court against DOE in June 1993. The safety of spent nuclear fuel storage facilities at INL was seriously undermined by DOE documents that surfaced during litigation between the agency and the State. IT Corp's Spent Fuel Background report [Ryan citing][Sept. 18, 1992 @3-24] cited the Underwater Fuel Storage Facility went into service in 1951 with a design life of 30 years and is not in compliance with current DOE Orders. Its design life has already been exceeded by 12 years. Consequently, pools are not an appropriate location for the long-term storage of spent fuel while a high-level repository is being developed. Another report [Ryan citing][WINCO Oct. 1992 @ 100-01] ,Nuclear Fuel Reprocessing Phase-out Plan for the ICPP, cites that the Underwater Fuel Storage Facility at INL lacks an impermeable liner underneath the storage basins, has no leak detection systems, nor any ventilation of air conditioning systems in the basin area. This report also expresses concern over potential leakage through the basin walls into the environment. [Ryan, Ex. B @ 101] Additionally, the report cites that "recent inspections have revealed gross corrosion of the fuel, baskets, and yokes. The potential for a severe seismic event to cause a criticality has not been fully evaluated yet but is a concern." [Ryan @ 50] In his summary judgment against DOE, Judge Ryan cites a March 4, 1993 letter from John Conway, Chairman of the Defense Nuclear Facilities Safety Board that cites the following concerns:

> "1.) several unusual occurrence reports issued in 1992 arising from improper fuel storage configurations and degradation of a criticality safety barrier; 2.) safety standards at INL are set too low; 3.) ineffective and/or inadequate inspection practices; 4.) existing detection equipment in some storage pools is inadequate and probably would not recognize a criticality if one were to occur; 5.) independent validation of criticality safety evaluations are not being done; and 6.) the ability of the existing storage facilities to withstand seismic events." [Ryan @ 51]

Judge Ryan also cites that DOE recently discovered in one of the storage areas 25 highly radioactive fuel elements being stored adjacent to each other, and in the same area, corrosion caused a carbon steel hanger to fail that resulted in a bucket containing spent fuel to drop to the floor in CPP-603 now closed. These events occurring in the same area violated the "double contingency" rule (two independent, unlikely and concurrent changes must occur before an accidental criticality is possible). In other words, these events came dangerously close to causing an accidental criticality or nuclear chain reaction at the facility. [Ryan @ 54]

> "The Office of Nuclear Safety also expressed significant concern over the Underwater Fuel Storage Basin at the ICPP. In particular, the Office noted that conditions at the facility have degraded to

> such an extent that the potential for a criticality accident has increased significantly. Particular problems cited in the report included corrosion of fuel storage devices, non-functioning safety devices, storage of spent fuel in unapproved locations, inadequate safety analyses based on inappropriate standards, and failure to follow facility operations procedures." [Ryan @ 53]

DOE's plan to shift spent fuel to the Underground Storage Facility (CPP-749) in order to make room for the Fort St. Vrain spent fuel was challenged by the court because the Environmental Assessment failed to address the fact that the dry wells in the underground facility are nearing the end of their 20-year design life. Furthermore, the most recent annual dry well atmosphere samples from the underground facility showed corrosion occurring in the dry wells, and Westinghouse had expressed concerns about its ability to continue to store spent fuel there safely. [Ryan @ 29]

Judge Ryan concluded that "despite DOE's desire to characterize serious safety concerns as irrelevant, the court finds that the documents are in fact relevant in light of the court's holding that DOE must thoroughly study all of the cumulative effects of the receipt and storage of spent nuclear fuel at INL in a single site-wide EIS. Furthermore, this latest affidavit shows DOE's persistence in down-playing risks and promoting corrective action. The record reveals that significant safety problems have arisen and continue to arise at INL; that DOE has been advised of these problems; and that DOE has failed to take adequate remedial measures. In addition, the record shows that the risks of serious environmental contamination and loss of life increase as additional spent nuclear fuel is brought to INL under these conditions." [Ryan @ 55] Phil Batt succeeded Cecil Andrus as Governor of Idaho in 1994 and, like Andrus, he was forced to continue the legal battle with DOE over INL waste.

In May 1995, DOE released its Record of Decision (ROD) on its Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Environmental Impact Statement ordered by Judge Ryan. This ROD articulates DOE's plan to consolidate its inventory of spent nuclear fuel by fuel type. Aluminum clad fuel goes to the Savannah River Site and non-aluminum fuel goes to INL. This allows "the Department to efficiently stabilize spent fuel for safe interim storage if necessary, or initiate new research and development for stabilization and ultimate disposition." [ROD(1995)@30] Stabilizing fuel is a euphemism for processing. Future spent nuclear fuel disposal scenarios in the ROD include "direct geologic repository disposal (in suitable containers) or processing followed by disposal." [ROD(1995)@30]

DOE, for the time being, appears to have backed away from building new high-level waste tanks described in the EIS, however processing startup will mandate it unless the State and EPA give DOE more extensions on the non-compliant existing tanks. The ROD leaves no doubt that DOE remains committed to rebuilding its nuclear fuel processing capability and that INL is one of its two designated supersites.

Section II. B. 1995 INL State/DOE Nuclear Waste Agreement

On October 17,1995 the long legal struggle between the State of Idaho and the Departments of Energy and Navy came to an end. However, the agreement on nuclear waste shipments to the Idaho National Laboratory (INL) and the removal of accumulated nuclear waste lacks the substance that most Idahoans hoped Governor Batt would have held out for.

Even former Governor Cecil Andrus weighed in with the critics, because the final agreement was significantly different from Batt's original offer that Andrus supported. Andrus' main concern was in the area of enforcement. He expressed serious reservations about whether those provisions in the Agreement would actually be enough to make the government keep its word after a generation of breaking it. The $60,000/day penalties stipulated in the agreement are "subject to the availability of the [Congressional] appropriations." [Batt(b)] Idahoans must remember that it is the present Congress that is trying to reinstate sovereign immunity back into the laws. The Republicans in Congress are writing language into the Superfund Reauthorization Act that exempt federal officials from fines and penalties for violating the law.

Andrus' main criticism was directed at Idaho's Congressional delegation, more specifically its senior Senator Larry Craig who left Batt with no choice but to cut what Andrus indicated was an unacceptable deal for the resumption of radioactive dumping in Idaho.

According to an Associated Press interview, Andrus stated that "I'm not going to second guess

Governor Batt." ... "But, I think what we have to do is look at how he found himself in the position of having to negotiate; and that was because Larry Craig did not give Idaho the support he should have." Andrus went so far as to say he believed Craig conspired with others wanting shipments to resume to make sure they did.

The most troubling part of the agreement is the State's requirement that, "DOE designate INL as the Department's lead laboratory for spent nuclear fuel." [Batt(b)] The agreement encourages and places no limits on the amount of spent fuel that can be sent to Idaho for processing. Specific expansion projects at the Naval Reactor Facility at INL are mandated " . . . to accommodate the removal of excess material and examination of Naval spent fuel in a dry condition." These "excess materials" are spent fuel parts that are removed to reduce the volume prior to storage/disposal. The Navy alone has dumped more than eight million curies of this excess material at the INL's Radioactive Waste Management Complex in shallow pits and trenches that would not meet municipal garbage landfill requirements. Since this material is part of the spent fuel element, it is extremely radioactive and requires remote handling and special shielded bottom dump shipping containers that allow the waste to be dropped into the burial ground without direct contact with workers. The recent agreement signed by Governor Batt will in fact increase INL's spent fuel processing volumes and proportionally the fuel element parts that are buried above the Snake River Aquifer. Nuclear Regulatory Commission regulations should be imposed on DOE and the Navy and require the entire spent fuel assembly to go to the repository.

In true pork-barrel style, the INL Agreement mandates " . . . for the fiscal 1997 no less than $7 million for the Navy to construct a Ships Model Engineering and Support Facility at the Naval Surface Warfare Center, Acoustic Research Detachment at Bayview, Idaho." Lake Pend Oreille residents have long fought that facility because of the restricted access to the lake. This appears to be a trade between a military instillation in the north and nuclear waste dump in the south of Idaho.

An equally troubling part of the Agreement is the statement that, "In any administrative or judicial proceeding, Idaho shall support the adequacy of the INL Environmental Impact Statement (EIS) and Record of Decision against any challenges by third parties." The State's previous success in court during the litigation phase was because it demonstrated that the EIS was fundamentally flawed. Yet there is no mention in the agreement to correcting those flaws. In fact, the State is now prepared to defend DOE against the Snake River Alliance suit that challenges the adequacy of the EIS. The Land and Water Fund of the Rockies is representing the Alliance in their suit.

The importance of the EIS cannot be overstated, because it is the only detailed plan that lays out what the government is going to do with its nuclear waste and how it is going to do it. The EIS is also an open process that allows for public participation and comment on its adequacy.

The waste agreement calls for DOE to "ship **ALL** Transuranic waste now located at INL, currently estimated at 65,000 cubic meters in volume to the Waste Isolation Pilot Plant no later than 2018." [emphasis added] The stated waste volume suggests that the state is only requiring DOE to ship Transuranic waste that is in storage and not the transuranic waste in the burial grounds. This is a serious shortcoming because it is the buried waste that is migrating into the aquifer and should be prioritized for being exhumed and prepared for shipment. The TRU waste buried and stored at INL's RWMC prior to 1984 that falls between the 10 and 99 curies per gram is currently and technically not TRU waste and therefore falls through a huge crack in the Governor's Agreement. DOE has taken full advantage of this loophole and rebury this former TRU waste at a new dump site at INL or simply put it back into the pit as in the Advanced Mixed Waste Treatment remediation where only 10% of the high-level/TRU waste is removed for shipment to WIPP. See Section IV.F below for more information on Radioactive Waste Management Complex Subsurface Disposal Area cleanup where the Advanced Mixed Waste Treatment Project (AMWTP) is located.

DOE is allowed under the agreement to ship foreign reactor fuel to INL under a national security and non-proliferation policy. On the surface, it is logical to keep this material out of the hands of rogue countries that have a history of terrorist activities. However, closer analysis of the countries shipping spent fuel to the US under this non-proliferation policy shows quite another picture. In descending order based on volume of spent fuel shipped, Canada, France, Japan, Netherlands, and Sweden rank as the top five. These top five countries represent nearly 75% of the total foreign shipment volumes. [AR-RF-1158] Idaho is faced with very serious problems just dealing with the waste already on the INL site. As a state, Idaho has shouldered more than its share of the Cold War legacy. Therefore, it is reasonable to expect that the above listed countries take responsibility for resolving their own nuclear waste problems.

The waste agreement also allows DOE to bring off-site nuclear waste to INL for treatment prior to shipment to a non-Idaho waste repository. The same fundamental principles apply to off-site waste treatment as to accepting foreign waste. Generically speaking, waste treatment plants are incinerators that by definition will release volatilized radionuclides and chemicals out the stack. This may be unavoidable to get the on-site waste into a stable form that will not continue to migrate into the environment. However, Idahoans should not have to bear the burden of process emissions from other states or foreign country's waste. INL released more than 18.5 million curies of radioactivity into Idaho's air over the past 50 years. There are limits to the amount of a radioactive biological burden a given population can endure. On October 24, 1995 the Shoshone-Bannock Tribes blocked a shipment of Navy nuclear waste to the INL when they attempted to cross Indian lands. Tribal Chairman Dealbert Farmer stated:

"The State of Idaho and Governor Batt do not represent nor speak for the Shoshone-Bannock Tribes." "The State of Idaho had no authority to agree that any nuclear waste shipments would cross the Fort Hall Indian Reservation." "The Navy and the Department of Energy have never communicated with the Tribes to obtain permission to cross the Reservation." "The Shoshone-Bannock Tribes are very concerned about the stockpiling of nuclear waste at the INL, the aboriginal lands of the Shoshone-Bannock Tribes, and the 40-year period that the federal government has to remove the high-level waste from Idaho." "All of the waste, in and out of INL, will cross the Fort Hall Reservation." "When our ancestors signed the Fort Bridger Treaty of 1868, they reserved the Fort Hall Reservation as the permanent homeland of the Shoshone and Bannock people." "We are entrusted with the continuing obligation to uphold the Treaty and protect and preserve our lands and people." "The federal government, which has an Indian policy, must understand that we are here to stay and our concerns must be addressed." [Shoshone]

On October 26, 1995 the Tribes agreed to ten shipments crossing the reservation while negotiations proceed with DOE, Nuclear Navy, Department of Transportation, and Department of Justice.

The waste Agreement also gives DOE another 17 years to complete calcining (solidifying) the high-level liquid wastes at INL's INTEC/Idaho Chemical Processing Plant tank farm. This is an unnecessary and unsupportable delay. These single wall tanks are over 63 years old and pose the most serious health and safety hazard on the site. The previous volume of over two million gallons in eleven tanks represent a potential radioactivity content of 155.8 million curies. Extensive calcination and evaporator concentration of the Tank Farm has brought down the volume to 3 tanks containing a volume of ~900,000 gallons. INL's tank waste problem is similar to DOE's Hanford Nuclear Reservation tank problem. By State imposed DOE deadline of 2012 the tanks will be sixty years old. Their original design life of these single wall tanks was less than 30 years. If DOE was forced to prioritize the high-level liquid waste processing, the job could be completed in less than five years.

Also giving DOE forty years to remove all high-level waste only shifts these burdens on to future generations. The federal government broke every promise and contract it has ever made with the State of Idaho on nuclear waste. This includes the contract with the commercial nuclear utilities to take possession of their spent reactor fuel by 1998.

The agreement mandates [Section F(1)] the designation of "INL as the DOE's lead laboratory for spent fuel." This lays the policy/ infrastructure ground work that initially will be research and development but later will be a national nuclear waste processing center. This designation is also consistent with the Spent Nuclear Fuel Programmatic Environmental Impact Statement Record of Decision, which the agreement also specifically supports. [Section J(1)]

The Materials Fuels Complex formerly the Argonne-West (ANL-W) Electrometallurgical / Pyroprocessing Technology project, currently funded by Congress, is the first step in the direction in establishing this spent nuclear fuel processing capacity. Despite its official designation as a demonstration project, the pyro-processor is being built to full production scale. [See Section VI(L)]

The agreement [Section II.B)] sets no limits on importing spent nuclear fuel (SNF) to Idaho "after a permanent repository or interim storage facility is operating and accepting shipments of spent nuclear fuel from INL." Legislation introduced in Congress [HR-1020; S-1271][Craig's bill] promises to overrule regulatory requirements and State of Nevada objections in order to open the Yucca Mt. high-level repository and Monitored Retrievable Storage (MRS) facilities. This legislation mandates an MRS at

Yucca Mt. by the end of 1998. Therefore, if these bills pass, there will be no impediments to waste shipments to INL.

The need to process spent nuclear fuel to prepare it to meet yet to be determined waste repository acceptance criteria has no credible policy or technical basis. Former Governor Andrus was correct when he stated that spent fuel could be sent directly from the generator to the repository and it required no processing. Spent fuel processing also includes the removal of excess materials to reduce the volume prior to storage/disposal. The agreement, because it encourages increased spent fuel processing, will increase the volume of these spent fuel parts to be dumped in Idaho as is currently the case.

Unlimited processing of off-site Transuranic waste is also provided for in the Agreement [E(2)(a)]. "Any Transuranic waste received from another site for treatment at the INL shall be shipped outside of Idaho for storage or disposal within six months following treatment." The Agreement only mandates the removal/off-site disposal of **stored** Transuranic (TRU) waste at INL. The State and DOE are quick to say that the **buried** TRU waste is covered by the Federal Facility Agreement/ Consent Order (FFA/CO). This is true however, the FFA/CO only specifies that the burial grounds will be evaluated for re-mediation. There is nothing in the FFA/CO that requires that the buried waste be exhumed and shipped to a repository despite the fact that it is the buried waste that is contaminating the soil and groundwater. Recent Superfund Record of Decisions (SL-1 and BORAX-1 burial sites at INL) stipulate no re-mediation except for a thin soil/rock radiation shielding cover. This is indicative of DOE's unwillingness to dig up buried waste and the State/EPA's unwillingness to press for real cleanup. Notwithstanding the Pit-9 demonstration project that exhumed some of the contents of this one pit, there is no certainty that other pits, trenches and waste holes will be dug up. Indeed, the Congressional cuts to DOE's environmental restoration budget strongly indicate that no money will be available to fully remediate this dump site. The Pit-9 treatment facility will likely only be used later to treat off-site waste for future disposal in a repository if/when one is ever opened.

An even more troubling problem is the complete reliance by our public officials on the Waste Isolation Pilot Plant (WIPP) to solve all of the TRU waste disposal needs. The WIPP Land Withdrawal Act (Public Law 102-579-Oct. 30, 1992) and the subsequent 1998 Record of Decision specifically limits WIPP capacity to 6.2 million cubic feet (175,637 cm). DOE's 1994 Integrated Data Base Report [DOE/RW-0006.Rev.11] shows the following TRU waste inventories.

Commercial & DOE Complex TRU totals	141,000 cm	Buried
	104,000 cm	Stored
	137 cm	Stored remote handled
	245,137 cm	
WIPP Capacity	175,637 cm	
	69,500 cm	WIPP Capacity Short fall
INL TRU totals	57,100 cm	Buried
	64,800 cm	Stored Contact Handled
	80 cm	Stored Remote Handled
	690,000 cm	TRU Contaminated Soil*
	811,980 cm	INL TRU Total Inventory
WIPP Capacity	175,637 cm	
	636,343 cm	WIPP Capacity Short fall
DOE Complex TRU Estimate Inventories in the year 2020		
	105,000 cm	Current Stored Inventory
	154,000 cm	Newly Generated
	259,000 cm	TRU total in 2020

The above figures show that even with WIPP, there is not adequate capacity to take INL's TRU waste let alone the rest of the DOE complex volumes. If the contaminated soil is not included INL's TRU waste would dominate 70% of WIPP's capacity. The situation is even more serious when the estimated TRU inventories in the year 2020 are compared to the WIPP legally mandated capacity. Moreover, there is no national discussion to initiate the siting process for another TRU waste repository. Due to accidents at WIPP in 2016, the site currently remains closed. The same capacity issues would have existed if the Yucca Mt. high-level waste repository in Nevada had ever opened where the total commercial and DOE inventories are far greater than the original design capacity.

Section II. C. Proposed New Reactors (By Tami Thatcher)

Small Modular Reactors

There are numerous Small Modular Reactors being designed; so far none have been licensed or built. DOE has "approved" of building one at INL called NuScale. SMRs are less than 300 megawatts and the hope is to offer shorter construction time tables, less up front financial risk, and economies from manufacturing in one location then transporting to the build site for final assembly. However, even Idaho's Line commission progress report in 2012 noted that SMRs economic viability is currently uncertain.

The Department of Energy has provided research money for SMRs and in 2012 began a program to provide licensing support. SMRs will be licensed by the US Nuclear Regulatory Commission.

Of numerous designs, the improved safety of a single SMR is unlikely to compensate for the higher risk of multiple units, each capable of meltdown. SMRs will be susceptible to accidents, terrorist acts, and do not address the problem spent fuel storage problem.

Tami Thatcher reports in EDI's newsletter [2] that: "The Idaho Falls Post Register reported on September 29, 2020 that the city of Kaysville, Utah, has withdrawn from the NuScale small modular reactor (SMR) project slated to be built at the Idaho National Laboratory.1It was reported on September 20 that the cities of Logan and Lehi, Utah, had also withdrawn. [3]

"The city of Kaysville, Utah is one of many member cities that are in the Utah Associated Municipal Power Systems (UAMPS). UAMPS's "Carbon Free Power Project" would put about 30 various member cities in Utah, California, Idaho, Nevada, New Mexico and Wyoming on the hook for the NuScale nuclear reactor rising estimated construction costs. UAMPS cities have until October 31 to exit the NuScale project.

"The Idaho Falls Post Register reported that the "Portland-based NuScale Power is designing the small modular reactors, which will produce 720 megawatts and which UAMPS plans to build at the DOE desert site west of Idaho Falls. The plant is expected to be operational in 2029." [4] 3

"The 720 megawatts (MW) figure assumes the facility has installed all twelve reactor modules and the modules are all running at full capacity of 60 MW. But the reality is that far less than 720MW would be generated. Initially only a few modules will be constructed—either that or NuScale will have to manufacture heat exchangers for all twelve modules, test them and hope the unique design for the heat exchangers was acceptable. So, while the NuScale facility could ultimately house twelve reactor modules, it would seem that only a few modules will be constructed and tested, perhaps redesigned and retested... for many years after the promised 2029 date.

"Another issue is that the NuScale's license application is only for 50 MW per module. A reactor license change would be required to uprate from 50 to 60 MW per module. And the newly proposed cooling tower fans are going to use more energy than more water intensive stay shutdown after inserting control rods. This and other NuScale safety problems indicate that uprating to 60 MW may not be a simple or inexpensive matter. The estimated benefits of assuming 60 MW per module seem to already be factored into electricity cost estimates. In addition, the NuScale design certification application was for conventional pressurized water reactor nuclear fuel of low enrichment, perhaps 3 or 4 percent. Promoters envision using 20

[2] Tami Thatcher, Another UAMPS City Withdraws from Proposed NuScale Small Modular Reactor Project Proposed to be built at the INL, EDI newsletter October 2020, http://www.environmental-defense-institute.org/publications/News.20.Oct.pdf

[3] The Editorial Board, The Idaho Falls Post Register, "Editorial -City Council should remain committed to SMR project," September 20, 2020

[4] Nathan Brown, The Idaho Falls Post Register, "Kaysville withdraws from nuke project," September 29, 2020.

percent uranium-235 enriched fuel. What is now considered "high burnup fuel" in the commercial reactor industry is near 6 percent. The Idaho National Laboratory is making High Enriched Low Assay Uranium (HALEU) of roughly 20 percent enrichment from higher enriched fuel at the Materials and Fuels Complex and increasing the INL's annual radiological air emissions 170-fold in doing so. [5] It is likely that the many changes to the original NuScale design certification are going to be costly as well as time consuming. UAMPS signed on to purchase 150 MW. The Department of Energy signed on to purchase power from one module and lease another module for a research and testing. [6] When NuScale writes that the full twelve module facility would be capable of generating 720 MW, it unlikely that even half of 720 MW would be generated for many years after 2029 and until many design issues are resolved."

Traveling Wave Reactor

Research is being conducted for Bill Gates Terrapower Traveling wave reactor. The hype is impressive. The realities are that this fast reactor concept is unlikely to overcome the huge hurdles that billions of dollars spent worldwide have not.

TREAT Reactor Restart

The transient reactor test facility (TREAT) reactor is being refurbished for resumption of nuclear fuels testing at INL. The reactor's design allows testing materials to mimic accident conditions involving sodium-cooled systems. TREAT was first operated in 1959 and last operated in 1994. [7] [8]

Versatile Test Reactor (VTR)

The Department of Energy has announced a public scoping period for DOE/EIS-0542, which evaluates the potential environmental impacts of alternatives for a versatile reactor-based fast-neutron source facility (VTR) and associated facilities for preparation, irradiation, and post-irradiation examination of test and experimental fuels and materials. The DOE/EIS-0542: Notice of Intent is at https://www.energy.gov/nepa/downloads/doeeis-0542-notice-intent

The VTR would be a small (approximately 300 megawatt thermal), sodium-cooled, pool-type, metal-fueled reactor based on the GE Hitachi PRISM power reactor. DOE projects approval for the start of operations to occur as early as the end of 2026.

Under the INL VTR Alternative, DOE would site the VTR at the Materials and Fuels Complex (MFC) at INL and use existing hot-cell and other facilities at the MFC for post-irradiation examination. This area of INL is the location of the Hot Fuel Examination Facility (HFEF), the Irradiated Materials Characterization Laboratory (IMCL), the Experimental Fuels Facility (EFF), the Fuel Conditioning Facility (FCF), and the decommissioned Zero Power Physics Reactor (ZPPR).

The Department of Energy's Environmental Impact Statement (EIS) must evaluate its alternatives for a versatile reactor-based fast-neutron source facility and associated facilities with more realistic assumptions regarding the continued buildup of radionuclides in our food, water and air. The EIS must evaluate not only the least severe accidents that are considered "credible" but also the severe accidents that it may deem in theory to be "incredible." And the EIS cannot continue to poison workers and the public, and especially our children but deny the harm by using outdated and wrong radiation health models. The Department of Energy must address the existing buried waste at the INL as well as the high-level waste that DOE intends to "reclassify" so that it never leaves Idaho. The DOE must address its unsolved spent nuclear fuel and radioactive waste problems in the EIS as well as the creation of more spent fuel and radioactive waste by the VTR.

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[5] See the Environmental Defense Institute newsletter for January 2020 article "Idaho National Laboratory on Track to Escalate Airborne Radiological Releases by a Factor of 170," at http://www.environmental-defense-institute.org/publications/News.20.Jan.pd

[6] NuScalepower.com website https://www.nuscalepower.com/newsletter/nucleus-spring-2019/powering-the-next-generation-of-nuclear

[7] Thatcher, Tami see; http://www.environmental-defense-institute.org/inlrisk.html Comments on Draft Environmental Assessment for Resumption of Transient Testing of Nuclear Fuels and Materials, Tami Thatcher, 1/10/2014

[8] http://environmental-defense-institute.org/publications/TREATcommentsFINAL.pdf

See Tami Thatcher's Public Comment Submittal on the Department of Energy Scope of an Environmental Impact Statement for a Versatile Test Reactor, ID: DOE-HQ-2019-0029-0001 Comment submittal by Tami Thatcher, September 2, 2019. [9]

The Department of Energy includes as "Potential Environmental Issues for Analysis" the following (this is a partial list):

* Item 1: "Potential effects on public health from exposure to radionuclides under routine and credible accident scenarios including natural disasters: Floods, hurricanes, tornadoes, and seismic events."
* Item 2: "Potential impacts on surface and groundwater, floodplains and wetlands, and on water use and quality."
* Item 3: "Potential impacts on air quality (including global climate change) and noise."
* Item 4: "Potential impacts on waste management practices and activities." [10]

Tami Thatcher's comments [11] (items) above for adding necessary depth and realism for each of these are provided below:

Item 1: "Potential effects on public health from exposure to radionuclides under routine and credible accident scenarios including natural disasters

"For Item 1, first of all, many of the reactor meltdowns that have occurred worldwide have been deemed "incredible." Three Mile Island Unit 2's meltdown in 1979 was incredible. The Chernobyl nuclear power plant accident in the Ukraine was incredible. The Fukushima Daiichi Nuclear Power Plant meltdowns in Japan were incredible. So, for the Department of Energy to address only those reactor accidents that it deems "credible" is to leave out the most important severe reactor accidents and their horrendous consequences. The assessment of which accidents are "credible" has all too often been indefensibly overly optimistic because of the many ways that an accident can be caused.

"The EIS must include severe accident consequences even if DOE considers the accidents to be incredible. And while the VTR is characterized as a "small" reactor (approximately 300 megawatt thermal), other DOE materials testing reactors have posed high hazards because of the high enrichment and high burnup, the lack of a containment, lack of filtered release, the lack of well-designed and well-tested safety systems, and the uniqueness of the design that makes design and computational errors harder to detect. The EIS must also include the very lax regulatory environment of the Department of Energy which is even worse than the U.S. Nuclear Regulatory Commission. If this reactor was designed to proper seismic design standards for a reactor, it would be the first time in the history of the INL that this would be the case. Even when adequate seismic design hazards are identified, it requires more diligence than the DOE can muster to actually ensure that all safety equipment and structures are actually adequately designed to meet the designated seismic criteria. The EIS cannot simply assume that all equipment will be adequately designed.

"Second, when the severe reactor accidents for the VTR are considered, the economic consequences must also be included. In the past, the DOE has left out consideration of economic consequences of an accident because they knew how unpopular their projects would be if the public understood that they were literally risking the farm, their property and their livelihoods as well as their lives and health and the health of their children. And it is not acceptable to simply assume that people evacuate and don't eat contaminated food, drink contaminated water and breath contaminated air after the accident.

"Third, the radiation health models that ignore non-cancer health effects, that underestimate the cancer and non-cancer health effects are known to underestimate the health harm of routine and accident ionizing radiation exposure. The inadequacy of the health modeling could have been improved by conducting epidemiology at U.S. nuclear power plants, but no funding for the study was provided.

"**While the penetrating power of an alpha particle is low, the energy imparted to tissue when in the body is very high.** Many alpha emitters such as plutonium and uranium decay not only by alpha decay but also by beta and gamma emission. Beta particle monitoring is often particularly inaccurate.

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9 http://www.environmental-defense-institute.org/publications/ScopeEISVTR.pdf

10 Tami Thatcher comments on; ID: DOE-HQ-2019-0029-0001. Department of Energy: Notice of Intent To Prepare an Environmental Impact Statement for a Versatile Test Reactor. https://www.regulations.gov/docket?D=DOE-HQ-2019-0029

11 Ibid.

Gamma ray monitoring is based on badges worn on the collar but the source of radiation may be beneath the workers feet as is the case when workers work over spent nuclear fuel pools. Workers at INL have also had neutron dose from the Materials Test Reactor neutron beam ad from concentrated fissile materials. Historical monitoring of neutron dose was inadequate.

"The public as well as radiation workers need to keep in mind that, despite what they may have been taught:

- The cancer risk is not reduced when radiation doses are received in small increments, as the nuclear industry has long assumed. [12]
- Despite the repeated refrain that the harm from doses below 10 rem cannot be discerned, multiple and diverse studies from human epidemiology continue to find elevated cancer risks below 10 rem and from low-dose-rate exposure. [13]
- The adverse health effects of ionizing radiation are not limited to the increased risk of cancer and leukemia. Ionizing radiation is also a contributor to a wide range of chronic illnesses including heart disease and brain or neurological diseases.

"The public and radiation workers take cues from their management that they should not be concerned about the tiny and easily shielded beta and alpha particles. DOE-funded fact sheets often spend more verbiage discussing natural sources of radiation than admitting the vast amounts of radioactive waste created by the DOE. The tone and the meta-message from the DOE, the nuclear industry, is that if you are educated about the risks, then you'll understand that the risks are low. Yet, these agencies continue to deny the continuing accumulation of compelling and diverse human epidemiological evidence that the harm of ingesting radionuclides is greater than they've been claiming.

"The biological harm that ionizing radiation may cause to DNA is mentioned sometimes but it is emphasized that usually the DNA simply are repaired by the body. And the training to radiation workers will mention that fruit flies exposed to radiation passed genetic mutations to their offspring but workers are told that this phenomenon has never been seen in humans even though, sadly, the human evidence of genetic effects has continued to accumulate. Birth defects and children more susceptible to cancer are the result." [14]

"Gulf War veterans who inhaled depleted uranium have children with birth defects at much higher than normal rate. The same kinds of birth defects also became prevalent in the countries were citizens were exposed to DU. There are accounts to suggest that the actual number of birth defects resulting from the World War II atomic bombs dropped on Japan and by weapons testing over the Marshall Islands have been underreported. The Department of Energy early on made the decision not to track birth defects resulting from its workers or exposed populations. But people living near Hanford and near Oak Ridge know of increased birth defects in those communities.

"In radworker training, there may be discussion of the fact that international radiation worker protection recommends only 2 rem per year, not 5 rem per year. There is no mention of recent human epidemiology showing the harm of radiation is higher than previously thought and at low doses, below 400 mrem annually to adult workers, increased cancer risk occurs.

"There is no mention of the oxidative stress caused as ionizing radiation strips electrons off atoms or molecules in the body at energies far exceeding normal biological energy levels. And there is no discussion explaining the harm of inhaling or ingesting radioactive particles of fission products such as cesium-137, strontium-90, or iodine-131; of activation products such as cobalt- 60; or transuranics such as plutonium and americium; or of the uranium itself.

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[12] Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015 This cohort study included 308,297 workers in the nuclear industry

[13] US EPA 2015 http://www.regulations.gov/#!documentDetail;D=NRC-2015-0057-0436 . For important low-dose radiation epidemiology see also John W. Gofman M.D., Ph.D. book and online summary of low dose human epidemiology in "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis," Committee for Nuclear Responsibility, Inc., 1990, http://www.ratical.org/radiation/CNR/RIC/chp21.txt

[14] 2016 newsletter for Ian Goddard's summary and listing of important human epidemiology concerning low dose radiation exposure.

"The volatile or gaseous radionuclides, some of which can't be contained even with air filters — include technetium-99, tritium, carbon-14, iodine-129, argon-39, krypton-85, and radon-222 as the volatile radionuclides dominating the proposed Greater-Than-Class C radioactive waste disposal for the Andrews County, Texas facility. Often radionuclides with low curie levels dominate the disposal harm. **So, when DOE states an overall curie level without stating which radionuclides and their specific curie levels, neither the radiotoxicity nor the longevity of the radioactive waste has been indicated.**

"Uranium and thorium and their decay products may be natural but in concentrated form in drinking water, soil or air, they are harmful. Radioactive waste disposal classification has often left out concentration limits for these radionuclides. Massive amounts of depleted uranium are considered Class a radioactive waste but won't be safe at the end of 100 years but will actually be more radioactive through decay progeny.

"Plutonium-238, plutonium-239, and other transuranic radionuclides in radioactive waste in what appear to be low curie amounts can pose health harm and often dominant radionuclide ingestion doses from migration of the waste to groundwater. GTCC waste includes large amounts of transuranic waste. Only defense-generated transuranic waste approved for acceptance at WIPP can be shipped to WIPP for disposal.

"Cancer rates for uranium are typically based on natural forms for uranium and not chemically altered forms that may be more soluble in the human body. The internal radiation cancer harm is not based on solid epidemiological evidence and there are experts from Karl Z. Morgan to Chris Busby to Jack Valentine that understand that the accepted models may understate the cancer harm by a factor of 10, 100 or more. The nuclear industry continues to ignore the epidemiological evidence that implies tighter restrictions are needed. As you see the cancer mortality risk per picocurie in Table 9, you have to wonder why the disposal of uranium was unregulated and later inadequately regulated for many decades. Uranium dispersal from reactor accidents is typically ignored.

"Table 9. Survey of selected radionuclide inhalation and ingestion lifetime cancer mortality risk.

Radionuclide	Lifetime Cancer Mortality Risk per pCi Inhalation	Lifetime Cancer Mortality Risk per pCi Ingestion	Notes
Cesium-137	8.1E-12	2.5E-11	Strong gamma emission used in aerial surveys. Mimics potassium in the body. Studies of the Chernobyl accident indicate that it is associated with increased risk of blood disorders, cardiac arrhythmias, autoimmune diseases, neuromuscular diseases, reproductive problems and cancer.
Stronium-90	1.0E-10	7.5E-11	Mimics calcium in the body and is a tooth and bone seeker.
Iodine-129	6.2E-12	3.3E-11	Long-lived and mobile fission product found to dominate long-term harm when inhaled or ingested. Collects in thyroid
Technetium-99	1.3E-11	2.3E-12	Long-lived and mobile fission product found to dominate long-term harm when inhaled or ingested. Tc-99 collects in thyroid

Radionuclide	Lifetime Cancer Mortality Risk per pCi Inhalation	Lifetime Cancer Mortality Risk per pCi Ingestion	Notes
Americium-241	2.4E-8	9.5E-11	Bone seeker, see plutonium-239. Don’t be misled by the 432 year half- life because it has many longer lived decay progeny.
Curium-242	1.4E-8	3.2E-11	See plutonium-239
Curium-242	2.3E-8	7.5E-11	See plutonium-239
Neptunium-237	1.5E-8	5.8E-11	See plutonium-239
Plutonium-238	3.0E-8	1.3E-10	See plutonium-239
Plutonium-239	2.9E-8	1.3E-10	ANL fact sheet says laboratory studies with experimental animals exposed to high levels of plutonium can cause decreased life spans, diseases of the respiratory tract, and cancer. Once in the blood stream, plutonium is highly retained in the body, especially in bone and the liver. Plutonium is associated with cardiovascular disease, leukemia, lung cancer, breast cancer, childhood cancers, infant mortality and transgenerational mutations. Uranium, plutonium, americium decay progeny ultimately result in an isotope of lead.
Uranium-234	1.1E-8	6.1E-11	See uranium-238. Uranium-234 is a decay product of uranium-238 and has a much higher specific activity, in curie per gram, than either U-235 or U-238.
Uranium-235	9.5E-9	6.2E-11	See uranium-238
Uranium-236	9.9E-9	5.8E-11	See uranium-238
Uranium-238	8.8E-9	7.5-E-11	Bone, kidney.

Radionuclide	Lifetime Cancer Mortality Risk per pCi Inhalation	Lifetime Cancer Mortality Risk per pCi Ingestion	Notes
			ANL Fact Sheet states: "reproductive effects in laboratory animals and developmental effects in young animals…" Uranium is associated with cancer, miscarriage, still births, childhood cancers, birth defects, infertility, brain disorders, kidney disease and trans-generational mutations. Spent nuclear fuel is usually over 90 percent unfissioned uranium. Uranium is released in reactor accidents and nuclear weapons testing, yet is rarely mentioned or monitored.
Radium-226	2.4E-8	2.9E-9	Radium-226 is a decay product of uranium-238 or plutonium-238 or uranium-234 or thorium-230. Mimics calcium in the body and is stored in bone and teeth
Table source of information: Argonne National Laboratory, EVS, Human Health Fact Sheet, August 2005 at https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf Source used by ANL was Federal Guidance Report 13, U.S. Environmental Protection Agency, 402-R-99-001, September 1999. Picocurie is 1.0E-12 curies. Lifetime cancer mortality risk ignores cancers that were caused but not the cause of death, ignores non-cancer illnesses such as increased risk of heart disease, and ignores genetic effects. Alpha emitters (from most uranium, plutonium and curium radionuclides) are more able to cause double-strand DNA breaks that are mis-repaired.			

"Item 2: "Potential impacts on surface and groundwater, floodplains and wetlands, and on water use and quality"

"The DOE along with the Idaho Department of Environmental Quality are pretending they don't know the source of radiological contamination — even when they do know. The public drinking water laws require periodically monitoring for gross alpha levels in drinking water. If the levels of gross alpha are high enough, often even, then the evaluation of uranium and radium levels are required. But often, in Idaho's public drinking water, the intermittently elevated levels of gross alpha are not explained by naturally occurring uranium and thorium. The regulations actually make it impossible to answer what radionuclides are in the water because methods to use gamma spec analysis have not been delineated for public drinking water use. Public water drinking municipals lose profits when laboratory sampling requirements are increased.

"The intermittently elevated levels of gross alpha in the southwestern portion of the state have been identified in public drinking water sampling and some studies have been conducted. But from what I see, no analysis has seriously tried to answer what the source of the radioactivity is. I say this because no trending over time of radionuclides has been conducted. No identification of all radionuclides in soil and water has been published. No assessment of the potential sources of the radioactivity have been identified. Basically, the Idaho DEQ actively fails to be curious about and seek the answers. Is it the airborne FUSRAP radionuclides? Is it from historical INL aquifer injection wells and percolation ponds that disposed of large amounts of "low-level" waste?

"After contacting the Idaho Department of Environmental Quality to ask why the drinking water on the southwestern side of the state is so radioactive, the Idaho DEQ could not identify anyone at the agency who understood the issue. But the Idaho DEQ did say that there was a report on its website that looked at the issue. It was implied that the report solved the mystery.

"The report 'Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho,' in 2011 [15] does look at the issue — but does not identify the source of the elevated radioactivity. The report confirms the widespread occurrence of sometimes very high uranium concentrations, up to 100 micrograms/liter. The report does conclude that the source is not from agricultural fertilizer. The report suggests that the source is a near-surface source of contamination.

"The mystery is not solved by the report and the report does not conclude that the source of the elevated uranium is natural. The report simply concluded that more work was needed — and there is no evidence that any work has continued since 2011.

"There is another effort afoot to study the issue by Boise State University but so far it has not provided any answers. [16] It states that "The Treasure Valley Aquifer System (TVAS) in western Idaho contains documented uranium and arsenic concentrations, up to 110 microgram/liter and 120 micrograms/liter, respectively…" And "The contaminants historically show elevated concentrations with high spatial variability throughout the region."

"See also our Environmental Defense Institute February newsletter article "What's Up With The Radionuclides in Drinking Water Around Boise, Idaho?" [17]

"The CERCLA cleanup at the Idaho National Laboratory is leaving behind roughly 55 "forever" radioactively contaminated sites of various sizes, and about 30 "forever" asbestos, mercury or military ordnance sites. [18] The areas contaminated with long-lived radioisotopes that are not being cleaned up will require institutional controls in order to claim that the "remediation" is protective of human health. People must be prevented from coming into contact with subsurface soil or drinking water near some of these sites — forever.

"The Department of Energy downplays the mess and usually doesn't specify how long the controls are required when the time frame is over thousands of years: they just say "indefinite." In some cases, the DOE earlier had claimed that these sites would be available for human contact in a hundred or so years.[19] [20] You can find a summary that includes the "forever" sites at https://cleanup.icp.doe.gov/ics/ic_report.pdf

"Institutional control of "forever" contamination means they put up a sign, maybe a fence or a soil cap — and assume it will be maintained for millennia. "Don't worry about the cost. And besides," they always add, "you and I won't be here." The DOE acknowledges that the soil cap they plan to put over the RWMC will require maintenance, basically annually, for millennia.

"DOE continues to find more contaminated sites and expectations are not always met by

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[15] Brian Hanson, Dr. Shawn Benner, Dr. Mark Schmitz, Dr. Spencer Wood, Department of Geosciences, Boise State University., "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," Submitted to the Idaho Department of Environmental Quality, April 2011. http://www.deq.idaho.gov/media/563327-uranium_treasure_valley_0411.pdf listed at http://www.deq.idaho.gov/regional-offices-issues/boise/water-quality-plans-reports/

[16] Gus Womeldorph and Shawn Benner, Boise State University, "A Study of Uranium and Arsenic in the Treasure Valley Aquifer System, Southwestern Idaho, Year 1, 2017-2018," 2018 at https://www.idwr.idaho.gov/files/publications/201807-GWQ-GW-Study-of-Uranium-in-TV-Aquifer-System.pdf

[17] Gus Womeldorph and Shawn Benner, Boise State University, "A Study of Uranium and Arsenic in the Treasure Valley Aquifer System, Southwestern Idaho, Year 1, 2017-2018," 2018 at https://www.idwr.idaho.gov/files/publications/201807-GWQ-GW-Study-of-Uranium-in-TV-Aquifer-System.pdf

[18] Gus Womeldorph and Shawn Benner, Boise State University, "A Study of Uranium and Arsenic in the Treasure Valley Aquifer System, Southwestern Idaho, Year 1, 2017-2018," 2018 at https://www.idwr.idaho.gov/files/publications/201807-GWQ-GW-Study-of-Uranium-in-TV-Aquifer-System.pdf

[19] Department of Energy Idaho Operations Office, *Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site*, Fiscal Years 2010-2014, DOE/ID-11513, December 2015.

[20] Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA-04: TRA-712 Warm Waste Retention Basin System (TRA-712 and TRA-612), NSI-26002. Signed by the Department of Energy in August of 2015. See Idaho National Laboratory Federal CERCLA Cleanup documents at www.ar.icp.doe.gov

remediation. [21] And the DOE has never stopped burying long-lived radioactive waste over the Snake River Plain aquifer.

"Frequently cited stringent EPA standards such as 4 rem/yr. in drinking water are emphasized. But cleanup efforts often won't come close to achieving the advertised standards.

"Item 3: "Potential impacts on air quality (including global climate change) and noise."

"For Items 2 and 3, we here in Idaho have been experiencing the continuing pollution of our water and air with long-lived radionuclides resulting from the Idaho National Laboratory and other waste disposal operations. The monitoring of both water and air has been inadequate. Even so, there are unacknowledged buildups of radionuclides in our water and air that are not the result of historical nuclear weapons testing.

"The State of Idaho made this law change, effective spring of 2019 after the adjournment of the Idaho Legislature, to IDAPA 58 – Department of Environmental Quality, 58.01.01 – Rules for the Control of Air Pollution in Idaho, Docket No. 58-0101-1801. [22]

"The law had included since 1995 a provision for radionuclides. But this section of the clean air law **has now deleted** the following text:

> *xvi. Radionuclides, a quantity of emissions, from source categories regulated by 40 CFR Part 61,Subpart H, that have been determined in accordance with 40 CFR Part 61, Appendix D and by Department approved methods, that would cause any member of the public to receive an annual effective dose equivalent of at least one tenth (0.1) mrem per year, if total facility- wide emissions contribute an effective dose equivalent of less than three (3)mrem per year; or any radionuclide emission rate, if total facility-wide radionuclide emissions contribute an effective dose equivalent of greater than or equal to three (3) mrem per year.(5-1-95)*

"Given the increasing levels of airborne radiological contamination occurring on the lower west Boise-side and the lower east Idaho National Engineering-side of Idaho, this law change certainly is not about protecting human health and the environment.

"The source of increasing radioactive contamination on the Boise side of the state is not being investigated by the Idaho Department of Environmental Quality. The ongoing importation of radioactive waste from around the country to the US Ecology Idaho Grandview site appears to have a role in the increasing airborne radiological contamination. Some of this radioactive waste is from Formerly Utilized Sites Remedial Action Program (FUSRAP) sites around the United States contaminated from the early years of nuclear weapons production and the atomic energy program.

"The last 20 plus years the gyrating levels of gross alpha and gross beta (when sampled) in Boise area drinking water, from Kuna to Boise, and Murphy to Marsing, are not from naturally occurring uranium and thorium in the soil. [23] The report "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," in 2011 [24] does look at the issue — but does not identify the source of the elevated

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[21] US Department of Energy, "Environmental Assessment for the Replacement Capability for Disposal of Remote- Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site," Final, DOE/EA- 1793, December 2011. http://energy.gov/sites/prod/files/EA-1793-FEA-2011.pdf

[22] Office of the Administrative Rules Coordinator, Department of Administration, Pending Rules, Committee Rules Review Book, Submitted for Review Before House Environment, Energy & Technology Committee, 65th Idaho Legislature, First Regular Session – 2019. January 2019 at https://adminrules.idaho.gov/legislative_books/2019/pending/19H_EnvEnergyTech.pdf

[23] Environmental Defense Institute newsletter article for October 2018, "Idaho DEQ Reports Concerning the Elevated Radioactivity in Drinking Water in the Boise Area Don't Identify the Source of the Radioactivity."

[24] Brian Hanson, Dr. Shawn Benner, Dr. Mark Schmitz, Dr. Spencer Wood, Department of Geosciences, Boise State University., "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," Submitted to the Idaho Department of Environmental Quality, April 2011. http://www.deq.idaho.gov/media/563327-uranium_treasure_valley_0411.pdf listed at http://www.deq.idaho.gov/regional-offices-issues/boise/water-quality-plans-reports/

radioactivity.

"The report confirms the widespread occurrence of sometimes very high uranium concentrations, up to 100 micrograms/liter.

"Item 4: 'Potential impacts on waste management practices and activities.'

"Item 4: The nation faces huge unresolved problems of storage and disposal of its spent nuclear fuel, of its high-level waste, of its Greater-Than-Class C low-level radioactive waste, of its depleted uranium waste, of plutonium waste, of low-level waste, of its below regulatory concern radioactive waste that is clouding the Idaho skies from disposal at the U.S. Ecology Grandview RCRA facility, as well as from past uranium mining, milling, and other uranium fuel production activities, and from uranium enrichment plants. To propose making more radioactive waste when the existing radioactive waste problems remain unsolved is foolish. The U.S. Nuclear Regulatory Commission also knows that any reactor accident produces enormous amounts of radioactive waste. After Fukushima, bags of ordinary substances like leaves were radioactive waste that lacked a disposal site. The U.S. NRC's desire is to make ordinary municipal landfills welcoming to radioactive waste disposal.

"To continue to point to the Yucca Mountain EIS as the disposal solution is unacceptable, as other Department EIS documents continue to rely on a non-existent facility.

"To fail to address the aging management issues and safety issues of pool storage and/or dry storage of spent nuclear fuel over the extended time periods that we may lack a disposal solution is also unacceptable.

"The Department of Energy, in addition to not having a spent fuel disposal facility has made a practice of shallow burial of radioactive waste over the Snake River aquifer **and using deceptive public relations statements to create the illusion of a satisfactory cleanup of buried waste.**

"I submitted a question to the Idaho Cleanup Project Citizens Advisory Board meeting asking how many curies of americium-241 would remain buried after the final exhumation of the Accelerated Retrieval Projects end. There are many other radionuclides that will remain buried, but I wanted to make the question manageable. The Department of Energy responded with stunning obfuscation.

"Question submitted to ICP CAB: Now that the Idaho Cleanup (Project) is on the last Accelerated Retrieval Project (ARP IX) to exhume buried waste, how many curies of Americium-241 are remaining buried at the Subsurface Disposal Area (SDA)?

"Answer from the Department of Energy*: The performance objective for targeted waste retrieval was established in a record of decision agreed to by the regulators that states: "Completion of targeted waste retrieval will be measured by the volume of targeted waste retrieved. A minimum volume of targeted waste of 6,238 m3 will be retrieved from a minimum of 5.69 acres…, with the need for additional retrievals, if necessary, determined pursuant to CERCLA." Therefore, the performance objective is based on the volume of targeted waste removed, not the removal of Am-241 curies from the SDA. (*DOE's response are posted on the CAB website: https://www.energy.gov/em/icpcab/recently-asked-questions)

"The actual answer is, according to DOE's own documents, 215,000 curies of americium-241 will remain buried over the Snake River Plain Aquifer. This would take 6 Snake River Plain aquifers to dilute to drinking water standards, assuming 2.44E15 liters in the aquifer and the federal drinking water standard of 15 picocuries/liter.

"In fact, over 90 percent of the americium-241 is remaining buried, of 230,000 curies of americium-241, after completing buried waste exhumation, an estimated 215,000 curies will remain buried according to composite analysis calculations. [25] [26] [27]

"The buried americium-241 is not the only radionuclide that contributes to contaminant migration, but it was the dominant contributor according to the buried waste performance assessment. A partial inventory of the radionuclides in the buried waste at the Radioactive Waste Management Complex, what will be buried at its replacement facility, in high-level calcine and liquid sodium-bearing waste from reprocessing stored at the INL is provided in Table 2.

"Table 2. Calcine bin set and Sodium-Bearing waste radionuclide partial inventory comparison to the waste that will remain buried at RWMC and at the replacement for RWMC.

Radionuclide (half-life)	**Calcine Inventory (curies)**	**Sodium-Bearing Waste Inventory (curies)**	**Buried (existing) RWMC Inventory (curies)**	**Buried (future) Replacement RH-LLW Inventory (curies)**
Carbon-14 (5730 year)	0.038	5.7E-4	731	432
Chlorine-36 (301,000 year)	0	?	1.66	260
Iodine-129 (17,000,000 year)	**1.6**	0.01	0.188	0.133
Technetium-99 (213,000 year)	**4600**	94.6	42.3	16.7
Neptunium-237 (2,144,000 year)	**470**	1.74	0.141	0.003
Uranium-232 (68.9 year)	1.6	?	10.6	0.00036

[15] See the July 2017 EDI newsletter for a timeline for the burial ground at the Radioactive Waste Management Complex and other cleanup information at http://www.environmental-defense-institute.org/publications/News.17.July.pdf

[16] U.S. Department of Energy, 2008. Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11244. Idaho National Laboratory, Idaho Falls, ID and U.S. Department of Energy, 2007. Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11243. Idaho National Laboratory, Idaho Falls, ID. Available at INL's DOE-ID Public Reading room electronic collection. (Newly released because of Environmental Defense Institute's Freedom of Information Act request.) See https://www.inl.gov/about- inl/general-information/doe-public-reading-room/

[17] See the CERCLA administrative record at www.ar.icp.doe.gov (previously at ar.inel.gov) and see also Parsons, Alva M., James M. McCarthy, M. Kay Adler Flitton, Renee Y. Bowser, and Dale A. Cresap, Annual Performance Assessment and Composite Analysis Review for the Active Low-Level Waste Disposal Facility at the RWMC FY 2013, RPT-1267, 2014, Idaho Cleanup Project. And see Prepared for Department of Energy Idaho Operations Office, Phase 1 Interim Remedial Action Report for Operable Unit 7-13/14 Targeted Waste Retrievals, DOE/ID- 11396, Revision 3, October 2014 https://ar.inl.gov/images/pdf/201411/2014110300960BRU.pdf

Uranium-233 (159,000 year) Product bred from U- 235 and thorium, also decay of Np-237	0.057	0.036	2.12	0.0001
Uranium-234 (245,500 year) Pu-238 decay product	**130**	5.33	63.9	0.0012
Uranium-235 (703,800,000 year)	**3.2**	0.127	4.92	0.005
Uranium-236	**11**	2.23E-5	1.45	0.0001

Radionuclide (half-life)	**Calcine Inventory (curies)**	**Sodium-Bearing Waste Inventory (curies)**	**Buried (existing) RWMC Inventory (curies)**	**Buried (future) Replacement RH-LLW Inventory (curies)**
(23,400,000 year) Pu-240 decay product				
Uranium-237 (0.0185 year to Np- 237)	**1.5**		-	-
Uranium-238 (4,470,000,000 year)	3.1	0.125	148	16.2
Thorium-228 (1.92 year to radium- 224) Natural thorium decay and Pu-240 decay product	1.6	?	10.5	-
Americium-241 (423 y decays to Np- 237)	12,000	316	**215,000**	0.38
Plutonium-238 (87.7 year)	**110,000**	3900	2080	-
Plutonum-239 (24,000 year)	**48,000**	410	64,100	-
Curium-244	?	1.36	?	?

"* Calcine inventory from DOE/EIS-0287; RWMC buried waste inventory from DOE/NE-ID-11243/11244 (figures cited may not be the latest estimates) and RPT-1267; replacement remote-handled facility INL-EXT-11-23102.

"**Bold highlighting of calcine inventory indicates a similar or larger inventory than the buried RWMC waste. The RWMC buried waste is estimated by the DOE to yield 100 mrem/yr. doses in drinking water for millennia unless a perfect soil cap limits the estimated doses to be 30 mrem/yr. Importantly, the inevitable spikes in contamination due to flooding have not been accounted for despite RWMC flooding in 1963 and 1969. The dose estimates are not conservative. The assumed dilution factors are not consistent with past INL aquifer contamination migration.

"Calcine migration Kd coefficients may be different than used for RWMC and may worsen the effect of calcine in the soil.

"Notes continued from above table
*** Sodium-Bearing Waste inventory decayed to 2012 from Sandia National Laboratories, "Evaluation of Options for Permanent Geologic Disposal of Used Nuclear Fuel and High-Level Radioactive Waste Inventory in Support of a Comprehensive National Nuclear Fuel Cycle Strategy," FCRD-UFD-2013-000371, SAND2014-0187P; SAND2014-0189P. Revision 1. 2014. For Sodium-Bearing Waste radionuclides not listed in FCRD-UFD-2013-000371, EDF-6495 values from 2007 are provided for C-14, Tc-99, and I-129. Other radionuclides in the Sodium-Bearing Waste, typically of shorter half-life, are not listed in this table.

"In addition to this refusal to state the amount of radioactive waste that is remaining buried is **the promotion of untrue claims at the April 25, 2019 Idaho Cleanup Project Citizens Advisory Board meeting in Twin Falls by the Department of Energy and the U.S. Geological Survey that the inter-sedimentary beds of soil beneath the buried waste will stop the contaminants from entering the aquifer.** This simply is not true, or why would the aquifer already have exceeded the federal drinking water standard for carbon tetrachloride?

"It is also important to note that the buried waste is heavily laden with chemical solvents of various types and this decreases the sorbing properties of radionuclides like plutonium. [28] The ability of radionuclides such as plutonium-239 to sorb to soil rather than migrate to the aquifer is already overly optimistically modeled in DOE's estimates of contaminant migration, but does not assume the waste is stopped from reaching the aquifer by inter-sedimentary beds.

"The EIS must address the continued failure to solve the existing spent nuclear fuel nationwide. At the INL, the buried waste that is not planned to be exhumed and the Department of Energy's modeling of the migration of this waste is not technically sound. Furthermore, the DOE has no plans to remove from Idaho the calcine and sodium bearing waste, following its upcoming "reclassification."

"Existing radiological waste problems as well as newly created radiological waste issues at any proposed VTR site alternative need to be addressed. Failing to solve the waste storage and disposal issues ought to be enough reason to **stop making more radioactive waste**, which is the only sure outcome of the VTR project." [29]

Statement of Peter A. Bradford At Utah Taxpayers Association News Conference Warning of Likelihood of Extreme Electric Rate Increases Resulting from Premature and Risk-riddled Commitments to Secretive and Unproven NuScale Reactor Project.

"Fifty years dealing with nuclear cost overruns and mismanagement, have familiarized me with the basic characteristics of troubled projects, of which the nuclear industry has all too many. Let's start by reviewing the most recent example, the expensive dog on which UAMPS is the tail.

"That would be the "nuclear construction renaissance", or "nuclear renaissance" launched twenty years ago on a tidal wave of press releases as well as state and federal subsidies – all that the industry asked for in fact. The promise of that time was that innovative new designs with modular features coupled with a streamlined federal licensing process would reduce costs and enable nuclear power to fulfill its oft deferred promise to become the nation's most economical nonpolluting electrical source, essentially the vision that Nuscale offers to UAMPS today.

"Several southeastern states signed up enthusiastically, entering into arrangements that locked their customers into long term nuclear commitments and froze out opportunity to take advantage of other cheaper technologies that might become available. That renaissance is now an expensive ruin. Twenty-nine of the thirty-one applications that were pending or scheduled at the NRC in 2009 are cancelled or indefinitely deferred. The two units staggering toward a much- delayed completion are hitting exasperated Georgia customers with cost overruns exceeding $10 billion. The greatest fiasco is in South Carolina, where the bankruptcy of nuclear industry mainstay Westinghouse left the state with a $9 billion hole in the ground mostly to be paid for by the customers who will get no electricity on return.

"Other cancelled projects also ran up billion-dollar tabs without adequate or clear-cut customer and

[28] *A Global Guide to Nuclear Weapons Production and its Health and Environmental Effects*, By a Special Commission of International Physicians for the Prevention of Nuclear War and The Institute for Energy and Environmental Research, The MIT Press, 1995. P. 253 Scientists found the migration of plutonium at the Savannah River Site had migrated to groundwater within 20 years, not the predicted migration time of hundreds of thousands of years. The presence of solvents is thought to have contributed to the rapid migration of contaminants.

[29] Tami Thatcher comments, ID: DOE-HQ-2019-0029-0001. Department of Energy: Notice of Intent To Prepare an Environmental Impact Statement for a Versatile Test Reactor. https://www.regulations.gov/docket?D=DOE-HQ-2019-0029

taxpayer safeguards. We are 20 years into the nuclear renaissance now, and not one single molecule of carbon in the U.S. has been displaced by a new reactor. That's twenty lost years and more than 20 billion lost dollars in the fight against climate change. Had that money and time been allocated among renewable options, energy efficiency, load management and storage options according to competitive procurement and resource planning processes that we know how to run, the savings would have been large, the electricity cheap and the new jobs plentiful.

"In an era of reexamined monuments nuclear history too has many lessons beyond the nuclear renaissance to offer – the Washington Public Power Supply System led an entity not unlike UAMPS to precipitate the largest municipal bond default in U.S. history; Shoreham in New York cost $5billion and never generated a single kilowatt hour; the "stranded costs" in nuclear plants paid off by customers in the 1990s exceeded $50 billion dollars; among the prototypes dependent on federal subsidy, Fort St. Vrain in Colorado, Clinch River in Tennessee and West Valley in New York all collapsed when federal priorities changed and the support dried up.

"Throughout my 50 years of regulating and teaching about the nuclear industry, another constant is that each period of abject failure is followed by an array of new design proposals said to be very different from the wreckage lying in plain sight around us. All 31 of the renaissance reactors were new designs, some of them modular. The new features were indeed improvements, but they caused problems of their own, both in construction and in licensing.

"We have already seen some new designs – including Bill Gates's much ballyhooed original Traveling Wave" and the Transatomic Power molten salt design embraced at MIT – drop out. There will be more. The development of untried new designs is no place for small utilities with no nuclear construction experience to risk their customers' money, especially with money for essential commodities as tight as it is right now and demand for electricity likely to fall well below past projections for at least several years.

"To make matters worse, serious issues of candor and transparency are arising with the NuScale project and throughout the nuclear industry. In Utah, UAMPS uses a freedom of information act exemption to prevent public scrutiny of its ever-changing cost and schedule projections. Across the country, nuclear executives and their legislative and other governmental allies are doing embarrassing perp walks as a result of proceedings where nuclear licensees apparently sought approvals through secrecy and bribes that they could not obtain through open and honest processes.

"The root cause, as long as we are not talking about safety, is always the same. Nuclear power is far more expensive than competitive technologies, even competitive low carbon technologies. If state and local governments accept that their power procurement decisions have vital, tax-like impacts on electricity prices, they will make their policy reviews – including the prices and impacts of alternatives - subject open and honest review. But experience shows that nuclear power doesn't prevail in open and honest competition, so it avoids it wherever possible, and by any means necessary.

"Companies, officials, and nuclear consortia that won't accept open and honest review can't be trusted. Their record of blending incompetence, arrogance, corruption and economic ruin stretches back more than half a century. Their record is too clear and too consistent for Utah to walk down the same woeful and expensive path." [30]

See Tami Thatcher's NuScale Small Modular Reactor Site at the INL Announced Environmental Defense Institute Newsletter September 2016 and January 2020 for more details. [31]

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[30] Peter Bradford is a former member of the U.S. Nuclear Regulatory Commission who served as chair of both the New York Public Service Commission and the Maine Public Utilities Commission. He has been an expert witness in many cases involving nuclear power economics, and he has taught Nuclear Power and Public Policy at the Vermont Law School as well as Energy Policy and Environmental Protection at the Yale School of the Environment.

[31] http://www.environmental-defense-institute.org/publications/News.20.Jan.pdf

Section II.D. Pyro-processing of Spent Reactor Fuel

The report by *A Global Guide to Nuclear Weapons Production and its Health and Environmental Effects States:*

> "The development of a head-end processing step for spent oxide fuel that applies to both aqueous and pyrometallurgical technologies is being performed by the Idaho National Laboratory, the Oak Ridge National Laboratory, and the Korean Atomic Energy Research Institute through a joint International Nuclear Energy Research Initiative. The processing step employs high temperatures and oxidative gases to promote the oxidation of UO2 to U3O8. Potential benefits of the head-end step include the removal or reduction of fission products as well as separation of the fuel from cladding. The effects of temperature, pressure, oxidative gas, and cladding have been studied with irradiated spent oxide fuel to determine the optimum conditions for process control. Experiments with temperatures ranging from 500oC to 1250oC have been performed on spent fuel using either air or oxygen gas for the oxidative reaction. Various flowrates and applications have been tested with the oxidative gases to discern the effects on the process. Tests have also been performed under vacuum conditions, following the oxidation cycle, at high temperatures to improve the removal of fission products. The effects of cladding on fission product removal have also been investigated with released fuel under vacuum and high temperature conditions. Results from these experiments will be presented as well as operating conditions based on particle size and decladding characteristics." [32]

There are three blanket treatment alternatives that are still feasible, but they all have technical and/or implementation risks. Since no one alternative is clearly preferable, it would be prudent to fund activities related to each alternative to reduce the risks as follows:

- "Reduce the risks associated with Electrometallurgical Treatment EMT by completing the treatment of driver fuel as quickly as possible and concurrently supporting the development of process improvements to increase blanket throughput.
- "Reduce the risks associated with Melt, Drain, Evaporate, Calcine (or Carbonate) MEDEC by additional testing on whole blanket elements and by determining the bounding radiation source strengths of the two generations of EBR-II blanket materials.
- "Reduce the risks associated with direct disposal without sodium removal by engaging the DOE program responsible for evaluating potential SNF and high-level waste repositories, to encourage them to include bond sodium reactivity as part of their repository safety evaluations and performance assessments."[33] [EBR-II Blanket Disposition Alternatives, Pg. 9, TEV-2200]

According to Materials and Fuels Operators Correspondence:

"**We received 1240 elements of sodium bonded [Fast Flux Test Facility] FFTF fuel, having a mass of approximately 300 kg, heavy metal. 250 of the 300 kgs was irradiated, the remaining 50 kgs were never placed in the reactor.** The fuel was sent here in 11 shipments commencing in October 2007 and concluding in May 2008. The majority of the fuel received was arranged as intact assemblies requiring disassembly prior to processing. Processing of the irradiated material via the Electrometallurgical Treatment (EMT) process set up in [Fuel Cycle Facility] FCF commenced September 2010 and completed in September 2011. Nearly 220 kgs of the 250 kgs received were processed in 24 batches. The remaining 30 kgs have been set aside to support further research and examination. Uranium from the process has been recovered, down blended and placed into interim storage pending future disposition. Disposition opportunities for this material include use as potential feedstock for Light Water Reactor fuel, or as fuel feedstock for advanced reactor designs that may incorporate uranium fuel designs having increased enrichment. [emphasis added] [34]
[Materials and Fuels Complex, Nuclear Material Management Status, Data on Fast Flux Test Facility (FFTF) SNF brought to INL, January 17, 2013 FFTF Press Release 10-24-11.pdf]

"The effects of temperature, pressure, oxidative gas, and cladding have been studied with irradiated spent oxide fuel to determine the optimum conditions for process control.

[32] K.J. Bateman, et.al., Effect of Process Variables During the Head-End Treatment of Spent Oxide Fuel, International Pyroprocessing Research Conference, 2006, INL/CON-06-11605

[33] EBR-II Blanket Disposition Alternatives, Pg. 9, TEV-2200

[34] Materials and Fuels Complex, Nuclear Material Management Status, Data on Fast Flux Test Facility (FFTF) SNF brought to INL, January 17, 2013 FFTF Press Release 10-24-11.pdf

Experiments with temperatures ranging from 500oC to 1250oC have been performed on spent fuel using either air or oxygen gas for the oxidative reaction.

"The equipment utilized for testing consists of a fuel containment vessel, a cylindrical furnace capable of operation to 1050oC, and a gas delivery/collection system, see Fig 1. The containment vessel has been specifically adapted for this program so that both a vacuum can be applied and oxidative gas can be regulated during a run. A more detailed description of this equipment can be found elsewhere.

"Irradiated testing with spent oxide fuel is performed in the Hot Fuel Examination Facility (HFEF) located at the INL. The HFEF is an inert shielded hot cell requiring remote-handled operations. With the exception of the oxidative gas cylinder, all the components of the equipment are located in the HFEF argon cell.

"The spent oxide fuel used for testing originated from the Belgium Reactor-3 (BR-3), a pressurized water reactor located in Mol, Belgium. The BR-3 fuel tested has a typical burnup of ~37 GWd/t with a 25 year decay time and zircaloy-4 type cladding." [35]

Section II. E. Environmental Assessment on Materials and Fuels Complex (MFC) Pyroprocessing

DOE released a Draft Environmental Assessment Electrometallurgical Treatment Research and Demonstration Project in Fuel Conditioning Facility at MFC (formerly called Argonne National Laboratory-West (ANL-W)) in January 1996. DOE is continuing to violate the National Environmental Policy Act (NEPA) by not conducting the required Environmental Impact Statement (EIS). The Environmental Assessment (EA) does not legally fulfill NEPA requirements. Without prejudicing the Environmental Defense Institute's (EDI) finding the EA inadequate, EDI supports the third alternative; "taking no action, placing all the EBR-II SNF in interim storage, and not demonstrating the electrometallurgical treatment technology".

Idahoans are outraged at DOE's subterfuge of using waste management as a guise to rebuild its special nuclear materials production capacity. No credible scientific analysis has been offered by DOE to show that EBR-II spent nuclear fuel (SNF) cannot be safely stored in interim monitored storage facilities or in long-term repositories.

DOE's own Spent Nuclear Fuel Vulnerability study shows no hazards related to EBR-II fuel storage other than decrepit facilities that are operating beyond their design life. Long-term underwater storage of **any** SNF will result in cladding failure. Even after DOE knew that a geologic repository was not going to be available for decades, the Department failed to move SNF from the wet storage to dry storage. Fuel cladding failure in inadequate storage facilities like CPP-603 was not unique to EBR-II fuel. SNF cladding failures are an indictment of DOE's own mismanagement of its wastes.

MFCR has a twenty-year history of safe dry storage of EBR-II fuel at Hot Fuel Examination Facility (HFEF). MFCR claims that "only a few" elements are stored at HFEF and that they do **not** represent a "statistically significant sample". DOE's Spent Fuel Working Group Report cites 90 EBR-II assemblies in storage at HFEF which **is** a statistically significant sample. This same report states that EBR-II stainless steel clad fuel stored at the Radioactive Scrap and Waste Facility (RSWF) "are not breached". Vulnerabilities cited in the report were related to inadequate storage areas including the RSWF. Idaho Division of Environmental Quality issued a Notice of Violation on the RSWF October 20, 1995. MFCR has cut corners with its underground fuel storage. The RSWF is a crude soil vault that lacks the corrosion control and essential monitoring features of above ground dry casks. Therefore, DOE's claims of EBR-II SNF vulnerabilities that are greater than many other fuel types is unsubstantiated. The EA claims an inventory of only 330 blanket assemblies whereas the Spent Nuclear Fuel Working Group Report acknowledges 500 currently being stored. This is a significant discrepancy.

The EA fails to fully characterize the ongoing project's waste streams. With decades of operating experience and presumably continuous data collection and record keeping, MFCR is remiss in not fully

[35] Pyro-Processing, 8/10/2006, **INL/CON-06-11605**

disclosing this information. The EA acknowledges reprocessing over 570 EBR-II assemblies since 1964 [DOE/EA-1148@36]. For instance, a breakdown of air emissions would show significant volatilized radionuclides that HEPA filters are not designed to control. MFCR's unwillingness to provide wet caustic scrubbers to reduce volatilized nuclide releases is unacceptable. With the potential of 203,000 curies available for release in any single process batch this represents a significant hazard.

MFCR deserves due credit for initiating for the first time in the history of the AEC/ERDA/DOE the classification of SNF parts and assemblies as Greater Than Class C waste requiring final disposal in a geologic repository. Unfortunately, this change follows EDI's exposing DOE's practice of shallow land burial and showing the public DOE's own shocking data gained through a Freedom of Information Act request. This policy represents a significant move toward responsible waste management that hopefully will be adopted throughout the DOE Complex.

The EA inadequately addresses the non-proliferation compliance issues. Indeed, MFCR's comparison of PUREX type SNF reprocessing "footprints" (600,000 sq. ft.) with the Pyroprocessing (16,000 sq. ft.) "small footprint" literally clinches the argument. This proliferation prone technology is so compact that it would be extremely difficult if not impossible to detect in a non-compliant country. Moreover, diversion of throughput after the "cathode processing" stage would be undetectable even in this country. Therefore, even the American public would have no assurance that DOE itself was not producing weapons grade material at this facility.

The EA's environmental impact calculations assumed a low 10% burnup. [DOE/EA-1148@73] Yet when trying to justify EBR-II SNF vulnerabilities, the EA characterizes EBR-II SNF as high burnup [DOE/EA-1148@122] which means high quantities of fission products that will be released during reprocessing. If the high burnup characterization is correct then the source term assumptions are wrong and the environmental releases may be grossly understated.

This EA further violates NEPA by its own admittance because it is retrospective. The Department has committed funds for many years (acknowledged in the EA) toward construction of the Pyroprocessing facility at MFCR.

The whole thrust of NEPA is to force agencies to conduct an EIS **prior to** committing resources so that expenditures will not prejudice the decision making process. The EA's proposal to defer any EIS until after the "demonstration project" technology is proven ignores NEPA's mandate that an EIS be prepared **in advance** of the stage where a program "has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives".

The fact that MFCR's pyro processor is already complete only highlights the need for an immediate EIS, and does not provide a rationale for deferral of full NEPA compliance. The pattern of "phased" EA's improperly segments the NEPA process, and obfuscates the need to prepare an EIS prior to any irretrievable commitment of resources. The EA reflects that detailed planning and substantial federal resources have been advanced toward a full scale electrometallurgical processing facility.

In May 1996, DOE issued a Finding of No Significant Impact on the electrometallurgical plant which means that the Department believes that the Environmental Assessment was adequate and that no significant impacts were identified. The plant continues to receive full funding at $50 per year up through Fiscal Year 1998. **See Section IV.L for more information on MFC**.

Section II. F. Naval Reactors Facility Expansion Summary

The Environmental Defense Institute (EDI) comments on the Department of Energy (DOE) Draft Environmental Impact Statement DOE/EIS-0453-D, submitted previously for the record, are available on EDI's website. [36] EDI's comments on the draft have more background contamination and radioactive waste information needed to fully understand all the environmental impacts. EDI's comments on NRF CERCLA review is also available. [37] Tami Thatcher's DOE comments on DEIS that cover other crucial issues are available. [38] The comments below focus on the final FEIS issues that were not covered and therefore make it deficient for the following reasons:

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36 http://www.environmental-defense-institute.org/publications/EDINRFcomments.pdf
37 http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdf
38 http://environmental-defense-institute.org/publications/CommentsECF.pdf

* The FEIS fails to comply with all National Environmental Policy Act (NEPA) requirements;
* The FEIS fails to fully evaluate keeping the existing Expanded Core Facility (ECF) spent (used) nuclear fuel (SNF) cooling pool in operation for "over 33 years" as an integral part of NRF operation;
* The FEIS incorrectly says NNPP will not generate high-level-waste, greater- than-class waste or transuranic waste;
* The FEIS failed to adequately assess the ECF's seismic vulnerabilities.

"The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)." [FEIS pg. Vol. I Abstract]

The Naval Reactors Facility (NRF) located on DOE's Idaho National Laboratory (INL) is the waste end of the used reactor fuel (spent nuclear fuel or SNF) from the NNPP's nuclear fleet. DOE's role is designated to manage the Navy's waste.

EDI finds this EIS a clever effort to slip in major expansion of the Navy's SNF waste management without acknowledging 50+ years of massive radioactive contamination at INL by claiming previous NRF environmental studies. [39]

DOE/NAVY claim these CERCLA reports are beyond the scope of this EIS. The Navy's previous radioactive contamination will remain for manila putting Idahoans at risk. This is an unconscionable and avoidable assault on Idaho's most valuable Snake River Aquifer that we depend on.

NRF NEPA Requirements Violated

A. The FEIS fails to comply with all NEPA requirements.

The FEIS correctly states: "NEPA, Sec. 1502.1 Purpose Environmental Impact Statement. The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. **It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment… Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document.** It shall be used by Federal officials **in conjunction with other relevant material** to plan actions and make decisions." [40] [emphasis added]

FEIS states: "Per NEPA requirements (10 C.F.R. § 1021 and 40 C.F.R. § 1500–1508), consideration must be given to whether actions performed under the alternatives could result in a violation of any federal, state, or local law or requirements, or require a federal permit, license, or other entitlements. Federal environmental laws that affect environmental protection, health, safety, and compliance were considered in the EIS scope development. In addition, environmental requirements that have been delegated to the state of Idaho and local requirements were considered to ensure compliance." [FEIS pg. 1-13]

The Yale Law Journal Review notes: "To comply with existing law and achieve NEPA's normative goals, agencies should expand EIS discussions of how applicable regulatory regimes will shape project impacts. Impact discussions are not 'full and fair' without this information because they fail to allow the public and other agencies to comment on— and more importantly, to challenge—this

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39 Remedial Investigation/Feasibility Study (RI/FS) studies required by CERCLA to characterize the nature and extent of contamination because of past releases of hazardous and radioactive substances to the environment, to assess risks to human health and the environment from potential exposure to contaminates, and to evaluate cleanup actions.

40 Authority: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977). Source: 43 FR 55994, Nov. 29, 1978, unless otherwise noted.

crucial aspect of project planning. Such an approach would further NEPA's aim to '[r]igorously explore and objectively evaluate' the full scope of project impacts that 'significantly affect the quality of the human environment.'" [41]

Due to public and Federal court pressure, DOE has in the recent past conducted numerous "Programmatic" EISs that comprehensively analyze all relevant aspects of a project's environmental impact. DOE/NNPP must be pressured to fulfill NEPA requirements by reissuing this FEIS as a comprehensive "Programmatic EIS."

The DOE/Navy is trying to avoid NEPA requirements to provide a comprehensive environmental impact statement of the proposed actions. Failure to provide NRF past- present-future waste characterization/disposition means the DEIS/FEIS are deficient. Absent this crucial waste data, Commenters' must rely on previous reports to ascertain how these operations effect the environment. The public cannot rely on this document to provide the information needed to make an informed decision.

B. DOE/Navy fails to issue a Comprehensive Programmatic EIS The FEIS inadequately evaluates keeping the Expanded Core Facility (ECF) in operation; for "over 33 years" as an integral part of NNPP operation.

FEIS states: "**Overhaul Alternative time period. The first 33 years of the 45 years (i.e., the [ECF] refurbishment period), refurbishment and operations activities would be conducted in parallel.**" [Pg. S-8] [emphasis added]

"[T]he NNPP will continue to operate ECF during new facility construction, during a transition period, and **after the new facility is operational for examination work**. **To keep the ECF infrastructure in safe working order during these time periods, some limited upgrades and refurbishments may be necessary. Details are not currently available regarding which specific actions will be taken; therefore, they are not explicitly analyzed as part of the New Facility Alternative.**" [42] [emphasis added]

The above FEIS statement: "Details are not currently available regarding which specific actions will be taken." **This documents the fundamental inadequacy of the FEIS.** DOE/Navy cannot legitimately claim compliance with NEPA when the most degraded part of this operation is not fully evaluated in explicit detail. More troubling is the Environmental Protection Agency (EPA) and Idaho Department of Environmental Quality's defining silence as regulators. This is a crucial issue given that the public's environmental defenders are politically compromised on enforcement of laws they have authority over.

The FEIS correctly states: "Per NEPA requirements (10 C.F.R. § 1021 and 40 C.F.R. § 1500–1508), consideration must be given to whether actions performed under the alternatives could result in a violation of any federal, state, or local law or requirements, or require a federal permit, license, or other entitlements. Federal environmental laws that affect environmental protection, health, safety, and compliance were considered in the EIS scope development." [FEIS Pg. 1-13]

Yes, environmental laws were considered but never acknowledged to be violated. In addition the FEIS fails to include soil and ground water contamination from ECF leaks and discharges that **do** violate environmental laws. [43] These issues will be discussed later.

1. ECF Degraded Condition

DOE/NRF's statements confirm the degraded condition of the ECF. Again documents the fundamental inadequacy of the FEIS to exclude specific actions required to mitigate continued significant ECF leaks. "Not a matter of urgency" discloses the Navy's previous decades of disregard for environmental degradation.

"Major portions of the ECF infrastructure have been in service for over 50 years. **The ECF water**

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[41] *A 'Full and Fair' Discussion of Environmental Impacts in NEPA EISs: The Case for Addressing the Impact of Substantive Regulatory Regimes*, Sarah Langberg, foot notes 178 & 179 citing 40 C.F.R. § 1502.14(a) (2014). U.S.C. § 4332(C) (2012). http://www.yalelawjournal.org/note/nepa-eiss-and-substantive-regulatory-regimes.

[42] Final Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling, October 2016, DOE/EIS-0453-F, Pg. S-9, herein after referred to as FEIS.

[43] See EDI's NNPP Report that offers a Review of NRF CERCLA issues not addressed in this EIS. And Final NRF Comprehensive Feasibility Study Waste Group 8 Naval reactor Facility. And "Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999", J. Giles et.al., April 2005, ICP/EXT-05-00833, pg. 18.

pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards. Although water pool surfaces are covered with a fiberglass or epoxy coating, the water pool does not have a liner, creating the potential for water infiltration into the reinforced concrete structure and the potential for corrosion damage of the reinforcing bar within the structure. The capability to detect and collect small leaks, a common feature in modern water pools, is not present for the ECF water pool. Consequently, while the replacement or overhaul of the current water pool is not a matter of urgency that must be done in a very short period, it is something that needs to be planned and started soon." [FEIS Pg. S-6][emphasis added]

2. ECF Leaks

"**Alternative methods would be to discharge the water from leak testing the pools (up to 18,927,000 liters (5 million gallons)) to the sewage lagoons or to the [Industrial Waste Ditch] IWD during the last year of construction.** This discharge would occur over a short period of time (about 6 days) but is not expected to exceed the infiltration capacity or the maximum flow distance (2.9 kilometers (1.8 miles)) previously recorded for the IWD. **The permitted annual discharge rate for the IWD of 113,600,000 liters (30,000,000 gallons) would not be exceeded. Section 4.4.3 reflects this potential discharge of water for pool leak testing."** [FEIS Pg. 1-21]

Table 4.4-5: Discharge to the IWD for the Construction Period of the New Facility Alternative [FEIS Pg. 4-44]

Source	**Volume[1]**	
	liters per year	gallons per year
Construction Period Increase **(leak test water)**	18,927,000	5,000,000
NRF Baseline [including ECF] [2]	43,190,000	11,410,000
Total[3]	62,117,000	16,410,000
Wastewater Reuse Permit Discharge Limit[4]	113,600,000	30,000,000
Percent Increase Over the NRF Baseline[5]	**43.8**	
Percent of Discharge Limit[6]	**54.7**	

[1]Numbers have been rounded; therefore, unit conversions are not exact.

[2]Total volume of discharge to the IWD from all NRF sources **(including ECF) for 2009.**

[3]Total of Construction Period Increase and NRF Baseline.

[4]Based on the Industrial Reuse Permit Renewal Application for the Naval Reactors Facility pending approval, dated January 26, 2012. [5]Percent increase from construction period over the NRF Baseline.

5 Percent increase from construction period over the NRF Baseline.

[6]Percentage of total discharges for NRF (62,115,000 liters) compared to the wastewater reuse permit discharge limit.

The NRF Industrial Waste Ditch (IWD) is just that; an open ditch where huge volumes of radioactive liquid process waste from the ECF is allowed to sink down into the aquifer below flushing previous contaminates down further into groundwater. DOE/Navy claims "CERCLA remedial action plan are outside the scope of this EIS" and thereby attempts to censure NRF groundwater and soil reports showing significant contamination above EPA/MCL limits. This FEIS facilitates continued contamination of Idaho's most precious resource that thousands of INL workers and all Idahoans rely on for drinking and crop irrigation.

Again, leak testing (in the above 4.4-5 table) is not defined, however the reader is left to assume that this represents the volume of water that continues to leak into concrete structure surrounding the ECF and that must be pumped out and discharged to the Industrial Waste Ditch (IWD) or other unlined percolation ponds at the NRF. These radioactive waste discharges eventually migrate to the aquifer and the Snake River via Thousand Springs near Hagerman, ID.

The above ECF "water tight" is not possible with planned epoxy/fiberglass coatings as previous use demonstrates, but only with the NRC required stainless liner which is not planned. FEIS fails to characterize/quantify what the above waste discharges will be and how these additional discharges will add to existing NRF soil/groundwater contamination described in CERCLA RI/FS. [44]

FEIS states: "The ECF water pool does not leak 16,000 gallons per day as alleged by the [EDI] commenter, and there is no known leak to the environment**." "Appendix F,** Section F.5.4.12 states that additions to the water pool are about 150 gallons of water per day to compensate for evaporation. The 150 gallons per day of make-up water is consistent with expected losses due to evaporation based on the surface area of the pool and facility humidity levels."
[FEIS Pg. G-102]

The above statement is misleading at best. The Navy's own earlier CERCLA report states: "The ECF water level is monitored frequently and recorded in water level logs. Water is routinely added to the pits to compensate for evaporation loss. **For the past four years, the average water loss has been 3500 gallons per month.** To determine if any leakage has occurred, the actual water loss per month is compared to theoretical and experimental evaporation data. **Between December 8, 1991 and February 6, 1992, significantly more water was added to the water pits than anticipated. The detailed investigation of this event identified that an unexplained water loss of 62,500 gallons occurred between December 8, 1991 and February 21, 1992.** A leak from one water pit was the expected cause of the water loss." [45]

The above documented ECF 62,500 gal. 30-day leak = 2,083 gal. /day. Obviously, the DOE/Navy is not offering true or credible information in this FEIS. The above cited document was obtained through an EDI FOIA request and not radially available to public. Clearly, this is why the DOE/Navy does not include NRF CERCLA data in this FEIS. [46]

ECF leaks and discharges to the Industrial Waste Ditch (IWD) are not fully evaluated in the FEIS especially when ECF projects will be heavily regulated under substantive environmental law regimes such as the Clean Air Act (CAA) [47] or Clean Water Act (CWA). [48]

C. The FEIS fails to include the Advanced Test Reactor as an integral part of NNPP operation

Currently, the Advanced Test Reactor at INL that tests NRF fuel is a crucial part of NRF operations and itself produces SNF. This sleight of hand that the ATR is not an integral part of the NNPP/NRF is ridiculous and challenges the credibility of this FEIS.

D. The FEIS fails to include Idaho Nuclear Technology and Environmental Center (INTEC) as an integral part of NNPP operation

"In addition to DOE owned fuel INL/INTEC CPP-666 stores spent fuel from the Naval Reactors Program." [49] "The Idaho [CPP-666] inventory includes SNF from the Naval Nuclear Propulsion Program (i.e., submarines and aircraft carriers), which is different from commercial SNF in many ways, including enrichment level and design. From about 1952 to 1992 this Navy SNF was reprocessed in Idaho to extract high-enriched uranium for use in driver fuel rods at weapons material production reactors elsewhere." [50]

Chemical reprocessing at INL/INTEC generated millions of gallons of high-level waste – 900,000 gallons of which remains in underground tanks today. Leaks from this INTEC high- level waste tank farm and aquifer waste injection wells continue to contaminate the soil and groundwater. [51]

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[44] Remedial Investigation/Feasibility Study (RI/FS) studies required by CERCLA to characterize the nature and extent of contamination because of past releases of hazardous and radioactive substances to the environment, to assess risks to human health and the environment from potential exposure to contaminates, and to evaluate cleanup actions.

[45] Final NRF Comprehensive Feasibility Study Report Waste Area group 8 Naval Reactors Facility, Idaho Falls Idaho, Pittsburgh Naval Reactors Office, and pg. 5-1.

[46] FEIS, Pg. G-102

[47] Clean Air Act (CAA)[10] Yale citing 42 U.S.C. ss 7401q(2012)

[48] Clean Water Act (CWA) Yale citing 33 U.S.C. ss 1251-1387

[49] Energy and Environment, Storage of DOE SNF at the Idaho National Laboratory, U.S. DOE.

[50] U.S. Spent Nuclear Fuel Storage, James Warner, Section Research Manager, Pg. 27, Citing T. Cochran, et.al., Nuclear Weapons Databook, Vol. II, May 24, 2012, Congressional Research Service, 7-5700, R42513, www.crs.gov

[51] Engineering Design File, Groundwater Pathway Risk Assessment for CPP-601, CPP-602, CPP-627, and CPP-640 Fuel

The FEIS states: "The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for **all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)."** [FEIS pg. Vol. I Abstract] [emphasis added]

Incomplete Environmental Impacts; The FEIS fails to include previous environmental contamination identified in CERCLA investigations in cumulative environmental impact;

DOE/Navy use a classical bait and switch ostensibly initially appearing to follow the legal requirements of NEPA, while later buried in the FEIS claim's the NRF has no obligation to include the full waste stream disposition and environmental contamination resulting from NRF/ECF operations. What is critical in any EIS is to review all environmental the impacts of any subject operation. That literally means the past, present and anticipated impacts as NEPA requires. By ignoring history, we are bound to repeat it.

FEIS states: "Comments on the NRF Waste Area Group 8 CERCLA remedial action plan are outside the scope of this EIS." [52] [FEIS Pg.G-104]

Again, it is essential to review previous CERCLA analysis to get an accurate assessment of what current and future operations will be since the basic operations have not changed.

Moreover, new waste discharges MUST be added to previous contamination to fully assess environmental impacts. An earlier NRF Environmental Report states: "Overall, less than an estimated 1500 curies of radioactivity have been released to the atmosphere during the period of 1953 through 1991, with the majority of the releases occurring in the 1950s.

During the past 10 years, releases have been less than 10 curies per year…. In Addition to the annual releases, a single release occurred in 1955 during the performance of an engineering test to obtain information on the effects of boiling conditions in naval reactors. A conservative estimate of the amount of radioactivity released from the site was 870 curies. [53]

Review of the historical deep well sampling data at NRF does not support the Navy's conclusion of no impact. NRF CERCLA report shows Table III Deep Well Sample Results for Wells # 1, # 2, and # 3 at 60, 69, and 44 pico curies per liter respectively for gross beta.[54] The federal drinking water standard for gross beta is 8 pico curies per liter. This deep well sample data confirm that contaminates in fact migrate, contrary to the Navy's claims that contaminates are bound up in the soil.

Vegetation at NRF CERCLA Unit 8-08-14 radioactivity (pCi/gm) Sampling Results (Pre- 1971) Sample # 68-1 was 144,522; Sample 6-82 was 687,447 pCi/gm. [55] DOE/NRF understandability is blocking this shocking data. Like a used house salesman showing a prospective buyer a fancy color brochure that does not show the failing foundation, leaking heating oil tank and water leaks, DOE fits perfectly by vehemently objecting to independent environmental review.

E. The FEIS Inadequately Characterize Groundwater Contamination

FEIS states: "Groundwater monitoring has generally shown long-term trends of decreasing concentrations for radionuclides, and **current concentrations are near or below EPA MCLs for drinking water and the sites where there is historic contamination are not used as sources for drinking water.**" [Pg. G-99][emphasis added]

Reprocessing Complex Non-Time-Critical Removal Action**,** Document ID: EDF-10195, Revision ID: 1, Effective Date: 02/08/12.

52 Proposed Plan Waste Area Group 8, and Removal Actions Considered for Naval Reactors Facility Idaho National Laboratory, issued by DOE, EPA, and Idaho Department of Environmental Quality.
Also: U.S. Spent Nuclear Fuel Storage, James Warner, Section Research Manager, Pg. 27, Citing T. Cochran, et.al., Nuclear Weapons Databook, Vol. II, May 24, 2012, Congressional Research Service, 7-5700, R42513, www.crs.gov
Engineering Design File, Groundwater Pathway Risk Assessment for CPP-601, CPP-602, CPP-627, and CPP-640 Fuel Reprocessing Complex Non-Time-Critical Removal Action**,** Document ID: EDF-10195, Revision ID: 1, Effective Date: 02/08/12.

53 Naval Reactors Facility Environmental Summary Report NRF-EC-1046, Pg.18. And Naval Reactors Facility Environmental Summary Report NRF-EC-1007, Calendar Year 1991, Pg. 18.

54 NRF October 1995 Remedial Investigation / Feasibility Study (RI/FS) Appendix K.

55 Final NRF Comprehensive Feasibility Study Waste Group 8 Naval Reactor Facility Appendix H, October 1995, Pg. H6-13, Table H6—5.

The above statement "current concentrations are "near" EPA MCLs for drinking water and the sites where there is historic contamination are not used as sources for drinking water" completely disregards NRF staff, visitors and thousands of INL workers at other facilities who drink water drawn from facility wells. What about adjacent Atomic City residents? What kind of credibility can the public put on the Navy's assurance that groundwater is "NEAR" regulatory EPA MCL limits? None! Every INL/NRF potable water source should have a notice DO NOT USE FOR DRINKING.

The FEIS states: "During the construction period of the New Facility Alternative, there would be **small impacts on the amount of water seeping into the perched water zone at the IWD outfall**." [4-44][emphasis added] "The increased water discharge volume at Location 3/4 or Location 6 during the transition period could result in **additional seepage of water to the perched water zone located beneath the IWD outfall. When the areal extent of this** perched water zone was greatest, annual discharge volume to the IWD was 650,000,000 liters (172,000,000 gallons) and was not regulated by a permit**.** [FEIS Pg. 5-40]

To characterize waste discharges as having "small impacts" to the ground water is ridiculous. Why? Because these huge contaminated waste water discharges will flush existing waste into the aquifer. Nuclear Regulatory Commission (NRC) would otherwise require leak-proof stainless steel liner in all commercial spent nuclear fuel (SNF) storage pools because leaks contaminate the groundwater. Epoxy/fiberglass coatings are not allowed at NRC regulated SNF facilities because they leak and the pool cannot be accurately leak tested. Moreover, applying more epoxy to acknowledged failing concrete pool walls adds to the absurdity. Below EDI discusses ECF significant leaks and what DOE/Navy euphemistically calls "Leak Testing" that is apparently when they measure the amount of ongoing ECF leaks into this pool substructure. Leaks to the soil cannot be measured except by water required to maintain pool water volume.

The FEIS states: "Water pool refurbishment would include correcting deteriorating conditions. These actions would be necessary to ensure that the water pools support long- term use by, to the extent practicable, **bringing the water pools up to current design and construction standards.** [Pg. S-8]

The "current design and construction standards" DOE/NRF refers to above are not the standards NRC requires of all regulated SNF storage pools. DOE/NRF makes no apparent reference what standards are being applied to this ECF. There is no intent to replace the degraded/leaking ECF SNF water storage pool. What will NRF do with the 400 SNF assemblies in the ECF while "The water pools [are] drained, decontaminated, and emptied of some equipment" with degraded pool gate seals? We discuss this major issue below in seismic vulnerabilities.

1. No NRF Discharge of Radioactive Liquid?

The FEIS states: "Liquid LLW: Refurbishment Period: There would be **no impact from liquid** LLW since waste generation volumes would not change. Post-Refurbishment Operational Period: There would be **no impact from liquid LLW** since waste generation volumes would not change." [Pg. S-69] [emphasis added]

"Groundwater: There would be **negligible impacts to groundwater** under the No Action Alternative and the refurbishment period of Overhaul Alternative from radiological constituents **if** preventive and corrective maintenance is not sufficient to prevent a **minor** water pool leak. There could be **small impacts to groundwater** during the transition period and new facility operational period under the New Facility Alternative from potential increases in non-hazardous salts in wastewater discharge." [Pg. S-73] [emphasis added]

No reasonable person can read these repeated statements of "no impact" "negligible impacts to groundwater" knowing the huge leak volumes in question and knowing this operation has been doing this for 50 years, without cringing. Again, the Navy intends to keep this leaking ECF in operation for decades. The FEIS offers no accurate characterization of the ECF water discharged/leaked. See below NRF CERCLA report EDI gained through FOIA that documents this crucial data.

The FEIS states: "Radiological Effluent: There would be **no impact from radiological effluent since none** would be discharged to surface water or the Snake River Plain Aquifer (SRPA). "NRF does **not discharge radiological liquid effluent to the environment**." [FEIS Pg.S-16] [emphasis added]

However, FEIS states: "Radiological Liquid Effluent Parameters for NRF [Industrial Waste Ditch] IWD maximum discharge for Co-60, Cs-137, Sr-90, and tritium (H3) at 20, 20, 1.9 and 0.7 pCi/l respectively. "Actual minimums and maximums over 5-yr. **or** 2 yr. period are reported." [FEIS Pg. 3-32] [56]

These two above FEIS statements are contradictory and challenge the veracity of the document. Additionally, why 5 yr. **OR** 2yr. periods recorded? Is there data in 5-yr. monitoring data showing higher numbers that DOE/Navy is withholding like 10 yr. monitoring data? See below CERCLA data showing significant radioactive contamination intentionally excluded.

The above FEIS table 4.4-5 showing tens of millions of gallons of water used for direct contact cooling of extremely radioactive used reactor fuel (SNF) and dumped in the open IWD ditch, belies DOE/NRF's statement: "**NRF does not discharge radiological liquid effluent to the environment." The coolant water is radioactive and hazardous due to corrosive activated material on extremely radioactive used fuel surfaces and must be treated as such.**

NRF CERCLA reports prove FEIS false by showing S1W Leaching Bed Area Radioactivity Soil Sampling for Cs-137 at 310,000 pCi/g; Co-60 at 1,300,000 pCi/g. [57] The NRF Retention Basin where highly radioactive process waste water is sent to allow short-lived isotopes to decay before discharging it to IWD showed sludge samples of Cs-137 at 192,700 pCi/gm; [58] Strontium-90 at 5,118 pCi/gm. NRF Vegetation sampling results at location 68-1 and 68-2 at 144,522 and 687,447 pCi/gm respectively. [59]

These FEIS statements of "no impact" are categorically false. Absence of recent CERCLA Remedial Investigations/Feasibility (RIFS) showing significant environmental contamination documents how this FEIS attempts to ignore fundamental NEPA policy. For instance, NRF CERCLA Unit 8-08-12 sample results show chromium at 2,090 mg/kg (MCL= 50 mg/kg); Cesium-137 at 149,759 pCi/gm (risk-based soil level = 0.003). [60]

Below Table H6-6 lists the radioactive isotopes found in the ECF process water Leaching Bed sediments. This CERCLA data contradicts FEIS statement: "NRF does not discharge radiological liquid effluent to the environment." These sample results show extremely high radioactive mud that will eventually percolate into the aquifer.

1971 Samples NRF Leaching Bed Mud [61]

Table H6-6- Unit 8-08-14 Radioactivity (pc/gm) Sample Results (pre-1971)

Sample Number	Soil				
	Cs-137	Cs-134	Co-60	Hf-181	Sb-124
1	310,000	42,000	450,000	4,900	190,000
2	190,000	42,000	42,000	6,200	37,000
3	210,000	7,600	1,300,000	8,700	43,000
4	80,000	14,000	640,000	9,100	ND
5	95,000	20,000	1,000,000	15,000	55,000

56 FEIS Pg. 3-32

57 Final NRF Comprehensive Feasibility Study Report Waste Area group 8 Naval Reactors Facility, Idaho Falls Idaho, Pittsburgh Naval Reactors Office, Appendix I, October 1995, Table 1-3a, Pg. I-59.

58 Ibid. Appendix H, Table H8-4, Unit 8-08-17, Pg. H8-8.

59 Ibid. Appendix H, Table H8-5, Pg. H8-9.

60 Ibid. Appendix H, Table H4-13, Unit 8-08-12, Pg. H4-22.

61 Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Prepared for the U.S. DOE Pittsburgh Naval Reactors Office, Pg.H-6-14.

6	140,000	42,000	1,000,000	19,000	ND
7	150,000	40,000	1,100,000	20,000	ND
8	140,000	31,000	440,000	8,200	33,000

NRF-RI/FS Table H6-6 Pg. H-6-14

NRF CERCLA report continues: "The release of 62,500 gallons is a conservative maximum estimate. Based on the results of periodic NRF Chemistry analyses of the low level of radio nuclides present in ECF water pool water, the estimated quantities of radionuclides released are as follows: 5.2 x 10-2 curies of tritium, 9.7 x 10-6 curies of carbon-14, 7.1 x 10-6 curies of manganese-54, 1.9 x 10-5 curies of cobalt-58, 4 x 10-4 curies of cobalt-60, 6.6 x 10-5 curies of nickel-63, 1.2 x 10-6 curies of strontium-90, 1.2 x 10-6 curies of yttrium, and 1.1 x 10-5 curies of cesium-137. Thus, a total of 5.25 X 10-2 curies of radioactivity were estimated to have been released. The estimate is considered to be conservative, because previous leaks from the water pit into observation rooms within the ECF building rarely indicated the presence of radioactive contamination. The release occurred about 30 feet below ground surface." [62] [5-1]

"Tritium is the only radionuclide expected to migrate with the water. The COPCs as identified in the Work Plan (WEC, 1995) were tritium, carbon-14, cobalt-60, manganese-54, nickel-63, strontium-90 and cesium-137. The concentration terms for each radionuclide are given in

[62] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-2

The below table 2-1 is found in a NRF CERCLA report and documents soil contamination.

Table 2-1 OU 8-08 COCs and Risk-based Soil Concentrations

COC	Exposure Route	Risk-based Soil Concentration[1] (pci/gm unless specified)	Max. Soil Concentration (pci/gm unless specified) Detected at OU 8-08
Lead	Direct Contact	400 ppm[2]	1,140 ppm
Americium-241	External Exposure	895	20
	Ingestion of Soil	283	--
	Food Crop Ingestion	301	--
Cesium-137	External Exposure	16.7	7,323
	Ingestion of Soil	24,860	--
	Food Crop Ingestion	164	--
Neptunium-237	Food Crop Ingestion	19.8	0.79
Nickel-63	Food Crop Ingestion	15,846	730
Plutonium-238	Ingestion of Soil	590	20
	Food Crop Ingestion	1,153	--
Plutonium-244	External Exposure	3.3	0.24
Strontium-90	Ingestion of Soil	15,418	750
	Food Crop Ingestion	45.6	--
Uranium-235	External Exposure	13.2	0.18

(1) Concentration which corresponds to a 1×10^{-4} carcinogenic risk.
(2) EPA recommended cleanup level (EPA, 1994)

Table 5-1. [63] [64] [Pg. 5-2] [65]

[63] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-2.

[64] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Prepared for the U.S. DOE Pittsburgh Naval Reactors Office, Pg. 7.

[65] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Prepared for the U.S. DOE Pittsburgh Naval Reactors Office, Pg. 7.

Summary of NRF Drinking Water Radioactivity Results [66]

Table 4 Well Number	Gross Alpha (based on Am-241) pCi/l	Gross Beta (Based on 137-Cs pCi/l)
#1 Maximum	5.0	2.0
#2 Maximum	3.0	2.0
#3 Maximum	1.0	3.0
#4 Maximum	1.5	2.0
EPA MCL	15	8

Summary of NRF Ground Water Radioactivity Results [67]

Maximum	Gross Alpha (based on Th-230) pCi/l	Gross Beta (Based on Sr-90 pCi/l)
Up Gradient	3.0	3.1
System	5.3	3.7
On site	3.1	3.9
Down Gradient	4.1	5.1
EPA MCL	15	8

EPA Maximum Concentration Level (MCL) for Drinking Water for Gross Alpha radioactivity is 15 pCi/L; Gross Beta is 8 pCi/L

Table 5-1 COPCs and Concentration Terms for Unit 8-08-79

Constituent	Estimated Amount Released (Curies)	Concentration (pci/l) of pit water (1992)	Concentration Term (pci/l) - Decay-Corrected to 1996
Carbon-14	9.7×10^{-6}	41	41
Cesium-137	1.1×10^{-5}	46.5	42.3
Cobalt-60	4×10^{-4}	1691	930
Manganese-54	7.1×10^{-6}	30	0.8
Nickel-63	6.6×10^{-5}	279	270
Strontium-90	1.2×10^{-6}	5.1	4.6
Tritium	5.2×10^{-2}	219791	170761

NRF CERCLA report: "5.5.2 Risk Characterization: Table 5-2 summarizes the risks associated with Unit 8-08-79. The carcinogenic risk for the 30 year future residential scenario is with cesium-137 being the risk driver through the groundwater ingestion pathway. The carcinogenic risk factor the 100 year future residential scenario is 7E-6 with cesium-137 and nickel-63 being the risk drivers through the groundwater ingestion pathway." [68]

"The specific activities of the water released are known, the volume of water can be accurately

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66 Naval Reactors Facility, Environmental Monitoring Report, Calendar Year 1991, NRFRC-EC-1007, Table 4, Pg. 21.

67 Ibid, NRFRC-EC-1007, Table 5, Pg. 22. Derived concentration Guide 2 of 15E-9.
EPA Maximum Concentration Level (MCL) for Drinking Water for Gross Alpha radioactivity is 15 pCi/L; Gross Beta is 8 pCi/L

68 Naval Reactors Facility, Environmental Monitoring Report, Calendar Year 1991, NRFRC-EC-1007, Table 4, Pg. 21.
Also: Ibid, NRFRC-EC-1007, Table 5, Pg. 22. Derived concentration Guide 2 of 15E-9.
EPA Maximum Concentration Level (MCL) for Drinking Water for Gross Alpha radioactivity is 15 pCi/L; Gross Beta is 8 pCi/L

calculated, and a conservative assumption is made that the specific activity of the water released remains the same until it reached the aquifer." [69]

Table 5-2 Summary of Risks Associated with Unit 8-08-79, Water Pit Release
Residential Groundwater Ingestion

	Concentration (pci/l)	30 Year Rad. Risk	100 Year Rad. Risk
Carbon-14	41	9E-07	9E-07
Cesium-137	42.3	1E-05	3E-06
Cobalt-60	930	7E-06	7E-10
Tritium	170761	5E-05	9E-07
Manganese-54	0.8	1E-18	3E-43
Nickel-63	270	3E-06	2E-06
Strontium-90	4.6	3E-06	5E-07
Total Risk		8E-05	8E-06

Source: Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-4
EPA Maximum Concentration Level (MCL) for Drinking Water for Gross Alpha radioactivity is 15 pCi/L; Gross Beta is 8 pCi/L.
Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-3.

NRF CERCLA report: "The release is estimated to have occurred approximately 30 feet below ground surface. The COPCs were identified as carbon-14, cesium-137, cobalt-60, manganese-54, nickel-63, strontium-90, and tritium." [70]

Why are these earlier NRF CERCLA reports important? The basic NRF operations are expanding but there is no commitment to stop contamination to the environment or even be honest about it. By reviewing previous CERCLA reports, we get clearer picture of what the current/future will do to Idaho's environment.

NRF FEIS fails to include Worker Exposures

NRF non-military employees are excluded from EEOICPA coverage with a faulty rationale and this egregious exclusion must be removed.

DEIS states: The Energy Employees Occupational Illness Compensation Program Act (EEOICPA) is outside the scope of this EIS. [DEIS Pg. G-117]

"The historically high allowable doses at NRF, the variety and complexity of operations at NRF, the

[69] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-3.

[70] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-4

problems of adequately monitoring internal dose and transient conditions, and the evolving science of radiation health [71] and epidemiology of radiation workers [72] showing elevated cancer risks at annual doses less than 2 rem per year point to the unsupportable rationale for excluding NRF workers from compensation. Although it would in many cases be decades late, and the compensation will never compensate for the early deaths of fine people, this exclusion must be removed. **By any measure of fairness and honest assessment, the exclusion of NRF workers from EEOICPA act compensation must be removed**." [73]

E. NRF Incomplete Waste Disposition

a. FEIS Fails to Include NEPA Requirements of Cumulative Radioactive Waste Disposition.

"Comments on the history of disposal at the RWMC are outside the scope of this EIS." [FEIS Pg. G-99]

Despite the above statutory statements the FEIS states: "Historic disposal at the RWMC including the subsurface disposal area of the RWMC were previously evaluated and addressed through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process which included opportunities for public comment.

The FEIS fails to acknowledge the NRF's waste stream to INL burial landfill that would not qualify as a municipal dump under EPA Subtitle D regulations. Since the NRF/ECF basic operations will increase but not change the process and the nature of waste generation, inclusion of waste is crucial. Thus, it is essential to review previous years to get an accurate assessment of what current and future operations will be. The DOE/NRF makes their position clear as the above statement shows – waste deposition is absolutely not part of this EIS thus violating basin NEPA rules.

EDI is obliged to offer the Summary of Naval Reactors Facility best-estimate radionuclide inventories in waste sent to the INL RWMC Subsurface Disposal Area from 1953 through 1999. When added the total curie content is 952,986.86. [74]

NRF plans to ship its highly radioactive remote handled waste to R-H LLW Facility yet FEIS claims: **"Comments on the location of the new Remote-Handled Low-Level Radioactive Waste disposal facility at the INL are outside the scope of this EIS."** [FEIS Pg. G-99]

DOE/Navy use a classical bait and switch ostensibly initially appearing to follow the legal requirements of NEPA, while later buried in the FEIS claim's the NRF has no obligation to include the

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71 Kohnlein,W, PhD., and Nussbaum, R. H., Ph.D., "False Alarm or Public Health Hazard?: Chronic Low-Dose External Radiation Exposure, Medicine & Global Survival, January 1998, Vol. 5, No. 1.

72 "An Epidemiology Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U.S. Department of Energy Facility, January 2005. http://www.cdc.gov/niosh/docs/2005-131/pdfs/2005-131.pdf and http://www.cdc.gov/niosh/oerp/ineel.htm and Savannah River Site Mortality Study, 2007. http://www.cdc.gov/niosh/oerp/savannah-mortality/

73 Tami Thatcher http://environmental-defense-institute.org/publications/CommentsECF.pdf Pg. 1. Citing:
Naval Nuclear Propulsion Program, Office of Naval Reactors, "Occupational Radiation Exposure from Naval Reactors' Exposure from Naval Reactors' Department of Energy Facilities," Report NT- 113, Mary 2011. http://nnsa.energy.gov/sites/default/files/nnsa/02-12-multiplefiles/NT-11-3%20FINAL.pdf
Kohnlein,W, PhD., and Nussbaum, R. H., Ph.D., "False Alarm or Public Health Hazard?: Chronic Low-Dose External Radiation Exposure, Medicine & Global Survival, January 1998, Vol. 5, No. 1. http://www.ippnw.org/pdf/mgs/5-1-kohnlein-nussbaum.pdf
"An Epidemiology Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U.S. Department of Energy Facility, January 2005. http://www.cdc.gov/niosh/docs/2005-131/pdfs/2005-131.pdf and http://www.cdc.gov/niosh/oerp/ineel.htm and Savannah River Site Mortality Study, 2007. http://www.cdc.gov/niosh/oerp/savannah-mortality/

74 "Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999", J. Giles. et.al, April 2005, ICP/EXT-05-00833, table 5 pg. 18.

full waste stream disposition and environmental contamination resulting from NRF/ECF operations. What is critical in any EIS is to review all environmental the impacts of any subject operation. That literally means the past, present and anticipated impacts as NEPA requires. By ignoring history, we are bound to repeat it.

b. FEIS says NNPP will not generate high-level-waste (HLW)

"High-Level Radioactive Waste: NRF **does not currently generate any high-level radioactive waste.** Transuranic Waste: NRF does **not currently generate any transuranic waste** from naval spent nuclear fuel handling operations." [Pg. S-19] [emphasis added]

Clearly NRF does not consider irradiated spent nuclear fuel (SNF) produced by NNPP as high-level waste as it is classified in statutes. In the recent past, the NRF had 5 propulsion prototype reactors several are defueled but operable. [75] Currently, the Advanced Test Reactor at INL that tests NRF fuel is a crucial part of NRF operations and itself produces SNF. This sleight of hand that the ATR is not an integral part of the NNPP/NRF is ridiculous and challenges the credibility of this FEIS. See EDI comments on Draft EIS for listing of NRF transuranic waste and GTCC waste dumped at RWMC. [76]

"In addition to DOE owned fuel INL/INTEC CPP-666 stores spent fuel from the Naval Reactors Program." [77] "The Idaho [CPP-666] inventory includes SNF from the Naval Nuclear Propulsion Program (i.e., submarines and aircraft carriers), which is different from commercial SNF in many ways, including enrichment level and design. From about 1952 to 1992 this Navy SNF was reprocessed in Idaho to extract high-enriched uranium for use in driver fuel rods at weapons material production reactors elsewhere." [78]

Chemical reprocessing at INL/INTEC generated millions of gallons of high-level waste – 900,000 gallons of which remains in underground tanks today. Leaks from this INTEC high- level waste tank farm and aquifer waste injection wells continue to contaminate the soil and groundwater. [79]

The FEIS states: "The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for **all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)."** [FEIS pg. Vol. I Abstract] [emphasis added]

c. The FEIS inaccurately characterizes transuranic waste

EDI comments on the DEIS (Page 18): "Navy Waste Characterization Partial listing of isotopes found in Navy waste dumped at INL" table shows clearly how Navy waste dumped in the RWMC burial grounds contains Transuranic waste. [80] One of the reasons for this is the lack of precision in cutting off the structural parts of the fuel element in preparation for reprocessing or storage. Destructive tests of fuel assemblies additionally add to the fissile content of the waste stream. In recent DOE documents characterizing the Navy waste streams going to the RWMC they acknowledge presence of, "Irradiated fuel element end boxes that were cut off of the fuel plates in the hot cells. The end boxes may contain some fuel, but **generally** only activation products". [81] [emphasis added]

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75 NRF Reactors: Large Ship Reactor A, Large Ship Reactor B, Natural Circulation Reactor, Submarine Thermal Reactor, High-Temperature Propulsion Reactor.

76 NRF Reactors: Large Ship Reactor A, Large Ship Reactor B, Natural Circulation Reactor, Submarine Thermal Reactor, High-Temperature Propulsion Reactor.

77 Energy and Environment, Storage of DOE SNF at the Idaho National Laboratory, U.S. DOE.

78 http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdf Page 17 through 18

79 Engineering Design File, Groundwater Pathway Risk Assessment for CPP-601, CPP-602, CPP-627, and CPP-640 Fuel Reprocessing Complex Non-Time-Critical Removal Action**,** Document ID: EDF-10195, Revision ID: 1, Effective Date: 02/08/12.

80 Transuranic (TRU) waste is "radioactive waste that is not classified as high-level radioactive waste contains more than 100 nanocuries (3700 Becquerel's) per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years.

81 EG&G-WM-10903; A Comprehensive Inventory of Radiological and Non Radiological Contaminates in Waste Buried In the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983,June 1994, Lockheed, Pg. 2-30.

Independent characterization of this waste must be made before more is dumped at the RWMC.

EDI's comments (Page 19) on DEIS table "Spent Reactor Fuel Dumped at INL's RWMC Subsurface Disposal Area Burial Grounds 1952 to 1980 [RWMIS] [82] shows:

Naval Reactors Facility (NRF)	27,707,700 Mass in grams or 27,707.7 kilograms

NRF Environmental Report states: "During 1991, approximately 776 cubic meters of solid radioactive waste containing 102, 706 curies of radioactivity were shipped to RWMC disposal facilities." [83]

DOE/NRF legitimately cannot deny its own waste data by claiming it is "beyond the scope of this FEIS. A legitimate assessment of any operation (absent FEIS disclosure or current publicly available data) is to look at past waste streams. The above preliminary numbers, compiled by the Environmental Defense Institute, are drawn from Freedom of Information Act from DOE's Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) and represent about 57 shipments specifically identified as "irradiated fuel". Not included in the above listing are even more numerous shipments called "un-irradiated fuel", "fuel rods", "control rods", and other reactor fuel not identified specifically as "irradiated". The curie content of these shipments identified as "fuel rods" (>7,000 curies) suggests that they are also irradiated reactor fuel. The above listing also does not include 7 shipments of "irradiated fuel" during the same period to the RWMC Transuranic Storage Area amounting to 621.549 kilograms, and which also were not included in the Spent Nuclear Fuel EIS.

DOE/NAVY gets to call waste whatever they want – HLW should equal either SNF or chemically separated material from reactor fuel reprocessing. But the activated metals and the bits of SNF on the chopped off end caps of the fuel/ECF canal trash --- these are going to a "low level radiation waste facility --- specifically, RWMC and the remote handled LLW facility at INL that has no permit to accept HLW. They don't even like to admit when its greater-than-class C material, let alone that it should be considered HLW.

Proper comprehensive evaluation – required by NEPA- looks at all cumulative environmental impacts – past, present and future. DOE/NRF cannot legally exclude complete characterization of its entire waste stream.

The FEIS inaccurately characterizes greater-than-class C waste

FEIS states: "Solid Low-Level Radioactive Waste (LLW): Operations at ECF result in generation of solid LLW primarily consisting of filters, resin, contaminated components, pieces of insulation, rags, sheet plastic, paper, and filter paper and towels resulting from radiochemistry and radiation monitoring operations. The annual average of LLW waste generated at NRF is 740 cubic meters (960 cubic yards) from routine activities and 1200 cubic meters (1600 cubic yards) from decontamination and decommissioning (D&D) activities. There are 38 shipments of LLW from NRF annually." [pg. S-20]

No complete characterization (isotope content/activity rate) of this highly radioactive remote handled waste is offered in this FEIS. Again, a violation of NEPA.

EDI's comments on DEIS (Page 8) notes; "Since this NRF reactor core waste going to the RWMC burial grounds contains long-lived radioactive isotopes due to many years of exposure in the reactor core, it should be classified as high-level waste and treated according to Nuclear Regulatory Commission (NRC) disposal standards. At the very least this waste must be put in NRC Greater than Class C (GTCC)

82 Radioactive Waste Management Information Data Base Solid Master Data Base (P61SH090), List for 1954 to 1970, Run Date 3/29/89, pages 517, 518, 519 and 520 (RWMIS).

83 Naval Reactors Facility, Environmental Monitoring Report, Calendar Year 1991, NRFRC-EC-1007, Pg. 37.

waste category. NRC disposal criteria require that "waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste." [10 CFR 61.7] Class C waste, must, for this reason, be disposed at a greater depth than other classes, or, if that is not possible, under an intruder barrier with an effective life of 500 years.

FEIS states: "Seismic Hazards Refurbishment Period: There would be **moderate** impacts from seismic hazards until refurbishment activities are complete. Activities during the refurbishment period would improve the building's ability to withstand vibratory ground motions from seismic activity. Post-Refurbishment Operational Period: There would be small impacts from seismic hazards since the refurbishment actions would improve the building's ability to withstand vibratory ground motions from seismic activity." [Pg. S-33]

FEIS further states: "Seismic Hazards: Differences in impacts from seismic hazards from the alternatives are related to the ability to withstand vibratory ground motions under each alternative. Since there would be no additional refurbishment or upgrades to ECF for the No Action Alternative, the facility and supporting infrastructure **would continue to degrade for a period of 45 years**. During the refurbishment period of the Overhaul Alternative, **to the extent practicable,** infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions. "During the **construction and transition periods** of the New Facility Alternative, **there may be upgrades or refurbishments to ECF,** to ensure operations continue in a safe and environmentally responsible manner**.** [Pg.S-72]

What do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously, this is slippery non-committal language that has no business in this FEIS and must raise RED flags to EPA/IDEQ regulators.

"At the end of the 500 year period," according to NRC regulations, "remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety." [Ibid.] The adequacy of the EPA, NRC, IDEQ regulations is discussed more fully in the waste dumping in this paper, for instance there is considerable debate over these **regulators non- enforcement that allows greater than class-C waste to be dumped in shallow land burial at INL in a flood zone.**

FEIS states: "Mixed Low-Level Radioactive Waste (MLLW) and TSCA MLLW: NRF generates a **small** amount of MLLW and TSCA MLLW, primarily from D&D activities at ECF. The annual average of MLLW and TSCA MLLW generated at NRF is 20 cubic meters (26 cubic yards). There are 12 shipments of MLLW (including TSCA MLLW) from NRF annually." [Pg.S-20]

The above DOE/NRF statement is a grossly inadequate and inaccurate waste characterization that does not meet NEPA requirements.

NRF FEIS Incomplete Seismic Vulnerabilities

The EIS failed to adequately assess the ECF's seismic vulnerabilities.

The FEIS states: "The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards." [Pg. S-6]

Despite this statement, NRF intends to continued use of the ECF for decades and does not specify exactly what modifications will be made and what independent seismic assessment will be made to demonstrate compliance.

The above FEIS statement contradicts the fact that NRF intends to continue ECF operations for over 3 additional decades. Additionally, the FEIS fails to offer requisite detail on what exactly these ECF "upgrades" will be.

"During the **refurbishment period** of the Overhaul Alternative**, to the extent practicable**, infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions."

Again, What do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously this is slippery non-committal language that has no business in this FEIS and must raise RED flags to regulators. Repeating a false statement over and over does not make it true.

FEIS states: "During the construction and transition periods of the New Facility Alternative, there may be upgrades or refurbishments to ECF, to ensure operations continue in a safe and environmentally responsible manner. During the transition and new facility operational periods, the structures, systems, and components in the new facility would be designed to the **appropriate natural phenomena hazard category to withstand vibratory ground motions."** [FEIS Pg. S-72]

Only careful reading reveals that only the NEW Facility portion covered in this EIS will be built to "appropriate natural phenomena hazard category to withstand vibratory ground motions" cleverly giving the impression that the ECF is included.

Seismic Vulnerability of Storing Highly Enriched SNF in ECF

The FEIS states: "Naval nuclear fuel is highly enriched (approximately 93 weight percent to 97 weight percent) in the isotope uranium-235 (235U). As a result of the high initial uranium enrichment, very small amounts of transuranic radionuclides are generated by end of life when compared to commercial spent nuclear fuel." [Pg.1-3]

This Navy high burnup SNF ECF is the most hazardous material in the world requiring deep geological disposal for hundreds of thousands of years due to the long-lived radio-isotopes produced in nuclear reactors. The current ECF inventory of ~400 assemblies constitutes a significant unregulated hazard in the event of accidental loss of canal coolant water.

"Since the 1990's, U.S. reactor operators are permitted by the U.S. Nuclear Regulatory Commission (NRC) to effectively double the amount of time nuclear fuel can be irradiated in a reactor, by approving an increase in the percentage of uranium-235, the key fissionable material that generates energy. In doing so, NRC has bowed to the wishes of nuclear reactor operators, motivated more by economics than spent nuclear fuel storage and disposal. Known as increased "burnup" this practice is described in terms of the amount of electricity in gigawatts (GW) produced per day with a ton of uranium." [84]

"Given these uncertainties the U.S. Department of Energy (DOE) and the NRC have provided general estimates of the radionuclide content of spent nuclear fuel based on current and previous burnup assumptions. According to DOE the estimated average long-lived radioactivity for a typical PWR and BWR assembly having lower burnup at the time of geological disposal are 88,173.69 curies and 30,181.63 curies respectively. For current burnups the NRC estimates that the post discharge radioactive inventory of spent fuel for a typical PWR and BWR assemblies are 270,348.26 curies and 127,056.67 curies respectively. [85] **Approximately 40 percent of the total estimated radioactivity for lower and high burnup is Cs-137**." [86] [emphasis added]

The FEIS ECF accident source terms do not list Cs-137. [87] This represents another significant deficiency in this FEIS. The Navy uses zirconium clad fuel that adds to storage hazards.

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[84] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, citing : Foot Note 29: U.S. Department of Energy, Final Environmental Impact Statement, for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, 2002, Appendix A, Tables A-7, A-8, A-9, A-10, (PWR/ Burn up = 41,200 MWd/MTHM, enrichment = 3.75 percent, decay time = 23 years. BWR/ Burn up = 36,600 MWd/MTHM, enrichment = 3.03 percent, decay time = 23 years.)

[85] Alvarez citing: U.S. Nuclear Regulatory Commission, Characteristics for the Representative Commercial Spent Fuel Assembly for Pre-closure Normal Operations, May 2007, Table 16, p.44-45. http://pbadupws.nrc.gov/docs/ML0907/ML090770390.pdf

[86] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, Pg. 5

[87] FEIS Pg. F-35

> "Zirconium cladding of spent fuel is chemically very reactive in the presence of uncontrolled decay heat. According to the National Research Council of the National Academy of Sciences the buildup of decay heat in spent fuel in the presence of air and steam: " is strongly exothermic – that is, the reaction releases large quantities of heat, which can further raise cladding temperatures… if a supply of oxygen and or steam is available to sustain the reactions.. The result could be a runaway oxidation – referred to as *a zirconium cladding fire* – that proceeds as a burn front (e.g., as seen in a forest fire or fireworks sparkler)...As fuel rod temperatures increase, the gas pressure inside the fuel rod increases and eventually can cause the cladding to balloon out and rupture.[original emphasis]" [88]

The FEIS states: "Naval spent nuclear fuel consists of solid metal and metallic components that are nonflammable, highly corrosion-resistant, and neither pyrophoric, explosive, combustible, chemically reactive, nor subject to gas generation by chemical reaction or off- gassing. Naval spent nuclear fuel is primarily from pressurized water reactors (PWRs)." [FEIS Pg. 1-3]

1. Seismic Vulnerabilities of ECF Degraded Concrete Basin

There are some crucial unknowns the FEIS failed to assess.

1. Is the ECF basin concrete already to degraded to allow continued operation?
2. What radiation cumulative level has the ECF basin been exposed to now and in 10 years? 10 x E 10 rad? More? Less?
3. Will the fuel in the ECF (or some fraction of fuel) melt/burn if water is removed and the fuel is uncovered?
4. Will the concrete or structural materials above the ECF actually fail if temperatures rise because of fuel heat up? Interesting that it has not been brought up as an issue before, but perhaps that is because the fuel melting temperature of fresher fuel assured fuel melt before such structural damage.

Defense Nuclear Facility Safety Board conducted a review of the newer INL/INTEC CPP- 666 SNF Basin concrete foundation. This review is relevant because the Navy's ECF "refurbishment" will entail draining portions of the basin so epoxy leak-proofing can be applied potentially putting similar stresses on the ECF concrete foundation.

"The [Fuel Storage Area] FSA Pool Structures is a passive design feature of the FAST facility. **Additional calculations performed to increase the allowable floor loading to support the FSA Reracking Project indicated that the original design objective to allow** an empty pool to be adjacent to a water filled pool resulted in <u>overstresses</u> during the [Design Basis Earthquake] DBE." [89] **[DFNSB Pg. A-4]**

FEIS fails to fully analyze the ECF refurbishing part that includes emptying sections so epoxy leak prevention remediation can proceed. Calculations of shifting ECF SNF on the degraded concrete basin foundations ability to withstand the "overstress" concurrently with a DBE are absent.

1. Radiation degradation of concrete ECF SNF basin

For continuously wetted concrete (no stainless steel liner) an aggregate dose of 10 x E10 rad (10 x E8 gray) is the limit. For dry concrete the limit is not known. The few pieces of data available from the X10 reactor in Oak Ridge, Tennessee and the Temelin reactor in the Czech Republic suggest that the allowable dose to avoid structural degradation and failure is 500 to 2,000 times lower than for wetted concrete (i.e., 5 x 10E6 rad).

It is highly likely that the ECF concrete walls have received an aggregate gamma ray dosage far in excess of that necessary to severely degrade the concrete, thus increasing seismic vulnerabilities. Maintaining ECF water levels should a significant seismic event (earthquake) occur is problematic.

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[88] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, December 17, 2013, pg. 8.

[89] DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Pg. A-4.

The FEIS fails to fully analyze these fundamental issues in the Hypothetical Accident 4.13.2.2.

The catastrophe hazard from an ECF basin drain down event is more than extreme. Such an event must be prevented at any cost. Once a drain down begins it cannot be stopped. Once the fuel is exposed no human or robotic response is possible - of any kind. A current example is Japan's Fukushima reactor/SNF storage disaster.

The accident will then proceed to its ultimate termination independent of human intervention. Temperatures inside the ECF structure will likely rise to levels sufficient to cause the concrete to fail and the building to crumble in on itself. The human exclusion zone for direct radiation exposure will likely be 1-2 km in all directions. No access will be possible in this zone for decades. Once fuel fails and radioactive atmospheric releases that zone will be pushed farther out (likely much farther out). Access to respond to the event may not be possible in or through that zone for centuries.

FEIS must provide independent engineering assessments of ECF basin concrete. Alternatively, using civilian fuel (since Navy fuel details are classified) as a surrogate; what is the concrete heat profile and rad profile of used civilian fuel? How far is it from the walls and floors of the basin? Then do some estimates of shielding and you have estimates of dose. Doing that correctly requires details about the fuel, and a complex set of radiation calculations that have a lot in common with optics problems. Gamma rays are light after all. The fuel is opaque to it, as are the water and concrete. Some of it is absorbed and heats the fuel, water and concrete. Several different interactions occur that shift the energy spectrum and generate secondary radiation. The most accurate way to assess all of this is to actually measure it.

What the ECF review will likely find is the surface of the concrete probably exceeded 10 x E10 rad after 10-20 years. It is likely now that the concrete 6-10 inches in has exceeded that same dose. The concrete 'paste' likely has little to no strength in 6-10 inches from the surface.

The temperature issue is different. So long as there is some cooling and the fuel is over 20 years old, there is not much heat to remove. If the basin water is lost, during an earthquake or severe leak, the rad field can be extreme. That prevents human entry. Lacking human entry the systems fail. When ventilation is lost heat then builds up having only convective and radiative cooling to keep things under control. [90] With limited ventilation, the temperatures inside the structure will rise substantially. If newer fuel is present, this could get out of hand quite quickly creating a second barrier (after the lethal rad fields) to human entry. The potential then is that following a basin drain down that uncovers the fuel that the accident progresses of its own accord to complete loss of control of the basin and failure of the fuel. It is likely that no recovery will ever be possible at that point. The accident proceeds to final completion (whatever that is) entirely outside of human ability to influence it.

The concrete dose serves to heat the concrete failing it prematurely. This is well known. And it served to hide the insidious damage to the concrete, as that is waived away as being all thermal damage, and then assessing that the concrete in the basin hasn't seen high heat, so it will not fail. For instance, the rad dose damage gets ignored. There are also an equally large but still handful of data points for dry concrete exposed to radiation. That data was thrown out in developing the standards for what radiation dose concrete can withstand. The data was discarded on the presumption that the early weakening was attributable to heat. The experience at Temelin and X-10 show that to be wrong. The concrete wasn't heated.

At a microscopic scale, absorbed radiation heats the concrete at nearly the atomic level. The heat damage is then limited to a small volume. But continue doing this over 50 years in a large SNF ECF basin and the problem becomes a stochastic one of adding up all of the random little damages into one large

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[90] A DNFSB review of the newer INL/INTEC CPP-666 Fuel Storage Area (FAST) water basin found "[T]he Confinement Ventilation System is degrading due to facility aging. This degradation could result in future operational downtime, radiological contamination and personnel exposure." DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Executive Summary.

failure. This can lead to a large uncontrollable leak and extended loss-of-coolant.

Yet another way to consider it is that the radiation serves to boil out the water from the cement paste that forms the backbone of concrete. When the concrete is moist there is water immediately available to cool the local heating and/or to replace the lost water. When the concrete is dry (< about 11% water) these effects are not enough and waters of hydration are lost from the paste to migrate out of the concrete. The paste then chemically changes and falls apart as damage accumulates.

One of the papers on this considered two different dose rates and times to accumulate the same aggregate dose or different doses. What they observed was very interesting. The time until the concrete was weakened remained the same despite the differing dose rates. In other words, the effect seemed to be caused by some critical radiation insult and then the passage of time. This is hugely concerning as it brings into question the entire safety basis and the possibility that the damage is essentially done in the first few days. It then just takes time for the basin concrete to fail. The FEIS acknowledges ECF basin concrete degradation.

Congress' Role Exemptions from Environmental Laws

Consequent to over a half century of Congressional exemptions to the NNPP from nuclear operations and waste management, the largest contamination of the human environment has resulted.

The 1985 Low Level Waste amendments require DOE to take ownership of a NRC licensee of GTCC waste. But as DOE manages its own LLW it is not required to classify it according to the laws for NRC licensed facilities. DOE does not have to classify its waste as A, B, C or Greater-Than-Class C except when it wants to send this waste to another state or NRC- licensed facility. Below are exemptions to the Low-level waste law for NRC licensees like commercial power reactors.

TITLE 42 United States Code Annotated 6.427.§ 28.021c

" Disposal of low level radioactive waste; (a) State responsibilities, (1) Each State shall be responsible for providing, either by itself or in cooperation with other States, for the disposal of (A) low-level radioactive waste generated within the State (other than by the Federal government) that consists of or contains class A, B, or C radioactive waste as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983;(B)low-level radioactive waste described in subparagraph (A) that is generated by the Federal Government **except** such waste that is (i) owned or generated by the Department of Energy; (ii) owned or generated by the United States Navy as a result of the decommissioning of vessels of the United States result of the decommissioning of vessels of the United States Navy; or (iii) owned or generated as a result of any research, development, testing, or production of any atomic weapons…." [91]

Exemptions from Regulatory Oversight

In the early 1990s Clinton Administration, Congress established the Defense Facility Nuclear Safety Board (DFNSB) to conduct safety assessments of DOE operations. Congress however did not grant the Board with enforcement authority similar to NRC.

Defense Facility Nuclear Safety Board enabling legislation states in pertinent part:

"SEC. 318. DEFINITION. [42 USC 2286g] "As used in this chapter, the term 'Department of Energy defense nuclear facility' means any of the following:

"(1) A production facility or utilization facility (as defined in section 11 of this Act) that is under the control or jurisdiction of the Secretary of Energy and that is operated for national security purposes, **but the term does not include**____________________

"(A) any facility or activity covered by Executive Order No. 12344, dated February 1, 1982, pertaining to the Naval nuclear propulsion program;"

The bottom line is NNPP is unregulated by any federal agency – even the Nuclear Regulatory Commission charged with regulating commercial nuclear operations or Defense Nuclear Facility

[91] 42 United States Code Annotated 6.427. § 28.021c.

Safety Board charged with monitoring DOE nuclear facilities. Attorney Mark Sullivan representing EDI petitioned the Defense Nuclear Facility Safety Board (DFNSB) to conduct a safety analysis of DOE's 60 year old Advanced Test Reactor at the INL. DFNSB chairman Winokur's reply states: "It is the Board's understanding that currently the primary defense-related mission of ATR is research and testing of components in support of naval nuclear propulsion program. **Navy nuclear propulsion activities are** excluded from the Board's jurisdiction by 42 U.S.C. ss 2286g(1)(A)." [92]

EDI's *Unacceptable Risk at INL's Advanced Test Reactor* details significant safety problems that neither DOE, the Navy or DFNSB are willing to address. As a fundamental part (as stated above) the ATR must be included in this FEIS but it is not!

NRF Comment Conclusion

EDI's comments are by no means a complete analysis of this lengthy 3 Volume document because the NRF operations are classified and there are no regulatory agency reports on it. For instance, the NNPP SNF coolant time, fuel cladding needed to properly determine ECF basin loss-of-coolant source terms are classified.

This DOE/NRF/NNPP FEIS is deficient and EPA and IDEQ are complicitous if they do not also reject its findings that contain innumerable fundamental false statements. This EIS should be detailing how NRF is going to completely replace the ECF basin as a SNF wet storage facility. Many casual EIS readers mistakenly assumed ECF replacement. Instead, DOE/Navy intends to keep this high-hazard heavily degraded ECF operating for 3-4 decades far beyond its design life that has already expired. The Navy is only willing to spend money to expand capacity for new large ship reactor SNF assemblies.

The DNFSB noted, in Recommendation 2000-2, (now 14 years back) that "[I]t was concerned with the fact that many of the DOE's nuclear facilities were constructed years ago and are approaching end-of-life. The DNFSB expressed concern that some degradation of reliability and operability of systems designed to ensure safety can reasonably be expected and recommended specific actions to assess system condition and apply system expertise in managing the configuration of vital safety systems." [93] Lacking enforcement authority, DNFSB can only advise.

EDI finds this EIS a clever effort to slip in a deliberately narrow major expansion of the Navy's SNF waste management without acknowledging 50+ years of massive radioactive contamination at INL by claiming previous NRF environmental studies. DOE/NAVY claim these CERCLA reports are beyond the scope of this EIS. The Navy's previous radioactive contamination will remain for manila putting Idahoans at risk. This is an unconscionable and avoidable assault on Idaho's most valuable Snake River Aquifer that we depend on.

Congress bears the most responsibility for NRF's unregulated willful contamination of Idaho's environment via nuclear waste mismanagement and exposure to catastrophic accidents by granting exemptions to these rogue agencies compliance with the same regulations imposed on commercial nuclear operations.

Even when federal (EPA) and state (IDEQ) regulators can enforce NEPA regulations, or mixed-hazardous RCRA regulations, Clean Water Act regulations, they remain largely silent. We the public are left with little alternative than the Courts for redress. Even this process is blocked by the courts. FOIA requests when approved are largely redacted and Appeals to DOE's office of Hearings and Appeals are denied.

It is unconscionable that 3-4 additional decades of continued operation of the ECF represents a significant unregulated hazard of the most deadly radioactive material in the world and that high-level waste ultimately must be interred in a deep geologic repository yet to be established by Congress. For more information on NRF see Section IV.K.-114

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[92] DNFSB Chair, Peter Winokur letter to Mark Sullivan, 9/23/10. Also see EDI's Unacceptable Risk at INL's Advanced Test Reactor.

[93] DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Pg.1.

Section II. G. What is INL Role with Space Travel?

In Section I.1., we discussed the Aircraft Nuclear Propulsion Program at INL during the 1950's when huge amounts of radiation was released testing various nuclear rockets. The US Air Force's Aircraft Nuclear Propulsion (ANP) program in the 1950's designed built, and flight tested a nuclear jet powered bomber which employed more than 10,000 workers. The plane was a modified B-36 (called NB-36) built by Convair and flight tested at Carswell Air Force Base in Fort Worth, Texas. That ANP program only went dormant for a while after the nuclear reactor propelled modified B-52N bomber Convair built and tested in Texas (see Section I.1.a).

In 1990 the Strategic Defense Initiative Organization (SDIO) revived the nuclear jet engine project for use in the space program. This new Black Budget program's (code name Timberwind) purpose is to develop the technology and demonstrate the feasibility of a high-temperature particle bed reactor propulsion system to be used to power an advanced nuclear rocket engine. The Strategic Defense Initiative involves orbiting space platforms that theoretically will have the capacity to shoot down missiles launched at the USA. To build these platforms, heavy payloads would have to be launched - requiring powerful rockets. SDIO believes that the nuclear rocket offers a greater thrust to weight ratio than conventional rocket designs. SDIO generated a secret Environmental Impact Statement (EIS) on Timberwind in 1990 but after environmentalists (including EDI) forced a declassified version of the EIS released (almost entirely blacked out) the project was canceled.

INL has continued to produce the plutonium-238 used in the Radioisotope Thermoelectric Generator at the Advanced Test Reactor. [94] INL's current role with space travel is described on DOE/INL website:

> "Idaho National Laboratory's Space Nuclear Power and Isotope Technologies Division fuels and tests Radioisotope Power Systems at the Materials and Fuels Complex, then delivers the systems for use in remote, harsh environments such as space. INL is working on the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) for NASA's upcoming Mars 2020 mission that will send a rover to the Red Planet. Generators fueled and tested at INL are currently powering the Mars Science Laboratory Curiosity rover (launched in 2011 and still going strong) and Pluto New Horizons (launched in 2006 and now more than 4.1 billion miles from earth, traveling at more than 30,000 mph). The power system on New Horizons was the first assembled and tested at INL.
>
> "What is an MMRTG, and How Does it Work?
>
> "Multi-Mission Radioisotope Thermoelectric Generators are ideal for space missions because they are compact, durable and reliable, providing continuous power over long periods of time. The Department of Energy (DOE) provides radioisotope power systems to NASA for civil space applications. The MMRTG for the Mars 2020 mission will be fueled and tested at the DOE's Idaho National Laboratory. It will later be shipped directly from INL to the launch site at Kennedy Space Center Florida, for integration into the rover. MMRTG's work by converting heat from the natural decay of radioisotope materials into electricity. Typically, the hot side of a general purpose heat source is 1800 degrees Fahrenheit while the cold side is approximately 570 degrees Fahrenheit. The generators consist of two major elements: a heat source that contains plutonium-238 (Pu-238) and thermocouples that convert the plutonium's decay heat energy and the cold of space to electricity. The MMRTG is designed to produce about 110 watts of electrical power to begin the mission. The system has a design life of 14 years (plus three years of pre-launch storage), but can be expected to produce power much longer than that. Additionally, the MMRTG provides a source of heat for the rover's instruments and on-board systems in the cold environment. Thermocouples have no moving parts and have proved an amazingly reliable source of energy for space missions. They have been used in RTGs for a combined total of 300 years, and not one thermocouple has failed." [95] [https://inl.gov/mars-2020/]

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[94] Final Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotopic Power Systems. DOE/EIS-0373F.

[95] [https://inl.gov/mars-2020/] Also see A History of Space Nuclear Power and Propulsion in the United States.

Section II.H. Mobile Nuclear Reactor Power Generation

The Department of Defense (DOD) acting through the Strategic Capabilities Office (SCO) and in close collaboration with the U.S. Department of Energy (DOE) plans on building a "warfighter mobile nuclear reactor power generation" unit at one of 3 Idaho National Laboratory (INL) sites operated by DOE. DOD wants to develop a "prototype advanced mobile nuclear microreactor to support DOD domestic energy demands, DOD operational and mission energy demands, and Defense Support to Civil Authorities mission capabilities." The 3/3/20 Notice of Intent [96] to prepare an Environmental Impact Statement is available for viewing online at: https://www.federalregister.gov/

The Environmental Defense Institute has been monitoring DOE's INL operations for over 20 years and can categorically say the US Army and DOE's record of mismanagement of INL nuclear projects has resulted in extensive radiation contamination to the Idaho region. Therefore, we are opposed to this prototype advanced mobile nuclear microreactor for reasons we layout below.

Because of the existential threat of climate disaster, these DOD/DOE nuclear addicts have ignored, they must add to the scope of this EIS alternative renewable energy and offer a demonstration for these energy applications. These renewable energy sources will not – as our below discussion demonstrates – add to the radiation contamination of Idaho's air and water.

DOD Plan for INL

According to DOD, three INL locations are currently under consideration; Idaho Nuclear Technology Center (INTEC) ICPP-691, Materials and Fuels Complex (MFC) ERB-II, and the Power Burst Facility (PBF) Critical Infrastructure Test Range. Initially, DOD will build a prototype inside an existing structure and after hot run testing move the reactor to an INL outside location for additional hot tests. We discuss each of these sites more below.

Idahoans remember when DOD built the Army's SL-1 small mobile reactor at the Idaho National Laboratory back in the 1960's because it exploded marking the first nuclear reactor accident that killed 3 operators. Operational mismanagement by the Army and contractor (Combustion Engineering) caused the explosion spreading significant radiation around the region. A crucial element that his new mobile reactor will share with the SL-1 design is there will be little to no radiation containment structure required for Nuclear Regulatory Commission (NRC) licensed reactors. Since the cause of the SL-1 explosion was gross materials/oversight/management problems, DOD appears to be ready to repeat the same old mistakes by stating in the NOI:

> "The microreactor must keep radiation exposure during power operation, abnormal operations, or upset conditions, as low as reasonably achievable. SCO seeks to produce a prototype that will minimize consequences to the nearby environment and population in case of kinetic or non-kinetic action affecting structural integrity or release of contamination Further, [Strategic Capabilities Office] SCO seeks to utilize nuclear materials in the construction of a prototype microreactor that, if damaged, do not generate and impose excessive training and equipping burdens on forward area first responders, site medical facilities, or supported military personnel and the civilian population." [97]

INL is desperate for a new mission to justify its existence other than cleaning-up its' huge legacy nuclear waste. DOD knows that the nuclear power option is the most expensive compared to renewables – plus and more importantly - there is no permanent deep geological disposal site for the high-level waste these reactors will generate. Tragically, nuclear waste production has never been an issue DOD/DOE have ever been concerned about. It's fine to continue to use Idaho as their nuclear waste dump. DOE/DOE 70+ year history of INL mismanagement and total disregard of the health and environmental

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[96] 12274 Federal Register / Vol. 85, No. 41 / Monday, March 2, 2020 / Notice of Intent to Prepare an Environmental Impact Statement for Construction and Demonstration of a Prototype Advanced Mobile Nuclear Microreactor

[97] Ibid.,12274 Federal Register / Vol. 85, No. 41 / Monday, March 2, 2020 / Notice of Intent

effects of their operations is prima-facia evidence that they can **NOT** be trusted for anything other than cleanup of the mess they've already made. [98]

Since DOE is self-regulated, its nuclear facilities do not come under the full regulatory authority of the Nuclear Regulatory Commission (NRC). Consequently, this new mobile nuclear microreactor will also not be required to meet NRC design/operation/safety specifications; though DOE claims to seek NRC consultation, it "does not require a NRC license."

DOD claims to need a prototype advanced mobile nuclear microreactor to support DOD domestic energy demands capable of producing 1–10 megawatts of electrical power, DOD operational and mission energy demands, and Defense Support to Civil Authorities mission capabilities. Given DOD/DOE track record their claim below sounds ridiculous:

"The microreactor must keep radiation exposure during power operation, abnormal operations, or upset conditions, as low as reasonably achievable. SCO seeks to produce a prototype that will minimize consequences to the nearby environment and population in case of kinetic or non-kinetic action affecting structural integrity or release of contamination. Further, [Strategic Capabilities Office] SCO seeks to utilize nuclear materials in the construction of a prototype microreactor that, if damaged, do not generate and impose excessive training and equipping burdens on forward area first responders, site medical facilities, or supported military personnel and the civilian population."

Each of the INL locations DOD/DOE are considering have their own major contamination issues from previous operations. EDI's extensive contamination reports on each site in the following indoor/outdoor locations at INL must be considered in the EIS scoping process before making the decision to select INL.

(a) Chemical Processing Plant 691 (CPP–691) situated within the Idaho Nuclear Technology and Engineering Center (INTEC); [99]

(b) Experimental Breeder Reactor II (EBR II) situated within the Materials and Fuels Complex (MFC); [100] [101]

(c) Power Burst Facility 613, situated within the Critical Infrastructure Test Range Complex (CITRC); [102] [103] or

(d) Alternate facilities and infrastructure identified during the scoping process.

Tami Thatcher's comprehensive comments on DOD/DOE microreactor are crucial to consider:

> **"DOE's allowable radiation level of 100 mrem/yr. would devastate public health**
>
> The EIS must not embrace the DOE's unscientific allowable radiation level of 100 mrem/yr. and implies that reaching such high levels would not be a devastation to the health of people in our communities.
>
> "Department of Energy "regulatory radiological dose limits for member of the public" is 100 mrem/yr. for onsite controlled areas and offsite or onsite outsider of controlled areas, no matter the age and gender of the member of the public.

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[98] See 1995 Settlement Agreement and Consent Order against DOE/INL for mismanagement of nuclear waste.

[99] EDI Review of Idaho Nuclear Technology and Engineering Center CERLCA Cleanup, 2016 http://environmental-defense-institute.org/publications/CERCLA.INTEC.pdf

[100] Public Comment for Class 2 RCRA Permit Modification for Materials and Fuels Complex at Idaho National Laboratory, EPA Number ID4890008952 by Tami Thatcher and Chuck Broscious, September 29, 2017 http://environmental-defense-institute.org/publications/EDIRCRAcomments2017.pdf

[101] EDI Review of ANL-W (Materials and Fuels Complex) CERCLA Cleanup, 12/10/15 http://environmental-defense-institute.org/publications/y2016ANLWcleanup.pdf

[102] EDI Review of Auxilliary Reactor Area (ARA) CERLCA Cleanup http://environmental-defense-institute.org/publications/EDICERCLAARARev9.pdf

[103] Public Comment Submittal for Department of Energy Draft Environmental Statement for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory, DOE/EA-2068, by Chuck Broscious, October 12, 2019 and Public Comment Submittal on DOE/EA-2068 also by Tami Thatcher, October 12, 2019 http://environmental-defense-institute.org/publications/EDINSTR.pdf

"Even now, with air emissions releases supposedly below 1 mrem/yr., communities near the Idaho National Laboratory have elevated levels of certain cancers, sometimes five times the state average, according to the Idaho Cancer Registry. The DOE's unique Derived Concentration Guidelines (DCGs) 3 allow about 100 times more radiological contamination than other federal standards. With federal drinking water standards, scientific study has shown that even the federal standards for radionuclides are not protective of human health.

"To get some perspective on how permissive the DOE's DCGs are, see the federal limits and public health goals for drinking water in Table 1. Compare the DOE's DCGs to federal Maximum Contaminant Levels (MCLs) and the public health goals. (To convert the DOE's DCGs as they are typically presented in microcurie/milliliter, you would multiply by 1,000,000,000 to obtain picocurie/liter.) The DOE DCGs are much higher than the federal Maximum Contaminant Level and even farther above the level would be protective of health by scientifically evaluated recommended health goals.

"For example, the federal limit for tritium in drinking water is 20,000 picocuries/liter, the DOE's derived concentration guide (DCG) is 1,900,000 picocuries/liter, but the level that isn't proven to cause harm is no higher than 400 picocuries/liter.

"The Department of Energy cites its "derived concentration guide" in defending the DOE's expansion of test range activities at the Idaho National Laboratory's National Security Test Range and Radiological Response Training Range. This will, for at least the next 15 years, will be releasing to the winds various long-lived and short-lived radionuclides to further the contaminate the INL and to blow to nearby communities at far higher levels than recent in recent decades.

"By no means is the DOE's 100 mrem/yr. dose limit in its "derived concentration guides" protective of human health. DOE ignores the epidemiology that shows that a few years of an average 400 mrem/yr. to adult radiation workers increases cancer risk. Exposure of pregnant women to DOE's allowed 100 mrem/yr. dose would greatly harm fetal health.

"The DOE ignores all modern epidemiology studies for human health effects that show harm greater than DOE chose to believe decades ago, especially to the unborn, and to females and children.

"The public as well as radiation workers need to keep in mind that, despite what they may have been taught:

• "The cancer risk is not reduced when radiation doses are received in small increments, as the nuclear industry has long assumed. U.S. Department of Energy Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063) at https://www.energy.gov/sites/prod/files/2019/09/f66/draft-ea-2063-expanding-capabilities-nstr-rrtr-inl-2019-09.pdf

" Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015 This cohort study included 308,297 workers in the nuclear industry.

• "Despite the repeated refrain that the harm from doses below 10 rem cannot be discerned, multiple and diverse studies from human epidemiology continue to find elevated cancer risks below 10 rem and from low-dose-rate exposure.

• "The adverse health effects of ionizing radiation are not limited to the increased risk of cancer and leukemia. Ionizing radiation is also a contributor to a wide range of chronic illnesses including heart disease and brain or neurological diseases. The public and radiation workers take cues from their management that they should not be concerned about the tiny and easily shielded beta and alpha particles.

"DOE-funded fact sheets often spend more verbiage discussing natural sources of radiation than admitting the vast amounts of radioactive waste created by the DOE. The tone and the metamessage from the DOE, the nuclear industry, is that if you are educated about the risks, then you'll understand that the risks are low. Yet, these agencies continue to deny the continuing accumulation of compelling and diverse human epidemiological evidence that the harm of ingesting radionuclides is greater than they've been claiming. The EIS must not be based on unscientific claims of low harm to the public from radiation, particularly the inhalation and ingestion risks." [104]

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[104] Tami Thatcher, Public Comment Submittal for the Department of Defense Prototype Microreactor EIS Comments regarding the scope of an Environmental Impact Statement for Construction and Demonstration of a Prototype Advanced Mobile Public Comment Submittal for the Department of Defense Prototype Microreactor EIS Comments regarding

the scope of an Environmental Impact Statement for Construction and Demonstration of a Prototype Advanced Mobile Nuclear Microreactor, Docket Number DOD-2020-OS-0002, March 30, 2020, by Tami Thatcher. http://environmental-defense-institute.org/
Nuclear Microreactor, Docket Number DOD-2020-OS-0002, March 30, 2020, by Tami Thatcher. http://environmental-defense-institute.org/

III. Environmental Cleanup vs. Nuclear Weapons Buildup

A. INL'S Environmental Management Plan

A number of events converged in the last ten to fifteen years that conspired to fundamentally alter the DOE's nuclear weapons complex. First, public outrage over environmental, safety, and health violations forced the closure of many of DOE's production sites. Second, the end of the Cold-War meant that previous production levels of nuclear weapons could not be justified. Indeed, with the Salt Treaties, there is now a warhead surplus that poses its own disposal problems. Third, the mortgage payments on the environmental legacy of the Cold War could no longer be deferred. This mortgage, originally estimated to range between $360 and $500 billion. The last estimate (1996) dropped to a range between $189 and $265 billion still ranks as the largest public works project in the history of the country. These reduced cost estimates reflect DOE's ability to cut corners on cleanup.

The bomb makers devised a series of new plans to restructure the DOE Complex. Complex-21, and Complex Reconfiguration are two such plans launched in the early 1990's. Basically, what these plans envisioned was a smaller leaner nuclear production and testing complex using designated "Super-Sites". INL and Savannah River were at the top of the Super-Site list. Even these sites were in bad shape with aging facilities that were many decades beyond their design life. The bomb makers desperately wanted modern nuclear production capacity that would meet current standards. So they shifted modernization projects from the Defense Program budget to the Environmental Management Budget in the early 1990s to ease passage through Congress, and avoid public scrutiny.

A detailed DOE budget analysis for FY-92 by Heart of America Northwest in *The Dirt in the USDOE's Nuclear Waste Clean-up Budget* further revealed how DOE diverted $547,859,000 from clean-up to subsidize Atomic Energy Defense Nuclear Materials Production programs. "Forty-four % of all `clean-up account' construction projects were found to be for weapons production and research missions, instead of clean-up."[Dirt @iii] "The 1992 cost of these projects that do not belong in the clean-up account is actually the tip of the iceberg. Over the course of the complete construction schedules for these projects, they will cost the Clean-up Account $821.484 million. (Based on the USDOE listed Total Estimated cost, or TEC, for each project) [Dirt @ 22] INL's "clean-up" construction projects supporting defense production missions for FY-92 is $12,995,000; and $91,600,000 over the complete multi-year construction schedules. [Dirt @ 33]

Funding, through 1998, for the ANL-W pyroprocessor for spent fuel is yet another project characterized as a waste management budget item when it should be a Defense Program item. See Section II(D). This is a back-door attempt to modernize the nuclear materials production capacity under the guise of waste management. Spent fuel requires no processing to meet acceptance criteria at disposal repositories. Also see Section I Inspector General Report.

The first years of the Clinton Administration changed some of the old culture but not as much as DOE's critics had hoped. Funding for nuclear weapons was decreased and cleanup funding was increased. Unfortunately, the new 1994 Republican Congress reversed these changes. Now nuclear weapons funding is increasing by $40 billion and cleanup is decreased by $4.4 billion over five years. DOE's 1998 Defense Programs appropriations increased six percent over 1997 and again the budget request for these programs in 1999 increase 8.6 % over 1998. DOE's 1998 Environmental Management appropriations were down 2.5% from Fiscal Year 1997.

DOE's INL 1996 Baseline Environmental Management Report shows a change from $30 billion 1995 INL cleanup estimate reduced to a $19 billion 1996 cleanup estimate. [BEMR(d)] This is not surprising because previously DOE thought they would have to do serious cleanup at INL. However, the State and EPA allowed DOE get away with inexpensive cover-up caps over dump sites as opposed to exhuming the waste and properly disposing of it at a repository. Thus, the cleanup cost estimates are nearly half of earlier projections. The following table shows INL cleanup costs between 2003 and 2020 add up to $ 7,985,550,000 that demonstrates the legacy costs of preventable gross waste mismanagement.

INL 2003 -2020 Cleanup Costs

FY-Year	Including NRF/Regulatory Support $	Excluding NRF	Source
2003		484,709,000	FY-05 P.34
2004	567,310,000		FY-05 P.34
2005		534,600,000	FY-05 P.34
2006		538,083,000	FY-07 P.144
2007		519,604,000	FY-07 P.144
2008		522,838,000	FY-07 P.144
2009		489,239,000	FY-07 P.144
2010		469,168,000	FY-07 P.144
2011		412,000,000	FY-14 P.59
2012		389,800,000	FY-14 P.59
2013		355,766,000	FY-15 P.29
2014		393,593,000	FY-16 P.127
2015		404,929,000	FY-17 P. 121
2016		401,919,000	FY-17 P. 121
2017		370,088,000	FY-17 P. 121
2018	595,198,000		FY-20 P. 29
2019	638,805,000		FY-20 P. 29
2020	553,225,000		FY-20 P. 29
Totals	2,354,538,000	8,640,874,000	
Total 2003-2020		10,995,412,000	

Sources:
Department of Energy FY (for each year + PG.#) Congressional Budget Request Environmental Management, Volume 5
DOE FY 2014 Congressional Budget Request Environmental Management, DOE/CF-0088, Volume 5
Department of Energy FY 2015 Congressional Budget Request, DOE/CF-0100, Volume 5
Department of Energy FY 2016 Congressional Budget Request DOE/CF-0111 Volume 5
Environmental Management Department of Energy FY 2017 Congressional Budget Request DOE/CF-0123, Volume 5
DOE FY 2020 Congressional Budget Page 28 of 129

Section III. B. INL Site-wide Environmental Impact Statement

The Environmental Defense Institute (EDI) supports the Department of Energy's (DOE) involuntary decision to conduct a site-wide Environmental Impact Statement (EIS) of the Idaho National Engineering Laboratory (INL). Responding to a citizen law suit, (EDI was a co-plaintiff) DOE initiated in 1991 two Programmatic Environmental Impact Statements (PEIS) of its nuclear weapons production complex. One PEIS covers Environmental Restoration and Waste Management (ER/WM PEIS) or "Cleanup", and the other PEIS covers Reconfiguration or "Modernization" of DOE's production Complex. In 1992 DOE decided to do a third PEIS or Spent Nuclear Fuel PEIS. These three PEIS's do not meet the complex wide programmatic National Environmental Policy Act (NEPA) requirements. DOE failed to comply with the Court's Stipulation by not producing the ER/WM PEIS but only generated a WM PEIS. The citizens groups went back to Court in May 1997 to force the Department to meet its legal obligations on the remaining ER PEIS. As of January 1998, DOE has been found in contempt of court. The importance of this ER PEIS lies in a number of the following issues.

- DOE would be obliged to establish complex wide cleanup standards.
- DOE would have to articulate where and how much of the waste is going to be disposed.
- Define the impact of workers from inter-site transport
- Institutional controls and land usability/long term stewardship
- Priority for complex wide cleanup

DOE is also responding to a June 28, 1993 Summary Judgment from US District Court, District of Idaho. Judge Harold Ryan found in favor of the State of Idaho and the Shoshone-Bannock Tribes. He issued an injunction on additional DOE waste shipments to INL until a comprehensive EIS was conducted and a Finding of No Significant Impact was determined. Ryan found that; "In light of all of these changes and new proposals, the court strongly believes that DOE must prepare a comprehensive, site-wide EIS addressing all nuclear waste activities at INL." [Ryan @35]

"On December 22, 1993, Senior US District Judge Harold L. Ryan issued an Order ratifying proposed modifications to the US District Court's Opinion and Order of June 28, 1993. Subsequently, the Notice of Non-compliance Consent Order between the Idaho Department of Health and Welfare (IDHW) and DOE, signed April 3, 1992, was amended on March 22, 1994, to include mixed waste management stipulations outlined in the ratification Order dated December 22, 1993. The amended Consent Order requires DOE to take the following actions:" [WINCO-1216]

* "Calcine all high-level liquid radioactive waste that does not contain sodium on or before January 1, 1998."
* "Calcine or otherwise process as much sodium-bearing high-level liquid radioactive waste (sodium-bearing waste) as DOE and the IDHW mutually agree is practicable by January 1, 1998."
* "...evaluate and test Freeze Crystallization, Radionuclide Partitioning, and Precipitation, the sodium-bearing treatment technologies identified by DOE in a November 15, 1993 letter."
* " Select the sodium-bearing waste pre-treatment technology, if necessary, and calcine or processing technology by June 1, 1995."
* "within ninety (90) days following the selection of ... technologies for sodium-bearing waste calcination and calcine conversion, ... enter into negotiations [with IDHW] on the construction schedule for any necessary facilities to implement the technologies."
* "On or before March 31, 2009 ... permanently cease use of [tank farm tanks with pillar and panel vault construction] and all associated vaults; or .... achieve compliance with all secondary containment requirements set forth in IDAPA ss 16.01.5009 (40 CFR ss 265.193)."
* "On or before June 30, 2015 ... permanently cease use of [all remaining tank farm tanks] and all associated vaults; or ... achieve compliance with all secondary containment requirements set forth in IDAPA ss 16.01.5009 (40 CFR ss 265.193)."

[WINCO-1216]

The Environmental Impact Statement (EIS) is over 4,200 pages, yet it offers less definitive information and waste stream characterization than the 1977 INL Waste Management EIS that was one eighth the size. The 1977 EIS at least offered some historical data on radioactive releases so that the reader could evaluate to some degree the cumulative environmental impact of future activities. This EIS offers little or none of this essential information. In order to satisfy NEPA, the INL ER/WM EIS must comprehensively assess the cumulative environmental impact of past and proposed government activities at INL, which it did not.

Summary of Issues in the INL Environmental Impact Statement (EIS)

* The EIS lacks sufficient detail to be considered a comprehensive programmatic site-wide Environmental Impact Statement.
* The EIS fails to be conducted within the context of DOE's Reconfiguration PEIS, ER/WM-PEIS, and implementation plan for compliance with the Federal Facilities Compliance Act.
* All public testimony at Idaho hearings on the two PEIS's must be included in a the EIS comments.
* EIS fails to consider all INL operating facilities and their related operating systems from 1947 to the present and fully assess and characterize their waste streams, (i.e.. reactors, fuel processing, incinerators, Calciner, evaporators, etc.).
* All activities within the boundaries of INL must be included in the EIS. By definition, this must include all facilities listed on Tabulation of Facilities at the INL, and the New Integral Fast Reactor (IFR).
* The EIS fails to fully characterize Navy waste streams for NRC disposal criteria compliance.
* All current and planned non-INL activities upon which successful implementation of INL activities depend, must be fully characterized and the potential environmental impacts of such activities not coming on line as anticipated identified, (i.e.. WIPP and Yucca Mt. dumps).
* The EIS fails to consider fully all planned INL facilities, their related operating systems and characterize their waste streams.
* The use of radioactive waste percolation ponds must be suspended.
* Radioactive and chemical waste must be disposed in fully compliant and permitted RCRA hazardous waste and/or EPA/NRC permitted radioactive waste disposal sites.
* Decontamination and Decommissioning waste volumes and toxicity must be fully characterized.
* EIS fails to fully assess the ICPP high-level waste tanks and vaults to include structural, constituents, seismic, leakage into/out-of vaults, and service line leaks.
* A full mass balance assessment of water pumped from aquifer and waste discharge volumes over INL's history.
* Compilation of Snake River Aquifer information into a single data base and a development of a new model to analyze contaminate dispersion.
* Declassification of all environmental, health and safety documentation relevant to establish historical INL source terms (radioactive releases).
* Analysis of the seismic and volcanic hazard that is fully peer reviewed by ID Geologic Survey and other qualified experts.

Section III. C. DOE’s High-Level Waste Environmental Impact Statement

The Department of Energy Idaho Operations Office (DOE) announced in 1998 its intent to prepare a High-Level Waste and Facilities Disposition Environmental Impact Statement (EIS). This is a requirement of the National Environmental Policy Act for all federal agencies. The scoping phase of this process is intended to give the public an opportunity to comment on the what issues must be addressed in the EIS. Unfortunately DOE refuses to provide the required hearings where citizens can be assured that their comments will become a part of the public record. Instead, DOE is offering feel-good focus group meetings and butcher paper pads.

Primarily, the EIS focus is the legacy of reactor irradiated fuel reprocessing at the Idaho Chemical Processing Plant (ICPP). Reactor fuel was reprocessed to extract highly enriched uranium and other isotopes for military nuclear programs. The high-level radioactive waste left behind after reprocessing includes both 1.7 million gallons of liquid waste in eleven underground tanks as well as 3,800 cubic meters (134,140 cubic feet) of solidified liquid waste known as calcine. The Calciner is basically an incinerator that took some of the liquid waste and burned off the liquid portion and mixed the residual ash with a granular calcine material so it could be more easily moved to underground storage silos at the ICPP.

DOE offers three alternative actions in their EIS scoping literature; 1.) no-action; 2.) proposed action; and 3.) non-separations action.

The EIS no-action alternative would continue the solidification of the liquid high-level waste into calcine and indefinitely store it in underground silos at the ICPP. Tank sediments and liquid portions (30-40,000 gallons) that cannot be removed using existing transfer pumps will also remain in the tanks permanently.

The EIS proposed action, preferred by DOE, would include building a pretreatment plant to separate the transuranic (heavier than uranium) or "high-activity" waste portions from the "low-activity" portions. This separations process would be applied to both the liquid and the calcine waste. The "high-activity" portion would then be vitrified into a glass-like form and shipped to a geologic repository. The "low-activity" portion would be mixed with cement (grout) and dumped back into the ground at INL or back into the old waste tanks on top of the remaining liquid and sediments.

The EIS non-separation alternative would treat both the liquid tank waste and the calcine for permanent disposal in-place at the INL or at an out of state geologic repository. Residual liquid and tank sediments would be mixed with cement and left in the old tanks.

DOE is legally obliged to offer EIS alternatives that meet all regulatory and legal requirements. However, none of the above three alternatives meet this basic test. Among the regulations that would be violated are the Resource Conservation Recovery Act, the Nuclear Regulatory Commission regulations on radioactive waste disposal, the U.S. District Court Settlement Agreement between the State of Idaho, Navy, and DOE, and finally DOE's own Record of Decision on Spent Nuclear Fuel Management and INL Environmental Restoration and Waste Management EIS.

Why don't the EIS alternatives meet regulatory and legal requirements? The Nuclear Regulatory Commission (NRC) defines high-level waste by the process that created it as opposed to specific characteristics. High-level is, (1) irradiated reactor fuel, (2) the waste generated by the processing of irradiated reactor fuel, (3) the solids into which the liquid wastes were converted. There is no question that the entire contents (liquid and sediment) of ICPP waste tanks and the calcine are high-level wastes. As such NRC disposal regulations require a permanent geologic repository and waste shipped to the repository must meet acceptance criteria. Anything less than total extraction of all the tank contents and vitrification of the waste will meet these requirements.

Additionally, the Resource Conservation Recovery Act (RCRA) classifies the ICPP tank waste as a mixed hazardous radioactive waste. RCRA requires vitrification treatment of this waste prior to disposal. Land Disposal Restrictions in RCRA will not allow the tanks or silos to be used as a disposal site. Therefore, DOE could not get a RCRA closure permit for the tanks or silos without first decontaminating them.

The separations technology DOE is pushing in Idaho is reminiscent of the Hanford grout scenario. DOE is trying to pull the same high-level/low-level nonsense at INL apparently thinking Idahoans are not aware of the Hanford escapade. The radionuclide partitioning technology is an unproven process of separating out the transuranic elements (heavier than uranium) from the rest of the waste and calling it "high-activity."

The driver to this treatment approach is volume reduction. The separations approach minimizes the volume shipped to a geologic repository and maximizes the volume dumped back into the ground. The Department also thinks that it can ship the smaller volume of high activity waste to another site to be vitrified, thereby avoid building a plant at INL. Since DOE is building a vitrification plant at Hanford, the Department wants to ship the high-activity portion of INL's high-level waste there for treatment thereby saving the $3 billion cost of the Idaho vitrification plant.

DOE's attempt to use grout (cement) to stabilize the "low-activity" waste is a Hanford rerun that generated so much public opposition that DOE was forced to cancel the project. The question of waste classification played a crucial role in ending the Hanford grouting program. DOE tried in 1990 to delist much of its high-level liquid waste saying it was not really high-level and therefore could be mixed with cement (grout) and dumped back into the ground. The Oregon and Washington State regulator's position is that all the tank farm waste is high-level and therefore regardless what DOE's separations treatment produced, it must be managed and disposed as high-level wastes.

Hanford now is planning to vitrify both the high and low activity parts of its high-level wastes. The low-activity parts are to be stored on-site in a retrievable form. Thomas Tebbs with the Washington Department of Ecology and Dirk Dunning with the Oregon Department of Energy believe this is a step in the right direction; but that it is a waste of resources to separate the high and low wastes; best just vitrify the whole volume together in one operation and ship it to a permanent repository.

Another very troubling part of DOE's INL plan is to leave the high-level tank farm sediments (heels) in the tanks. "The ICPP Tank Farm heels will not be removed and the Tank Farm will be closed under RCRA [Resource Conservation Recovery Act]." "The closed Tank Farm would probably meet the subtitle D landfill standards for industrial waste." Subtitle D is a municipal garbage dump classification. It is obvious, even to the most pedestrian observer, that garbage and high-level radioactive waste are different. If DOE is allowed to implement any of its EIS options it will literally translate into INL becoming a permanent high-level waste dump site.

The tank heels can be removed by conventional dredging techniques currently being used at Oak Ridge or use the Hanford Tank Sluicer Mechanism. DOE believes: "However, it is not practical to remove all of the heels from the INL tanks, decontaminate the equipment, and remove all surrounding soils due to technological, economic, and health and safety factors involved." In a technical journal called *Initiatives in Environmental Technology Investment* the history of tank heel removal equipment is explained along with the most recent application with Oak Ridge's Bethel Valley high-level tanks.

"Power Fluidic devices have been used in nuclear installations in the United Kingdom for the past 20 years, and more than 400 systems have been installed with no failures, to date. They offer an alternative to mechanical pumps, which are generally more expensive, produce large volumes of secondary waste, and tend to fail frequently, increasing the risk to maintenance workers. Steam jets require less maintenance but have limited ability to pump solid/liquid mixtures, operate on one fixed flow rate, and heat and dilute tank contents." [Initiatives]

The Environmental Defense Institute (EDI) suggests that the best approach is to directly vitrify the whole volume of the tank liquid, the tank heels, and the calcine wastes without any partitioning or separation of high-activity and low-activity wastes. This vitrified "road-ready" waste would then be put into an on-site monitored retrievable storage facility until a safe permanent disposal site is developed. The State of Idaho must fully review the failed Hanford grout program before committing to a similar project at INL. DOE's continued efforts to run the evaporator to reduce the liquid volume in the ICPP high-level tanks though on the surface appear to minimize the risks of leaks, could ultimately exacerbate any heal removal program and increase the amount of waste left in the tanks if proceed with the preferred alternative of grouting the heals in place.

The Final Report from the Hanford Tank Waste Task Force got it right by recommending: "The high cost and uncertainty of high-tech pretreatment and R&D threatens funding for higher performance low-level waste form, vitrification, and cleanup. Put wastes in an environmentally safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup. Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository. Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." The Institute for Energy and Environmental Research's 1997 report Containing the Cold War Mess discussion of the Hanford tank problems are applicable to the INL situation.

"However, the current predisposition in the DOE seems to be to pour cement into the tanks over the residual waste volume as a method of closure. This is being done on the one tank that has been emptied of sludge at the Savannah River Site, pursuant to an Environmental Assessment. This closure method could leave tens of thousands to millions of curies of long-lived radionuclides in each tank at the time of closure. It would put these wastes in forms that would be very difficult to retrieve, because they would be hardened cement. This method of closure is converting the few programs actually reducing risks a weapons site (i.e., vitrification of high-level waste in the Defense Waste Processing Facility) into a potential long-term liability, in a manner analogous to examples that we have discussed where short-term waste management 'solutions' are converted into long-term environmental problems.

"Pouring cement into the tanks should be ruled out as a method of closure, especially as there is insufficient understanding of the long-term risks to soil and groundwater from residual waste and there has been insufficient retrieval technology development. If hardened wastes cannot be retrieved, then the focus for such waste should be on technology development, because they do not pose risks that would be mitigated by cementation in the near-term. Cementing would also make remediation of the vadose zone far more difficult than it already is. Cementing the tanks appears to be DOE's way of washing its hands of the environmental problem of tank decommissioning." [IEER(g)@212]

In summary, the repeated mantra "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. DOE is wasting precious resources by refusing to recognize the public's demand for real solutions to the radioactive waste problem. DOE must get on with cleanup and apply proven technologies that will put all radioactive waste into a stable vitrified form for on-site storage for the near-term because there are no guarantees on any permanent geologic repositories coming on line soon.

Section IV. INL Cleanup Plans

A. How Clean is Clean

Conscientious environmental restoration of the INL site where massive quantities of radioactive and chemical wastes have been recklessly dumped will not occur unless clear quantitative environmental standards are established. "How clean is clean." The Environmental Protection Agency's (EPA) last promulgated ruling on maximum concentrations limits (MCL)for radionuclides in drinking water was issued in the Federal Register (28404) July 9, 1976. The agency also issued National Interim Primary Drinking Water Regulations (EPA-570/9-76-003) that went into effect in June 24,1977. EPA tried to promulgate new standards for high level and Transuranic radioactive wastes in 1985 that offered inadequate protection of human health. These standards were challenged by the Natural Resources Defense Council and were overturned by the First District Court of Appeals in 1987. See Section IV.A.1 for details.

In 1991, EPA announced National Primary Drinking Water Regulations; Radionuclides; Proposed Rule, published in the Federal Register, July 18, 1991. As of this writing, EPA has yet to promulgate these new standards. The table below titled EPA Drinking Water Standards- Current and Proposed compares the two standards. EPA has issued grossly less stringent standards promulgated shown in Appendix E. See Section IX Appendix E for a complete listing of both the current rules and current Primary Drinking Water Standards (again grossly inadequate).

EPA Drinking Water Standards - Current and Proposed [EPA-570/9-76-003] [FR-7/18/91-Part-II]

Nuclide	Symbol	EPA 1976 Standard pCi/L	EPA Proposed Standard pCi/L
Beryllium-7	Be	6,000	43,500
Carbon-14	C	2,000	3,200
Sodium-22	Na	400	466
Phosphorus-32	P	30	641
Sulfur-35	S	500	12,900
Chlorine-36	Cl	700	1,850
Calcium-45	Ca	10	1,730
Calcium-47	Ca	80	846
Scandium-46	Sc	1,000	863
Scandium-47	Sc	300	2,440
Scandium-48	Sc	80	766
Vanadium-48	V	90	644
Chromium-51	Cr	6,000	38,400
Manganese-52	Mn	90	733
Manganese-54	Mn	300	2,010
Iron-55	Fe	2,000	9,250
Iron-59	Fe	200	844
Cobalt-57	Co	1,000	4,870
Cobalt-58	Co	9,000	1,590
Cobalt-60	Co	100	218.00

Nickel-59	Ni	300	27,000
Nickel-63	Ni	50	9,910
Zink-65	Zn	300	396
Germanium-71	Ge	6,000	436,000
Arsenic-73	As	1,000	7,850
Arsenic-74	As	100	1,410
Arsenic-76	As	60	1,060
Arsenic-77	As	200	4,330
Selenium-75	Se	900	574
Bromine-82	Br	100	3,150
Rubidium-86	Rb	600	485
Rubidium-87	Rb	300	501
Strontium-85	Sr	21,000	2,830
Strontium-89	Sr	20	599
Strontium-90	**Sr**	**8**	**42**
Yttrium-90	Y	60	510
Yttrium-91	Y	90	576
Zirconium-93	Zr	2,000	5,090
Zirconium-95	Zr	200	1,460
Niobium-93	Nb	1,000	10,500
Niobium-95	Nb	300	1,250
Molybdenum-99	Mo	600	1,830
Technetium-96	Tc	300	2,050
Technetium-97m	Tc	1,000	4,450
Technetium-97	Tc	6,000	32,500
Technetium-99	Tc	900	3,790
Ruthenium-97	Ru	1,000	7,960
Ruthenium-103	Ru	200	1,810
Ruthenium-106	Ru	30	203
Ruthenium-105	Ru	300	3,720
Palladium-103	Pd	900	6,940
Palladium-109	Pd	300	2,120
Silver-105	Ag	300	2,700
Silver-110	Ag	90	512
Silver-111	Ag	100	1,080
Cadmium-109	Cd	600	227
Cadmium-115m	Cd	90	339

Cadmium-115	Cd	90	958
Indium-115	In	300	35.1
Tin-113	Sn	300	1,740
Tin-125	Sn	60	446
Antimony-122	Sb	90	810
Antimony-124	Sb	60	563
Antimony-125	Sb	300	1,940
Tellurium-125m	Te	600	1,490
Tellurium-127m	Te	200	663
Tellurium-127	Te	900	7,920
Tellurium-129m	Te	90	524
Tellurium-129	Te	2,000	27,200
Tellurium-131m	Te	200	971
Tellurium-132	Te	90	580
Iodine-126	I	3	81
Iodine-129	I	1	21
Iodine-131	I	3	108
Cesium-131	Cs	20,000	22,800
Cesium-134	Cs	20,000	81.3
Cesium-135	Cs	900	794
Cesium-137	**Cs**	**200**	**119**
Barium-131	Ba	600	2,950
Barium-140	Ba	90	582
Lanthanum-140	La	60	652
Cerium-141	Ce	300	1,890
Cerium-143	Ce	100	1,210
Praseodymium-143	Pr	100	1,170
Promethium-149	Pm	100	1,380
Samarium-151	Sm	1,000	14,100
Samarium-153	Sm	200	1,830
Emporium-152	Eu	60	814.00
Emporium-154	Eu	200	573.00
Emporium-155	Eu	600	3,590.00
Gadolinium-153	Gd	600	4,680
Terbium-160	Tb	100	815
Dysprosium-166	Dy	100	830
Holmium-166	Ho	90	981

Erbium-169	Er	300	3,640
Thulium-170	Tm	100	1,030
Thulium-171	Tm	1,000	12,700
Ytterbium-175	Yb	300	3,110
Lutetium-177	Lu	300	2,550
Hafnium-181	Hf	200	1,170
Tantalum-182	Ta	100	842
Wolfram-181	W	1,000	19,000
Wolfram-185	W	300	3,440
Rhenium-183	Re	2,000	5,400
Rhenium-186	Re	300	1,880
Rhenium-187	Re	9,000	520,000
Osmium-185	Os	200	2,460
Osmium-191	Os	600	2,380
Osmium-193	Os	200	1,690
Iridium-190	Ir	600	1,010
Iridium-192	Ir	100	957
Platinum-191	Pt	300	3,810
Platinum-193m	Pt	3,000	3,020
Platinum-193	Pt	3,000	46,100
Platinum-197	Pt	300	3,400
Gold-196	Au	600	3,660
Gold-198	Au	100	1,310
Thallium-204	Ti	300	1,680
Lead-203	Pb	1,000	5,060
Bismuth-206	Bi	100	656
Bismuth-207	Bi	200	1,010
Radium-226/228	Ra	5	15.7
Protactinium-233	Pa	300	1,510
Gross Alpha		15	15
Tritium		**20,000**	**60,900.00**

EPA's current Primary Drinking Water Standards maximum contaminate level (MCL) have been reduced to only six listed below in Table A. 40 CFR §141.66 Maximum Contaminant Levels for radionuclides states the following:

"(2) Except for the radionuclides listed in table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents must be calculated on the basis of 2 liter per day drinking water intake using the 168 hour data list in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in

Water for Occupational Exposure," NBS (National Bureau of Standards) Handbook 69 as amended August 1963, U.S. Department of Commerce. *http://www.archives.gov/federal__register/code__of__federal__regulations/ibr__locations.htm*

EDI's online attempt to access the above link found it nonfunctional or "Page Not Found" and a hours of search Dept. of Commerce for National Bureau of Standards Handbook 69 found nothing.
"l. **If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.**

"Table A—Average Annual Concentrations Assumed To Produce: a Total Body or Organ Dose of 4 mrem/yr maximum contaminate level (MCL) Regulated Contaminants (Radionuclides Rule 66 FR 76708 December 7, 2000 Vol. 65, No. 236)

1. Radionuclide	Critical organ	pCi per liter ug/L
2. Tritium	Total body	20,000 pCi/l
3. Strontium-90	Bone Marrow	8 pCi/l
4. Combined Radium-226 and 228		5 pCi/l
5. Gross Alpha particle activity (excluding radon and uranium)		15 pCi/l
6. Beta particle and photon radioactivity		30 µg/L
Beta/photon emitters* 4 mrem/yr		4 mrem/yr
7. Uranium		30 µg/L

"(e) ***MCL for uranium***. The maximum contaminant level for uranium is **30 µg/L**
"(b) ***MCL for combined radium-226 and -228***. The maximum contaminant level for combined radium-226 and radium-228 is **5 pCi/L**. The combined radium-226 and radium-228 value is determined by the addition of the results of the analysis for radium-226 and the analysis for radium-228.
"(c) ***MCL for gross alpha particle activity (excluding radon and uranium).*** The maximum contaminant level for gross alpha particle activity (including radium-226 but excluding radon and uranium) is **15 pCi/L.**
"(d) ***MCL for beta particle and photon radioactivity.*** (1) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year).
"(e) *MCL for uranium.* The maximum contaminant level for uranium is **30 µg/L**
"(2) **Except for the radionuclides listed in table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents** must be calculated on the basis of 2 liter per day drinking water intake using the 168 hour data list in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," [1]

The current and proposed comparative table shows the obvious trend to raise the allowable limits of radionuclides in drinking water. Clearly, this an effort to change the standards to accommodate increases of radiation from DOE operations and commercial nuclear power plants. The 1976 regulations are based on whole body or critical organ dose limit of 4 mrem/year. Whereas the proposed 1991 regulations are based only on whole body effective dose equivalent of 4 mrem/yr without critical organ dose limit. Thus, any nuclides that were limited by their dose (4 mrem being the limit) to a critical organ (e.g. Sr-90 to bone) are now limited by that same (4 mrem) dose, but calculated on the effective whole-body equivalent basis, thus the allowable uptake of these nuclides go up. EPA rationale has been severely challenged to the extent that seven years later the agency has not promulgated the rule to avoid the anticipated litigation. This is an attempt by EPA to legitimize federally generated contaminates

[1] Title 40 CFR Part 141: Protection of Environment]
PART 141—NATIONAL PRIMARY DRINKING WATER REGULATIONS

dumped by a sister federal agency - DOE, that is the primary radioactive polluter. EPA's rule-making is in direct contradiction to the independent research which document the risks to exposure to low-level radiation, and the need to lower the allowable radioactive contaminates in the environment. And once again, it will be the public interest groups that must generate the resources to challenge these rules in court in order to protect the public health.

A Congressional Office of Technology Assessment report states that: "The existing Federal guidance for protection of the public against radiation is outdated, and the development of new guidance is uncertain." ... "It is uncertain when and whether EPA would revise their standards to reflect: 1.) recent findings by the National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR V report) that the risks of low-level ionizing radiation are two to three times more serious than it previously anticipated and 2.) the draft recommendation by the International Commission on Radiological Protection that the current radiation limit for workers be reduced by 60 percent." [OTA @ 41]

The Nuclear Regulatory Commission's definition of transuranic waste was also changed from 10 nano curies per gram to 100 nano curies per gram, which effectively wrote off large quantities of waste that must go to permanent repositories as opposed to going to low-level landfill dumps like the RWMC burial ground at INL.

The federal government continues to violate its obligation to clean up its environmental disasters by setting standards that will minimize cleanup costs - not maximize restoration. Risk minimization dictates that the establishment of environmental standards be guided by considerations of health effects on current and future residents. DOE must assume that currently sparsely populated areas will not remain so. Declaring large areas of land as "nuclear sacrifice zones" into perpetuity is unacceptable - if not grossly unconscionable.

The National Academy of Sciences (NAS) offered standards in "A Study of the Isolation System for Geologic Disposal of Radioactive Wastes." This study used risk-based approach for standards setting. The NAS panel recommended that there be a limit on the dose to the maximally exposed individual at <u>any</u> future time from wastes buried in a repository. The NSA's risk-based approach is the most sensible and scientifically supportable approach to standards. However, the 10 millirem limit NSA recommended is far too high. Recent epidemiological studies are revealing that exposures at that level can cause serious health effects. [IEER(c)] The May 1997 NRC standards are set at 25 millirem for unrestricted access and 500 millirem for restricted access. EPA advises for a 15 millirem/year limit for lifetime exposure that again based on independent studies is too high.

Congressional action on the Resource Conservation Recovery Act (RCRA) which is up for reauthorization, will have far reaching impact on INL cleanup. Currently, RCRA excludes radionuclides, in their pure form, from regulation based on Atomic Energy Act. However, if radionuclides are mixed with other RCRA listed hazardous materials, then the laws apply. DOE has for decades, hidden behind this exemption. Hopefully, Congress, now having to appropriate (between 2003 and 2020) ($10,995,412,000) to cleanup DOE's INL mess, will finally recognize that federal agencies must be held to the same standard as corporate America. Continuing the RCRA exemption will surely continue the past abuses and exacerbate the cleanup process. See table INL Cleanup Costs below.

The public must be involved and able to fully participate in developing clean-up standards. This issue must be specifically addressed and ample opportunity for public comment. The question of "How Clean is Clean" is a question that the public, not government agencies, must decide. Therefore, Congressional hearings are needed not only to address standards, but also the fundamental structural issues concerning the funding of cleanup programs under a permanent trust fund that would not be subject to annual Congressional and Administrative raids.

INL 2003 -2020 Cleanup Costs [2]

FY-Year	Including NRF/Regulatory Support $	Excluding NRF	Source
2003		484,709,000	FY-05 P.34
2004	567,310,000		FY-05 P.34
2005		534,600,000	FY-05 P.34
2006		538,083,000	FY-07 P.144
2007		519,604,000	FY-07 P.144
2008		522,838,000	FY-07 P.144
2009		489,239,000	FY-07 P.144
2010		469,168,000	FY-07 P.144
2011		412,000,000	FY-14 P.59
2012		389,800,000	FY-14 P.59
2013		355,766,000	FY-15 P.29
2014		393,593,000	FY-16 P.127
2015		404,929,000	FY-17 P. 121
2016		401,919,000	FY-17 P. 121
2017		370,088,000	FY-17 P. 121
2018	595,198,000		FY-20 P. 29
2019	638,805,000		FY-20 P. 29
2020	553,225,000		FY-20 P. 29
Totals	2,354,538,000	8,640,874,000	
Total 2003-2020		10,995,412,000	

As is true with "all-things-government," regulation is only as good as the political will of those in power to protect the general public's interest. The current struggle between federal agencies to generate nuclear site cleanup standards is a high stakes game because of the hundreds of billions of dollars required for cleanup and decommissioning. A strict standard that protects the public health will cost more than a lax standard that only protects the polluter. As the first commercial nuclear power plants end their design life and the utilities move toward decommissioning, the Nuclear Regulatory Commission (NRC) is determining "how clean is clean." Michael Mariette, Director of the Washington, DC based Nuclear Information and Research Service (NIRS) reported May 23, 1997 in his "Radiation Crisis Alert" the following:

> "The Nuclear Regulatory Commission's (NRC) FINAL Rulemaking in a process that began as ERORR (Enhanced Rulemaking on Residual Radioactivity-- and before that BRC) has a three part deal -- 25 millirem/year for unrestricted, and 100 or 500 millirem/year for 'restricted' license termination at nuclear sites. This new rule currently applies to civilian sites under NRC or state agreement agencies, (thousands of sites in the US) and may be applied to DOE sites, if prospective external regulation of DOE by NRC is approved. NRC's rule provides no special protection for groundwater, and indeed assumes that if public water supplies are available, that water contamination does not have to be factored as an exposure pathway, in some cases creating permanent sacrifice of water

[2] Department of Energy FY (for each year + PG.#) Congressional Budget Request Environmental Management, Volume 5 and;
DOE FY 2014 Congressional Budget Request Environmental Management, DOE/CF-0088, Volume 5 and;
Department of Energy FY 2015 Congressional Budget Request, DOE/CF-0100, Volume 5 and;
Department of Energy FY 2016 Congressional Budget Request DOE/CF-0111 Volume 5 and;
Environmental Management Department of Energy FY 2017 Congressional Budget Request DOE/CF-0123, Volume 5 and;
DOE FY 2020 Congressional Budget Page 28 of 129

resources."

"To qualify a site for unrestricted use, licensees must 'clean' contamination of the site to a level 'As Low as Reasonably Achievable' (ALARA) below a 25 mrem/yr dose to the average member of the 'critical group.' The 25 mrem/yr dose is in addition to the NRC's estimated background dose of 300 mrem/yr which, by itself, results (according to NRC) in a little more than one fatal cancer per hundred people. Unrestricted use includes farming, homes, day care centers and other uses--i.e. anything. Both dose and critical group are based on many assumptions made by NRC that may not represent actual radiation exposure that will result from activities on any given site. Again, using NRC calculations, the 25 mrem/yr incremental dose above background, over a lifetime will result in 1 fatal cancer for every 1144 people exposed. Not only are there thousands of sites, but much of the radiation will persist for decades, centuries, millennia. It is not possible to calculate the cumulative death toll."

"A dose of 25 mrem/yr for unrestricted sites is clearly inadequate to protect public health and safety even by EPA standards. EPA drafted a clean-up rule that would have limited the site dose to 15 mrem/year and would have enforced the Safe Drinking Water Act limit of 4 mrem/yr on ground water. EPA has tabled the rule for now after DOE announced it did not want this rule. EPA could still issue the rule, and has made a rare display of standing tough, by suggesting to NRC that EPA would declare sites released under the NRC rule to be Superfund sites, requiring a more stringent clean-up."

"NRC proposes even laxer standards for "restricted" sites. Although "restricted" sites will have higher contamination levels, NRC claims these sites can still be used for certain activities, as long as licensees "guarantee" no one at these sites receives more than a 25 mrem/yr dose. Exemptions may be granted by NRC, on licensee request based on factors such as prohibitive cleanup costs, and arguments that further clean-up may cause greater harm than the residual dose. The rule allows contamination levels that will cause doses of 100 mrem/year and as high as a 500 mrem/yr to those who use the site, if restrictions fail. The NRC claims exceptions will only be made in 'unusual circumstances,' such as perceived loss of institutional control of the contaminated site, sites that have contaminated soil, or SDMP sites. Since many site operations have resulted in contaminated soil, and SDMP (Site Decommissioning Management Plan) is composed of the current major nuclear license terminations, NRC's definition of 'unusual circumstances' verges on criminal."

"Licensee proof of compliance with the regulations required by the rule is not stringent and NRC has left many loopholes by using non-specific language and definitions. It appears that almost any site contaminated with radionuclides could apply for cleanup standards at the 500 mrem/yr level and be considered as long as it was 'restricted' use. 'Restricted' use could mean simply fencing in the area or planting obstructing bushes. This is clearly unacceptable since 500 mrem/yr over 'background' translates into a citizen cancer fatality of approximately 1 in every 57 people exposed to this radiation dose for a lifetime. Those are NRC numbers for the rate of cancer. Independent analysts have made findings that the rate could in fact be 10 times higher. Further, other health impacts that NRC's rule ignores altogether include non-fatal cancer, infertility, genetic and birth defects and lowered immunity. The rule does not account for Hot Spots, which could allow certain individuals to get a double dose of radiation (or more), while others receive none. Since the projected radiation doses are averaged, this effectively assumes the dose is spread evenly among all individuals in the critical group, while in reality, those receiving the largest doses (and the higher risk), are effectively ignored and unprotected."

"This devastating departure from the NRC's mandate to protect the public health and safety is one more piece in a long history of placing industry economic interests ahead of citizen health and citizen's economic interests, not to mention all the other species that are affected, and in affect us indirectly. This process of deregulation of radiation has been ongoing at NRC, but in 1986 the agency formalized it as a policy called "Below Regulatory Concern" or BRC. Citizens across the country did a phenomenal organizing effort, including passage of over a dozen state laws prohibiting deregulation and in 1992, Congress directed NRC to revoke the BRC Policy."

"In 1993, in the wake of this industry defeat, NRC put together the ERORR (Enhanced Rulemaking on Residual Radioactivity) process and citizens from across the country attended "stakeholder" meetings. Again and again we told NRC that in order to release the polluter from liability; it is their job to require that the site be returned to naturally occurring levels of background radiation. Indeed, the NRC draft rule of August 22, 1994 was more stringent than this final rule. The proposed rule did not mention a 500 mrem/year dose cap, only a 100 mrem/yr cap, and the level of 15 mrem/yr was given for unrestricted sites. The final rule also drops mandatory Site Specific Advisory Boards (SSABs). There are other forms of public in-put in decommissioning, but the implication is clear: NRC does not wish to create any more opportunities for public participation." [NIRS]

EPA's standards for nuclear waste sites by Tami Thatcher [3]

The Environmental Protection Agency (EPA) environmental standards for the disposal of spent nuclear fuel, high-level and transuranic radioactive wastes (40 CFR 191) but specifically limits EPA's consideration of public comment on these proposed standards. Questions on the adequacy of the proposed standards include:

a. Are there reasons for adopting a different regulatory time frame for the individual and ground-water protection requirements than the 10,000-year period of analysis associated with the containment requirements in 191.13? EDI believes that a regulatory time frame of at least 100,000 years is appropriate and necessary. The Transuranic wastes to be regulated, for instance at the Waste Isolation Pilot Plant (WIPP), remain hazardous for longer than 240,000 years. The 10,000-year time frame proposed in the standards is an arbitrary time frame that cannot be justified given the hazard of these wastes and the length of time they remain hazardous. A 100,000-year time frame would allow for the degeneration of a significant proportion of these wastes, thus reducing the danger of radioactivity to the public after the control period.

b. Should the Agency adopt non-degradation requirements for especially valuable ground water? If so, what types of ground water warrant this extra level of protection?

EDI believes that all ground water warrants a no-degradation protection requirement. Particularly in the West where surface water is scarce, ground water is frequently used, even today, for human and livestock drinking water and irrigation. When considering 10,000 to 100,000 year time frames and given the projected exponential growth predicted for future populations, it will be important to protect all ground water from endangerment. In addition, because it is difficult to predict future hydrologic flows over the period of time contemplated for this standard, there is a possibility that water not currently classified as Class I that is an "underground source of drinking water could, in the future, be used for human consumption.

Strict limits will discourage siting nuclear disposal facilities near ground water that people depend on for personal use. Stringent requirements also will limit the cost of future remediation of this ground water that is limited in quantity and necessary for human survival. Not only have ground water remediation techniques thus far not been 100% successful in reversing contamination, but these processes are also expensive. Current technology relies on two processes: containment and extraction. Containment involves expensive engineered barriers, and extraction is an equally costly process of pumping, treating, and reinjecting water into the water table. By requiring a no-degradation standard for irreplaceable ground water today, EPA can save future dollars, preserve our valuable natural resource, and prevent the future need for bulky and expensive remediation programs.

c. Is it reasonable for the Agency to adopt a standard (15-millirem) that allows a slightly higher level of risk when the dose is being received through all exposure pathways, e.g., direct exposure, food ingestion, water ingestion, and inhalation and all environmental media, e.g., air and water, than when regulating doses received through a single environmental medium, e.g., a 10-millirem committed- effective-dose (CED) per year standard for air emissions (40 CFR Part 61). EDI believes that the CED limit for nuclear waste disposal facilities should be much lower than 15-millirem per year. As early as 1983 in A Study of the Isolation System for Geologic Disposal of Radioactive Wastes, the National Academy of Sciences (NAS) recommended a "lifetime radiation-dose commitment to the maximally exposed individual at any future time" to be "10-4 sieverts per year (Sv/yr)," which is equivalent to a CED limit of 10-millirem. [BRWM]

In 1990 the NAS Board on Radiation Effects Research [BRWM] Commission on Life Sciences Committee on the Biological Effects of Ionizing Radiation (BEIR) published Health Effects of Exposure to Low Levels of Ionizing Radiation BEIR V. The BEIR V committee concluded: "The cancer risk estimates derived with the preferred models used in this report are about 3 times larger for solid cancers (relative risk projection) and about 4 times larger for leukemia than the risk estimates presented in the BEIR III report." The BEIR III report was published in 1980. (National Academy Press, 1990, page 6)

Because the most recent research into the biological effects of ionizing radiation indicates a greater risk to the public than was previously thought, EDI believes that EPA standards minimally must limit the CED to the 1983 NAS's recommendation of 10-millirem per year. The direction of the current research, however, argues for an even more conservative limit.

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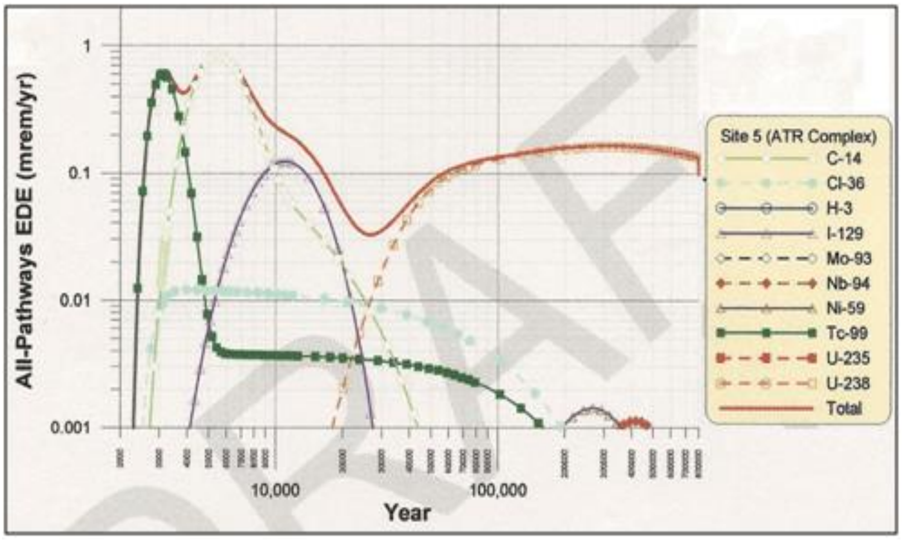
[3] Margret Carde also contributed to developing these criteria.

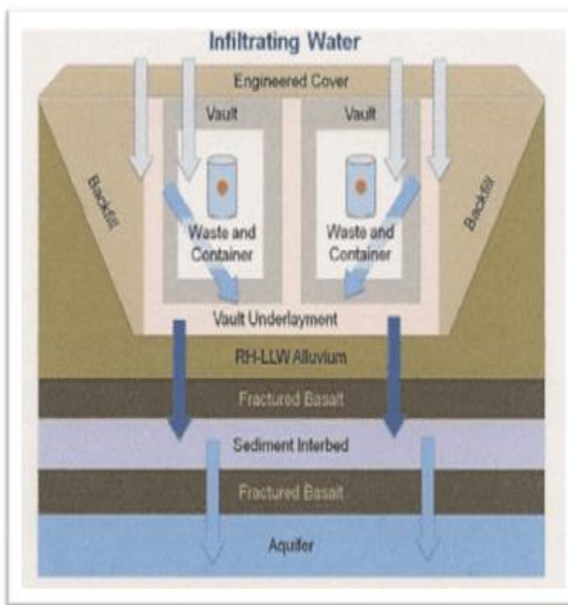
d. Does the public have comments on how, if at all, implementation of Subpart C, in lieu of direct compliance with the SDWA regulations, to the extent that statute applies for a particular disposal system, if at all, would not be equivalent to direct application of the SDWA. EPA standards must not take away a state's right to permit underground injection wells under the Safe Drinking Water Act (SDWA 1421(b) (3) (C). EPA's Federal Register publication (58 Fed. Reg. 7931) states that "compliance with the new Subpart C will provide an equivalent level of protection as would compliance with SDWA regulations. Thus ... compliance with Subpart C will constitute compliance with the SDWA to the extent -- if at all -- such compliance would otherwise be required for a particular disposal system." EDI believes that this section of the standard must be eliminated so that each state's right to regulate Underground Injection Controls (UICs) within its boundaries is preserved. A state's right under SDWA to permit underground injection wells must not be preempted by this standard. Procedures for issuing UIC permits are different from those of Subpart C, so compliance with Subpart C is not "equivalent" to a UIC permit.



Tami Thatcher's report *More Buried Waste in INL's Future? o*n EDI website*:*

"Radiological waste burial practices at INL are not protective of the environment and will continue to contaminant Idaho's sole source Snake River Plain Aquifer. Waste buried at the Radioactive Waste Management Complex includes large quantities of the radioactive material in spent fuel (enriched and depleted uranium and fission products); actually, it contains discarded spent fuel from experiments, accidents and other processing.

"DOE's proposed new replacement of RWMC, the Replacement Remote-Handled Low-Level Waste Facility is a permanent disposal facility that will leach radionuclides into the ground and aquifer for thousands of years. The concrete vaults have holes in the bottom to prevent water buildup. The metal canisters are expected to corrode and release the contaminants.



"The timeframe for leaching contaminants is hundreds of thousands of years. The analysis ignores inevitable variations in precipitation and flooding in order to produce the appearance of a steady trickle of contaminants, not exceeding regulatory thresholds.

"In addition to continued radioactive waste burial at INL's Radioactive Waste Management Complex and the proposed new Replacement Remote-Handled Low-Level Waste disposal facility, the INL remains short-listed for DOE's Greater-Than-Class-C repository. This waste includes DOE GTCC waste and the commercial nuclear industry waste DOE will become the owner of. This waste placed in the ground, whether or not in metal cans, permanently.

"DOE can finalize its Greater-Than-Class-C Low-Level Waste environmental impact statement (EIS) now that public comment was taken. DOE's draft EIS for GTCC waste assessed various locations around the country including INL. DOE can now finalize its report and select along with Congress who will take the country's long-lived waste from commercial reactors, DOE operations, and other waste generators. See more at DOE's GTCC EIS

"Interestingly, DOE's draft EIS had conservatisms that made INL's contaminant migration and subsequent dose relatively high. But more recent INL contaminant migration studies have produced estimates of slower contaminant migration and radiation dose, see INL's assessment of its Replacement RH-LLW facility. Hanford already has so many long-lived contaminants, it appears not viable. So, INL cannot be ruled out as a place for this waste.

"Other waste facilities at INL are called temporary where highly radioactive waste is placed in cans in the ground, awaiting a plan to retrieve the waste after finding a permanent home for the waste. Buried cans are located at INL's INTEC (formerly for fuel reprocessing) and the Materials and Fuels Complex, formerly Argonne National Laboratory-West (MFC) at its Radioactive Scrap and Waste Facility." [4]

The Environmental Protection Agency (EPA) arbitrarily limits the scope of public comment

EDI believes that EPA must consider public comment on all parts of 40 CFR 191. In 1987, the 1st Circuit Court remanded the entire 1985 EPA nuclear waste disposal standards, not just the specifically cited subsections that concerned individual and ground water protection requirements. Subsequent to the 1987 court ruling, EPA reviewed all aspects of the 1985 standards, producing four drafts of the standards which were never published in the Federal Register. These drafts clearly show that EPA has its own concerns with other parts of the 1985 standards.

In October, 1992, Congress passed Public Law (PL) 102-579 that directs EPA to "issue ... final disposal regulations." Section 8 of the law reinstates "the disposal regulations issued by the Administrator on September 19, 1985, and contained in Subpart B of part 191 of title 40 Code of Federal Regulations" and excepts " (A) the 3 aspects of sections 191.15 and 191.16 of such regulations that were the subject of the remand ordered in Natural Resources Defense Council, Inc. v. United States Environmental Protection Agency, 824 F.2d 1258 (1st Cir. 1987); and (B)the characterization, licensing, construction, operation, or closure of any site required to be characterized under section 113(a) of Public Law 97-425." Thus, PL 102-579 intended the reinstatement of EPA's 1985 nuclear waste disposal standard (with the above exceptions) to be a temporary measure until EPA issued a new standard. EPA's promulgation of only revised sections of its 1985 standard does not address the mandate of PL 102-579, which expressly directs EPA to "issue ... final disposal regulations." EPA's limited promulgation not only fails to satisfy PL 102-579, but it denies the public right to comment on the whole, final standard.

EPA granted the Idaho Department of Environmental Quality (IDEQ) enforcement authority to administer EPA's Hazardous Waste laws. [5] This arrangement allows a captured inadequately funded state agency to set INL cleanup criteria and issue inadequate permits for INL operations. In the DOE/EPA/ IDEQ Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site it states:

> "Review of the various [applicable or relevant and appropriate requirement] ARARs and to-be-considered criteria identified in the [Record of Decision] RODs showed that ROD requirements do not affect remedy protectiveness. The one ARAR that was used in several RODs as a remediation goal was the Safe Drinking Water Act MCLs (State of Idaho Groundwater Quality Standards) (IDAPA 58.01.11), and this review determined that MCLs have not changed for the COCs identified in RODs evaluated in this FYR. For other remediation goals, such as soil cleanup levels and performance-based goals (e.g., for engineered barriers), RODs relied primarily on calculated site-specific risk-based values rather than ARAR-derived values. This review found no changes to ARARs or to-be-considered criteria that affect remedy protectiveness for this FYR." [6]

Response to EPA's inadequate nuclear waste disposal standards

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[4] http://environmental-defense-institute.org/cleanup.html

[5] 40 CFR Part 271[EPA–R10–RCRA–2011–0973; FRL–9684–6] Idaho: Final Authorization of State Hazardous Waste Management Program; Revision

[6] Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site— Fiscal Years 2010–2014, *1.4.2.2 Conclusion*, Pg. 1-15, December 2015 DOE/ID-11513, Revision 0

a. EPA must revise the standards and require states with enforcement authority to isolate the alpha-emitting TRU radionuclides with the same degree of effectiveness as for high-level waste. EPA has stated its intention that the radioactivity from either high-level or TRU wastes would be "isolated with about the same degree of effectiveness ... so that about the same fraction of TRU radionuclides would be retained for either high-level or TRU-wastes (Numark, Presentation to BRWM, 9/24/92)." Reissuing the 1985 standard without revising the TRU-waste unit ignores EPA's own stated concerns. EDI recommends that EPA revise its TRU-waste unit to be between 3 and 11 million curies in accordance with the conclusions and the recommendations of the Environmental Evaluation Group (EEG). [7]

b. EPA must revise the standards' assurance requirements to prohibit waste disposal in areas with large deposits of valuable natural resources. EPA and DOE are in agreement that future human intrusion is probably inevitable at the WIPP site because of the presence of valuable natural resources. The proposed standard does not, but should, give clear guidelines for acceptable limits to human intrusion from petroleum drilling, innocent intrusions or intrusions from exploration for solid mineral deposits or salt bed storage areas. EPA's language, "Such places [with valuable water or other natural resources] shall not be used for disposal of the wastes covered by this part unless the favorable characteristics of such places compensate for their greater likelihood of being disturbed in the future," does not insist on a scientific limit either to the frequency of future intrusion or to the releases allowed by that intrusion. Rather, EPA's language allows this requirement to be ignored for political or policy considerations.

c. EPA disposal standards should include performance standards for engineered barriers such as TRU-waste containers, backfill, plugs and seals at repositories which are not licensed by the Nuclear Regulatory Commission (NRC). PL 102-579 (Section 8(g) directs DOE to "use both engineered and natural barriers, and waste form modifications, at WIPP to isolate Transuranic waste after disposal to the extent necessary to comply with the final disposal regulations." Thus Congress directed EPA to set guidelines in its disposal standards for engineered barriers. Indeed, the EPA 1985 standard explicitly recommends that "[D]isposal systems shall use different types of barriers to isolate the wastes from the accessible environment. Both engineered and natural barriers shall be included." However, disposal facilities not regulated by NRC do not have the benefit of NRC guidelines for these engineered barriers. Therefore, EPA must provide specific performance standards to be met for engineered barriers at non-NRC regulated disposal facilities.

d. EPA must review all public comment on all of the proposed standard, rewriting all sections which need to be strengthened. EPA should then issue these rewritten standards, ask for additional public comment, and review the public comment. Then and only then should EPA attempt to publish final standards

Section IV. B. DOE Changed the Definition of High-level Waste to Avoid Cleanup Obligations

DOE's Idaho National Laboratory (INL) formerly National Reactor Testing Station is where the U.S. chose to build/test/operate over 52 reactors since its creation in 1949 by the Atomic Energy Commission. INL has extensive inventories of high-level waste (HLW) along with the remains of those 52 reactors and the full range of HLW mixed hazardous radioactive waste produced by them and from the reprocessing of used (irradiated) spent nuclear fuel (SNF) from military and commercial reactors.

EDI's discussions cover the eight INL facilities that handle HLW, transuranic (TRU), and greater-than-class C low-level (GTCC) and what DOE euphemistically calls "greater-than-class-C-like" waste because once DOE implemented Order 435.1, that's how they "managed" previously classified HLW. We discuss how DOE's policies resulted in mismanagement of these wastes and irrevocably [8] contaminating Idaho. Between 1949 and 1995 there were few-if any restraints on DOE HLW waste management – they simply dug pits and trenches and dumped it all in – reactors, spent nuclear fuel (SNF) [9], chemicals from SNF reprocessing. This represents an

[7] Environmental Evaluation Group (EEG) report by James Channell, February 5, 1992, and the September 1992 presentation by Neil J. Numark, Associate, and S. Cohen & Associates.

[8] Once hazardous/radioactive waste migrates into the underlying aquifer, it's virtually impossible to cleanup.

[9] SNF (90.282 metric tons) dumped were typically damaged from reactor meltdowns or otherwise not usable for reprocessing. Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) [RWMIS]

existential environmental threat to all Idahoans due to the contaminate air and migration into our sole source Snake River Aquifer.

EDI's focus is on all of these waste categories (HLW, TRU, and GTCC) wastes because DOE's continuing policy to unilaterally change the definition of HLW results in this (most lethal) waste being reclassified as TRU and GTCC at INL. Specifically, DOE illegally [10] changed the formerly HLW 900,000 gal. sodium-bearing waste (SBW) generated from reprocessing spent nuclear fuel (SNF) to "waste incidental to reprocessing" (WIR) mixed hazardous TRU [11] and changed formerly HLW calcine to TRU [12] so it can be dumped at Waste Isolation Piolet Project (WIPP) in New Mexico. In keeping with the NWPA, NM Department of Environmental Quality has blocked bringing waste derived from reprocessing SNF (like calcine/SBW) to WIPP. [13]

To implement this new HLW reclassification policy, DOE is relying on Public Law 108–375—Oct. 28, 2004 Section 3116 that states:

"SEC. 3116. DEFENSE SITE ACCELERATION COMPLETION.

"(a) IN GENERAL.—Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982, the requirements of section 202 of the Energy Reorganization Act of 1974, and other laws that define classes of radioactive waste, with respect to material stored at a Department of Energy site at which activities are regulated by a covered State pursuant to approved closure plans or permits issued by the State, the term ''high-level radioactive waste'' does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy (in this section referred to as the ''Secretary''), in consultation with the Nuclear Regulatory Commission (in this section referred to as the ''Commission''), determines—

a. "does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste;
b. has had highly radioactive radionuclides removed to the maximum extent practical; and

(3)(A) does not exceed concentration limits for Class C low-level waste as set out in section 61.55 of title 10 Code of Federal Regulations, and will be disposed of—

(i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations; and

(ii) pursuant to a State-approved closure plan or State- issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; or

(B) exceeds concentration limits for Class C low-level waste 10, Code of Federal Regulations, but will be disposed of—

(i) in compliance with the performance objectives set out in subpart C of part 61 of Federal Regulations;

(ii) pursuant to a title 10, Code State-approved closure plan or State- issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; and

(iii) pursuant to plans developed by the Secretary in consultation with the Commission."

DOE claims INL Idaho Nuclear Technology and Engineering Center (INTEC) tank "sodium-bearing" wastes are:

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[10] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, discussed more below.

[11] Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management.

[12] Comments On U.S Department of Energy Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375-D) February 2011, Submitted by Chuck Broscious, May 12, 2011.

[13] Review of U.S. Department of Energy Final Environmental Assessment Replacement Capacity for Disposal Remote Handled Low-Level Waste Generated at Idaho National Laboratory December 2011 DOE/FEA-1793, [13] Submitted by Chuck Broscious on behalf of Environmental Defense Institute 3/30/17 [Rev12]. Also see EDI special report Unwarranted *Confidence in DOE's Low-Level Waste Facility Performance Assessment The INL Replacement Remote-Handled Low-Level Waste Facility Will Contaminate Our Aquifer for Thousands of Years.* by Tami Thatcher http://www.environmental-defense-institute.org/publications/rhllwFINALwithFigs4.pdf

"WASTE DOES NOT REQUIRE PERMANENT ISOLATION IN A DEEP GEOLOGIC REPOSITORY FOR SPENT FUEL OR HIGH-LEVEL RADIOACTIVE WASTE
"Section 3116(a) of the National Defense Authorization Act (NDAA) provides in pertinent part:
"[T]he term "high-level radioactive waste" does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy …, in consultation with the Nuclear Regulatory Commission …, determines—
"(1) does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste.
"Under Section 3116(a), certain wastes from reprocessing are not "high-level radioactive waste" if the Secretary, in consultation with the NRC, determines that certain criteria are met. Section 3116(a) sets out two specific criteria in Clauses (2) and (3). Clause (2) requires the DOE to remove highly radioactive radionuclides to the maximum extent practical. Clause (3) generally mirrors the criteria that the NRC has established for determining whether waste qualifies for land disposal as LLW (see 10 CFR 61.55 and 61.58). This clause provides that disposal of the waste must meet the NRC performance objectives of 10 CFR 61, Subpart C, and that the waste must not exceed the concentration levels for Class C waste in 10 CFR 61.55 or the Secretary must consult with NRC concerning DOE's disposal plans." [14]

EDI documents in this comment/report how DOE is violating Nuclear Waste Policy Act (NWPA), PL 108–375 Section 3116, and 1995 Settlement Agreement, [15] subsequent Agreements with the State of Idaho [16] and other related environmental statutes at INL. DOE is clearly having a waste constipation problem that leaves the WIPP dump option their solution; as opposed to legally disposing HLW in a deep geological repository designed and permitted for HLW. The Waste Isolation Pilot Project (WIPP) Permit, issued by the New Mexico Environment Department, has the following provision:

"Section 2.3.3.8. Excluded Waste:
TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at WIPP unless specifically approved through a Class 3 permit modification."

Permit Attachment C lists all of the tanks at Hanford, INL, and SRS.

Class 3 permit modifications include public hearing and judicial review,

What Idahoans legitimately fear is the waste staying in Idaho in near-surface dumps. These comments discuss these issues in detail because they are already occurring.

Section 3116 states: "Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982" Congress acknowledges the ongoing validity of the Act. EDI poses the following questions with respect to DOE reclassification of high-level waste (HLW) that deserve consideration due to the significant violation of established governing statute but more importantly the resulting environmental health and safety consequences on Idahoans.

1. Is DOE exceeding its authority and violating the NWPA?

Judge B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003 states yes:

"While DOE has the authority 'to fill any gap left…by Congress,'…it does not have the authority 'to adopt a policy that directly conflicts with its governing statute.'…
DOE's Order 435.1 directly conflicts with the NWPA's definition of HLW. NWPA's definition pays no

[14] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, November 2006, Revision 0, Pg. 45, DOE/NE-ID-11226

[15] 1995 Settlement Agreement, The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No.CV-91-0065-S-EJL (D. Id.), Pgs. 2&3. Hereinafter, 1995 Settlement Agreement.

[16] See below: SECTION III. Radioactive Waste Management Complex (RWMC) for details on revisions to the 1995 Settlement Agreement.

heed to techical or economic constraints in waste treatmet. Moreover, NWPA does not delegate to DOE the authority to estblish 'alternative requirements for solid waste.' Because Congress has spoken to that subject "that is the end of this matter,' leaving no room for 'alternative requirements'" [17] [[Pg. 12]

2. **Does NWPA permit DOE to permanently intern HLW including tank sediments "heels" at INL**?
   Again Judge Winmill states:
   "In this case, Congress defined HLW in NWPA as 'highly radioactive material resulting from the reprocessing of spent nuclear fuel.' Congress then used the word 'including' to signal that what followed were examples designed to illustrate the definition just given. The two examples designated to illustrate the definition just given. The two examples are (1) 'liquid waste produced directly in reprocessing'; and (2) 'solid material derived from such liquid waste that contains fission products in sufficient concentrations.'" [Pg.10]
   "These two examples neatly cover the manner in which the waste separates in the tanks over time. As discussed above, the solids sink to the bottom, forming a sludge, leaving the liquids on top. This physical separations is analogous to the NWPA's definitional separation: The liquid and solids are treated differently by the Act. While NWPA allows DOE to treat the solids to remove fission product, thereby permitting reclassification of the waste, NWPA does not offer the option of reclassification for liquid waste produced directly in reprocessing." [Pg.10]
   "NWPA's definition of HLW considers the source of the waste and, in the case of solids derived from liquid waste, its hazard. It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids are yet been extracted from the liquid waste at those sites and treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." [18] [Pg.11]
3. **Does Idaho allow DOE to leave HLW (including calcine) permanently at INL?**
   The Settlement Agreement/Consent Order between Idaho and DOE states NO:
   "E. Treatment and Transfer of Existing Wastes at INEL: 1. Treatment Commitment. DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho." [19] [Settlement Agreement, Pg. 5]
4. **DOE does NOT have the authority to consolidate HLW irradiated fuel because it is illegal and not allowed under federal law until there is a permanent repository operating.** [20]
   Robert Alvarez's 6/9/12 report "D.C. Court of Appeals Overturns NRC's Waste Confidence Decision" states:
   "The discussion on the risks of spent nuclear fuel (SNF) in commercial nuclear power facilities also applies to Department of Energy (DOE) SNF storage pools at the Idaho National Laboratory and other DOE sites where "re-racking" of SNF to conserve space has increased the risk of a major accident in Advanced Test Reactor SNF canal and INTEC CPP-666. DOE states: "This underwater storage facility (in Building 666) contains spent fuel from nuclear reactors. Almost all of the fuel stored here is from nuclear submarines and nuclear surface ships of the U.S. Navy. "There are 4 main storage pools (one is not visible in this photo). The individual fuel storage vaults can just be seen in the foreground. To the left and rear are transfer channels for moving the spent fuel in and out of the pools. This facility is the newest and most modern at INL. "This facility was designed to store spent fuel *temporarily* until the fuel rods could be reprocessed to extract residual uranium. The uranium was then reused for weapons programs.

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[17] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 12.

[18] B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 11.
Also see Settlement Agreement/Consent Order that states: "3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035." Pg.3

[19] 1995 Settlement Agreement, Pg.5. Section III Radioactive Waste Management Complex below discusses the subsequent revisions to the 1995 Agreement all of which acknowledge the ongoing validity of the 1995 Agreement.

[20] Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense- institute.org/publications/EDIXConsentFinal.pdf

When reprocessing was halted in 1992, this facility became a de facto *permanent* storage facility. Spent fuel continues to come in from the Navy, but nothing leaves because there is no place for it to go. As a consequence, this pool is now filled to its design capacity and additional fuel vaults are being 'over-stacked'."

The Department of Energy's two repository approach announced in 2015 are rarely mentioned but it designates one repository for commercial spent nuclear fuel and another for DOE spent fuel and high-level waste. 21 DOE's consent-based approach for a new HLW repository has disappeared. 22

This year, the administration proposed funding to attempt to revive Yucca Mountain, but a senate bill put forth in July 2018 left out this funding. [23] Idaho should be paying attention to whether or not Yucca Mountain, even if attempts to revive it survive, would actually accept spent fuel and high-level waste from INL since current inventory of commercial (that gets priority over DOE) SNF will nearly fill it today.

5. Can DOE be challenged in court on its HLW reclassifying policy?

US Federal District Court for District of Idaho ordered 3/6/06 states yes:

"The National Resources Defense Council (NRDC) has filed a brief describing various actions of the Department of Energy (DOE). However, none of those actions are final as required by the Ninth Circuit in this case. If they become final, the NRDC retains the right to challenge them in a new lawsuit. However, this lawsuit is governed by the Ninth Circuit's decision that directed this Court to dismiss this action." [24]

6. Can DOE be challenged in the Ninth Circuit Court on its HLW policy?

Judge B. Lynn Minmill, Chief Judge, US District Court, August 9, 2002 states:

"This case was transferred to this Court by the Ninth Circuit. *See NRDC v. Abraham, 244 F.3d 742 (9th Cir. 2001)*. In its opinion, the Circuit found that it lacked original or exclusive jurisdiction under 42 U.S.C. ss 10139 to entertain Plaintiffs' claims because the decision by the DOE in promulgating Order 435.1 was not made pursuant to the Nuclear Waste Policy Act 42 U.S.C. ss 10101 et seq. See is.at 747. However the Ninth Circuit expressly noted that issues relating to standing, ripeness, and the merits of the Plaintiff's claims must be decided by this Court. *See id.*" [pg2]

"Moreover, delaying review of Order 435.1 until the DOE makes a site specific decision conformance with the Order may cause substantial harm. Tank closures, once undertaken, aren't readily altered and future judicial review may therefore be foreclosed until it is too late. [5]

Foot note 5 "The Court notes that council for Plaintiffs suggested during oral arguments that the closure of two tanks at SRS occurred under circumstances in which they were unable to bring a timely action to obtain judicial review of that decision." [pg.7]

"The Court need not wait until a threatening injury comes to fruition before undertaking judicial review. This is particularly true where the DOE Order has the force of law and requires immediate compliance by DOE facilities as well as DOE contractors. In such a case, a justiciable controversy exists that is ripe for

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21 U.S. Nuclear Waste Technical Review Board, Management of U.S. Department of Energy Spent Nuclear Fuel, Report to the United States Congress and the Secretary of Energy, December 2017. "**Nuclear Waste Policy Act** The federal statute enacted in 1982 that establishes both the Federal Government's responsibility to provide a place for the permanent disposal of high-level radioactive waste and spent nuclear fuel, and the nuclear power generators' responsibility to bear the costs of permanently disposing of commercial spent nuclear fuel. Amendments to the Act in 1987 limited the Federal Government's site characterization activities to a possible geologic repository at Yucca Mountain, Nevada. The Act provides for extensive state, tribal, and public participation in the planning and development of permanent repositories." [Pg.180] "Finding: DOE's aging management programs are not fully implemented. Some DOE SNF storage facilities lack aging management programs to facilitate retrieving stored SNF and packaging it into multi-purpose canisters needed to transport it to either a centralized interim storage facility or a permanent repository." [Pg.7&8]

22 EDI's 2016 comments on the consent-based siting of permanent and interim spent nuclear fuel storage and disposal facilities. http://www.environmental-defense-institute.org/publications/EDIXConsentFinal.pdf

23 Brief overview of issues on H.R. 3053 on Donna Gilmore's website: https://sanonofresafety.org/

24 US Federal District Court for District of Idaho in NRDC v. DOE, Case 1:01-cv-00413-BLW, Document 125 Filed 03/06/2006, Page 2 of 2

review, because the Court can 'firmly predict' the result that would occur through the application of Order 435.1. ('One does not have to await the consummation of threatened injury to obtain preventive relief. If the injury s certainly impending, that is enough.')" [pg.8]

"In short, the Court concludes that there is a clear indication of the hardship that plaintiffs and the intervenors will suffer if review is delayed, there is no indication that undertaking judicial review at this jucture would interfere with subsequent agency action, and the Court perceives no benefit which would be obtained by allowing further factual development of the issues involved. Under such circumstaces, the Court concludes that Order 435.1 and its mandate that all DOE contractors and entities comply with its provisions, are ripe for jucicial review." [pg.8]

"Conclusion: Therefore, pursuant to its review authority under 5 U.S.C. ss 704 & 706, the Court will deny the Defendants' [DOE] Motion to Dismiss. However, indenying the Defendants' motion the Court makes no ruling as to the merits of Plaintiffs' [NRDC] claims." [25] [Pg.14] Judge B. Lynn Minmill, Chief Judge, US District Court, August 9, 2002, pages noted.

In 2005 when DOE announced its "Notice of Preferred Sodium Bearing Waste Treatment Technology" it stated:

"The Final EIS contains an evaluation of reasonable alternatives for the management of mixed transuranic waste/sodium bearing waste (SBW)…

"The Final EIS refers to SBW as mixed transuranic waste/SBW. However, a determination that SBW is transuranic waste has not been made."

"In the Final EIS DOE did not identify a preferred treatment technology for SBW from among the several technology options evaluated." [emphasis added]

"SBW is a liquid mixed radioactive waste (contains hazardous and radioactive constituents) produced primarily from INTEC decontamination and cleanup activities. SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste. SBW contains large quantities of sodium and potassium nitrates; however, the radionuclide concentrations for liquid SBW are generally ten to 1,000 times less than for liquid HLW."

"In 1992, DOE entered into a Notice of Noncompliance Consent Order with the State of Idaho Department of Environmental Quality and the Environmental Protection Agency that requires DOE to cease use of the tanks in which the SBW is stored by December 31, 2012.

"In 1995, DOE and the State of Idaho entered into a settlement agreement that resolved litigation and that established dates for the treatment of approximately 900,000 gallons of liquid SBW stored at INTEC." [26]

It is crucial to note in the above DOE Notice it states: "SBW is a liquid mixed radioactive waste (contains hazardous and radioactive constituents) produced primarily from INTEC decontamination and cleanup activities. SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste." The State of Idaho got suckered into believing DOE estimates on the % of raffinate in the SBW and would follow through with its promises to ship the treated SBW to WIPP and disregarded the Nuclear Waste Policy Act's definition of HLW. Again Judge Winmill states:

"In this case, Congress defined HLW in NWPA as 'highly radioactive material resulting from the reprocessing of spent nuclear fuel.' Congress then used the word 'including' to signal that what followed were examples designed to illustrate the definition just given. The two examples designated to illustrate

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[25] Judge B. Lynn Minmill, Chief Judge, US District Court, August 9, 2002

[26] Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management

the definition just given. The two examples are (1) 'liquid waste produced directly in reprocessing'; and (2) 'solid material derived from such liquid waste that contains fission products in sufficient concentrations.'"

"These two examples neatly cover the manner in which the waste separates in the tanks over time. As discussed above, the solids sink to the bottom, forming a sludge, leaving the liquids on top. This physical separations is analogous to the NWPA's definitional separation: The liquid and solids are treated differently by the Act. While NWPA allows DOE to treat the solids to remove fission product, thereby permitting reclassification of the waste, NWPA does not offer the option of reclassification for liquid waste produced directly in reprocessing." [Pg.10]

"NWPA's definition of HLW considers the source of the waste and, in the case of solids derived from liquid waste, its hazard. It is undisputed that the waste stored at Hanford, INEEL, and Savannah River is highly radioactive and the result of reprocessing. No solids are yet been extracted from the liquid waste at those sites and treated to reduce fission products. Thus, the waste at issue in this case falls within NWPA's definition of HLW." [27] [Pg.11]

The State of Idaho again got fooled by DOE because WIPP's Waste Acceptance Criteria (WAC) specifically prohibits any waste derived from HLW [28] which by DOE's own definition is: "SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste." DOE can call it whatever it wants, but it is still HLW by Congressional NWPA statute.

7. Is NEPA and/or CERCLA working as intended to address DOE's waste mismanagement and environmental degradation?

Ultimately DOE continues to abuse the National Environmental Policy Act (NEPA) process by routinely and repeatedly ignoring comments, no matter how reasoned, and no matter how supported by science and facts. NEPA needs to require DOE and other agencies to directly answer with technical justification each question asked or challenge made. When they cannot, they must resolve the underlying issue.

The whole risk assessment and public process is irreparably broken. The risk assessment process is subject to fiddling and fudging in myriad ways. As a result, the agencies can bury their desires in a warped process to get any outcome they desire. It is not in any way an honest process. And it isn't a process that gets to truth. Thus, reclassifying HLW to lesser waste category of waste has significant environmental consequences since DOE is able to leave it in INL shallow dumps rather than shipping to the requisite (under the NWPA) HLW geologic repository. DOE claims CERCLA is not a requirement for implementing current policy:

"<u>Section 3116 is not dependent on the independent process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)</u> (42 USC 9601 et seq. 1980) and <u>does not provide a basis for any new authority, responsibility, or obligation for DOE or any other entity with respect to the CERCLA process or otherwise affect the CERCLA process.</u> Decisions regarding past releases of contaminants and the impacts of contaminated soils associated with the [Tank Farm Facility]TFF will be addressed under the CERCLA process as specified in the Federal Facility Agreement and Consent Order among DOE, the State of Idaho, and the U.S. Environmental Protection Agency (EPA) (State of Idaho et al. 1991)." [29] [pg.3] [emphasis added]

DOE/INL's HLW INTEC tank closure plan using the new DOE Order 435.1 policy further compromised the CERCLA cleanup process by changing one word from – "<u>maximum extent *technically to economically* practical.</u>" This seemingly minor change made a significant difference in the requirement to utilize the best

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27 B.Lynn Winmill, Chief Judge U.S. District Court for Idaho, July 2, 2003, Memorandum Decision in NRDC v. DOE, Civ. No. 01-0413-S-BLM, pg. 11.
Also see Settlement Agreement/Consent Order that states: "3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035." Pg.3

28 New Mexico WIPP Permit "Section 2.3.3.8. Excluded Waste: TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at WIPP unless specifically approved through a Class 3 permit modification." Permit Attachment C lists all of the tanks at Hanford, INL, and SRS.

29 DOE/NE-ID-11226, Pg.3.

technology available to clean the HLW tanks to a less expensive economical solution. The implications of leaving the tank solids (heals) [30] are incalculable. DOE considers it too expensive to remove - this most deadly waste – left permanently over the aquifer for millennia (the half-life of the tank radionuclides).

> "While prior NRC and DOE requirements for waste determinations called for removal "to the maximum extent *technically* and *economically* practical," Section 3116 omits these adverbs, thereby suggesting that a broad range of considerations, including but not limited to technical and economic practicalities, may appropriately be taken into account in determining the extent of removal that is practical." [31] [emphasis added]

8. Is DOE going to reclassify calcine HLW at INL's Integrated Waste Treatment Unit as MTRU?

Calcine and the Integral Waste Treatment Unit (IWTU) slated to treat calcine will produce Steam Reform Product (1,078.00 cm). [32] DOE will again unilaterally reclassified it as mixed hazardous transuranic (MTRU) waste waiting disposal at WIPP. [33] DOE's plan to extract calcine from bin-sets "only to the extent practicable" and then grout the remainder in the tanks again violates the NWPA. Calcine and the IWTU waste products are derived from HLW. Again Idaho got fooled by DOE because WIPP's Waste Acceptance Criteria (WAC) specifically prohibits any waste derived from HLW. DOE knows full well this waste will remain in Idaho if (for no other reason) there is no HLW geologic repository to send it to. The IWTU operability remains so uncertain as to have no schedule. EDI discusses this and DOE's missed Settlement Agreement milestones in detail below. DOE continues to miss 1995 Settlement Agreement to prepare calcine for "road-ready" transport out of Idaho.

9. What is DOE's plan for formerly HLW reprocessing liquid waste in INL tanks?

DOE renamed this ~900,000 gal. (3,222.14 cm) [34] tank waste as "sodium-bearing waste" (SBW); also called "waste incidental to reprocessing" (WIR) as the first step in reclassifying it as a MTRU for treatment at the IWTU and disposal at WIPP. "The DOE is evaluating the disposition path for SBW at this time. Until such time as the regulatory approvals are obtained and a determination is made, the DOE will manage the waste for appropriate storage at the INL Site." [35] Again, this is a violation NWPA that defines HLW (in addition to SNF) as: "(1) liquid waste produced directly in reprocessing; and (2) solid material derived from such liquid waste that contains fission products in sufficient concentrations." See Section IV.C.

10. Are there HLW disposal options?

The mythical disposal option for HWL is deep geological repository at Yucca Mt. in Nevada. The big question is "will it ever open"? Nevada says NO! [36] WIPP, currently prohibits waste that has been HLW or "waste incidental to reprocessing, thanks to New Mexico's understandable resistance. The document DOE gave the Idaho Citizens Advisory Board, written by the Energy Community Alliance says that DOE wants to reclass the calcine and the treated sodium bearing waste as TRU and ship it to WIPP in violation of WIPP's Permit. Idahoans predict – given DOE history at INL – the new Remote-Handled Waste Disposal Facility will get the HLW. See Section 6 below for details.

Congress refuses to address an alternative for HLW geological repository at Yucca Mt. and the state of Nevada –to date- justifiably refuses to accept the flawed Yucca Mt. EIS.

11. Undisclosed and ongoing HLW reprocessing of waste disposal at INL threaten Snake River Aquifer.

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[30] "Tank heel" means the liquid/solid level remaining in each tank after lowering the level to the greatest extent possible by using existing transfer equipment, such as steam jets. See SECTION 3 below for more information on how much of the tank heels and the curie contents are left in the tanks.

[31] Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, November 2006, Revision 0, Pg. 48.DOE/NE-ID-11226

[32] Idaho National Laboratory Site Treatment Plan, November 2016, INL-STP Rev. 36A, Pg. 4-10. Hereinafter called INL STP 2016, Pg. 4-10.

[33] WIPP's waste acceptance code (WAC) prohibits any waste derived from reprocessing SNF.

[34] INL-STP Rev. 36A, Pg. 4-10.

[35] INL-Site Treatment Plan Rev. 36A, Pg. 4-10.

[36] Gary Martin / Las Vegas Review-Journal Nevada officials brace for new attempt to revive Yucca Mountain October 31, 2018. "Former Sen. Harry Reid, Gov. Brian Sandoval and the current state congressional delegation have effectively blocked development of Yucca Mountain since it was designated by Congress in 1987 as the sole site for permanent nuclear waste disposal."

Tami Thatcher reports Past Waste Water Practices at INL Included Dumping Thorium and Uranium into the Aquifer:

> "The acceptance of direct dumping of thorium and uranium related material following [HLW SNF] separations or examinations processes at the Department of Energy's Hanford facility gives important insight into the dumping practices at Idaho's Department of Energy site, now called the Idaho National Laboratory. There were many U-233 programs at the Idaho site at the Naval Reactors Facility, Test Reactor Area (now the ATR Complex), MFC (now the Materials and Fuels Complex), and the Radioactive Waste Management Complex.
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> "In fact, the thorium and uranium in the Snake River Plain aquifer found by various US Geological Survey reports is not naturally occurring but is there because of radioactive waste disposal into the aquifer by the Department of Energy. [37] For an idea of the radioactive and chemical waste resulting from one DOE facility at the Idaho National Laboratory, see this CERCLA cleanup report and others at the administrative record. [38]
>
> "The high levels of gross alpha from uranium and thorium radioactive wastes, along with hexavalent chromium, have long reached Idaho's Magic Valley. The state's drinking water monitoring program has done what is can to pretend this isn't from INL. Experts attending the INL Citizens Advisory Board continue to claim that only a few molecules of contamination can be found south of the INL. This frequently repeated falsehood along with inadequate state oversight ignores the elevated cancers in counties downgradient from the Idaho National Laboratory that are probably because of the chemical and radioactive contaminants in the aquifer from the INL.
>
> "One of the contaminants particular to U-233 production that does not occur otherwise in reactors is the production of contaminant europium-152. While highly enriched U-235 reactor produce europium-154, they do not produce Eu-152." [39]

Section IV. C. Idaho Nuclear Technology Environmental Complex and Calcined of High-Level Waste [40] [41]

Idaho Nuclear Environmental Complex (INTEC) (formerly called Chemical Processing Plant or is the largest

[37] LeRoy L. Knobel et al., US Geological Survey, "Chemical Constituents in the Dissolved and Suspended Fractions of Ground Water From Selected Sites, Idaho National Engineering Laboratory and Vicinity, Idaho, 1989," Report 92-51, March 1992. See Table 19 for USGS well 14 contamination including thorium-232 decay products lead-212 and radium-228. They were mystified by the variations in monitored contaminant levels in the same well. But the variations likely resulted from the stratified contamination levels and variation in mixing the stratified levels during well sampling. http://pubs.er.usgs.gov/usgspubs/ofr/ofr925

[38] See INL CERCLA Cleanup Administrative Record at https://ar.icp.doe.gov and See one report for an idea of contaminants in Department of Energy Idaho Operations Office, "Final Removal Action Report for CPP-601, CPP-602, CPP-627, CPP-630, and CPP-640," DOE/ID-11453, February 2012. See Table 3, p. 19 and 20. *https://ar.icp.doe.gov/images/pdf/201202/2012022800768BRU.pdf*

[39] Tami Thatcher, Department of Energy Past Waste Water Practices at INL Included Dumping Thorium and Uranium into the Aquifer: They Keep Pretending It's There Naturally, EDI Newsletter December 2016

[40] David B. McCoy, Preliminary Comments on Calcined Solids Storage Facility Draft Hazardous Waste Management Act Resource Conservation and Recovery Act Storage Facility Partial Permit Renewal for the Idaho Nuclear Technology & Engineering Center on the Idaho National Laboratory To Idaho Department of Environmental Quality Waste and Remediation Division RE: Draft Hazardous Waste Management Act/Resource Conservation and Recovery Act Storage Facility Partial Permit Renewal for the Calcined Solids Storage Facility at the Idaho Nuclear Technology & Engineering Center on the Idaho National Laboratory, EPA ID# ID4890008952 Submitted by Chuck Broscious and David B. McCoy on behalf of the Environmental Defense Institute May 9, 2017 [Rev. S] http://www.environmental-defense-institute.org/publications/EDI-CSSF-Permit-S.pdf

[41] Tami Thatcher, Public Comment for inclusion in the public record on US Department of Energy (DOE) Application to renew the Calcined Solids Storage Facility Mixed Hazardous Waste Permit (EPA ID No. ID4890008952) (Docket No. 10HW-1604) July 11, 2016. http://www.environmental-defense-institute.org/publications/EDICalcineComments.pdf

of the INL's high-level waste (HLW) storage and treatment facilities. [42] Leading in the INTEC HLW storage and treatment is the Calcined Solids Storage Facility (CSSF), the Integral Waste Treatment Unit (IWTU) and the INTEC HLW Tank Farm Facility (TFF).

Idaho Department of Environmental Quality (IDEQ) and EPA (primary regulatory authorities with jurisdiction over INL) fail to offer the public "in one concise document" what the RCRA permit is required to cover and more importantly what is missing in the Permit. IDEQ must reject the 10-year extension of DOE's Calcined Solids Storage Facility (CSSF) Permit and replace it with an annual storage permit based on correcting the following regulatory non-compliance and Settlement Agreement/Consent Order requirements:

1. IDEQ/EPA fail to demand DOE initiate Calcine Retrieval Technology Calcine waste is high-level Waste (HLW) by the definition given in NWPA and DOE Order 435.1 states in section 1: [43]

"High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel. High-level waste includes:

* liquid waste produced directly in reprocessing;
* <u>any solid material derived from such liquid waste that contains fission products</u>;
* <u>and other highly radioactive material that requires permanent isolation</u>."

(Emphasis provided.)

INL's calcite (calcine) waste is clearly high level waste as defined by statute. It is nothing more than solidified SNF reprocessing first cycle raffinate - HLW by definition. DOE may add names to it like SBW. That does not change its character nor does it make it something else. DOE lacks regulatory authority to do that. Idaho Department of Environmental Quality (IDEQ) must force DOE (via the NWPA and Consent Order) to start calcine extraction - starting with the oldest Bins that AoA [44] claims may be problematic and to prevent DOE from permanently grouting calcine in place in violation of RCRA and NWPA. The retrieval process must be done regardless of the treatment chosen. Why wait? DOE wants to reclassify calcine as greater-than-class-c (GTCC) waste not HLW in order to save money on cleanup.

2. IDEQ has the duty under RCRA, 42 USC § 6901 (b) to avoid risk from the following:

"[T]he placement of inadequate controls on hazardous waste management [that] will result in substantial risks to human health and the environment;

"[I]f hazardous waste management is improperly performed in the first instance, corrective action is likely to be expensive, complex, and time consuming;

"[C]ertain classes of land disposal facilities are not capable of assuring long-term containment of certain hazardous wastes, and to avoid substantial risk to human health and the environment, reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes."

These unaddressed hazards include:

a. Inadequate flood analysis;
b. Inadequate seismic qualifications;
c. Inadequate accident dose evaluation;
d. Inadequate contaminate migration in soil and aquifer;
e. Inadequate emergency/remediation response in the event of the above a, b, c, and d hazards;
f. Non-existent Current Calcine Bin Set Safety Analysis.

3. The DOE documents presented to IDEQ for RCRA floodplain review present misleading, incomplete, inconsistent facts and conclusions, and fail to comply with the state and/or federal requirements for information to be supplied under the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act of 1969 (NEPA) and floodplain/ Wetlands Environmental Review Requirements of 10 CFR 1022 *et seq***.**

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[42] Materials and Fuels Complex also has a spent nuclear fuel reprocessing (pyroprocessing), discussed in Section IV. J below.

[43] **http://energy.gov/sites/prod/files/2013/06/f1/O-435-1_ssm-01.pdf** Page 3

[44] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report. Hereinafter AoA.

The permit must be **rejected** until DOE/INL first addresses the immediate potential flood hazard and incorporates sufficient measures to protect the INTEC and other INL facilities as required by Idaho Code §39-4409(5). Specifically, corrective action is required prior to permit approval - as stated in IDEQ's Fact Sheet.

"Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

4. Historical Background

DOE/INL is a major generator of high-level (HLW) radioactive waste since its inception in 1949. DOE and its predecessor have never been willing to appropriately deal with this waste unless forced by Federal Court Order. This background is crucial in understanding this Permit. We discuss this long history of blocking every effort to force waste remediation below in the RWMC Section.

Waste Stream ID	Waste Stream Name	Current Storage Volume (m^3)	5-Year Generation (m^3)
ID-TEC-173	Sodium-Bearing Waste	3,222.14	0.00
ID-TEC-174	High-Level Waste Calcine Solids	4,386.00	0.00
ID-TEC-176	IWTU Steam Reform Product	0.00	1,078.00
	Total	**7,608.14**	**1,078.00**

Table 4-3. Waste Calcine and Sodium-Bearing Waste (SBW). [45]

DOE's Permit Extension for INL Seven Calcined Solids Storage Facilities

EPA/IDEQ must require DOE to follow through with 2002 Idaho High-level Waste & Facilities Disposition FEIS, [46] the 1995 Settlement Agreement Consent Order and its own State of Idaho's Preferred Alternative that States in Pertinent Part:

"The State of Idaho's Preferred Alternative for waste processing is the Direct Vitrification Alternative described in HLW EIS Section 3.1.6. This alternative includes vitrification of mixed transuranic waste/SBW [formerly called HLW] [47] and vitrification of the HLW calcine with or without separations. Under the option to vitrify the mixed transuranic waste/SBW and calcine without separations, the mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository.

"The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected **if separations were shown to be technically and economically practical.** Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified.

"In addition, under the Direct Vitrification Alternative, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW, or DOE could construct a separate treatment facility for newly generated liquid waste." [48] [Emphasis added]

What Happened to the State of Idaho's Preferred Direct Verification Waste Processing?

The State of Idaho has allowed DOE to stall implementing "the Direct Vitrification Alternative" for over 40 years (based on the 1977 EIS that preferred direct vitrification) by allowing DOE to attempt to deploy various

[45] Idaho National Laboratory Site Treatment Plan, November 2016, INL-STP Rev. 36A.

[46] Idaho High-level Waste & Facilities Disposition Final Environmental Impact Statement, September 2002, DOE/EIS-0287F. Hereinafter called HLW FEIS.

[47] See Background History discussion below for how DOE used the Federal Circuit Court of Appeals to delay a decision on HLW.

[48] HLWFEIS, Section B.9.3.3.1

"separations/steam-reforming treatment" (~17 years) now under construction at the INTEC/Integrated Waste Treatment Unit (IWTU). The "separations" approach to treatment is designed to **maximize** the portion of the waste that can be dumped in the new Remote-Handled Disposal Facility (R-HDF) located between INTRC and the Advanced Reactor Complex and **minimize** the portion that must go to a deep geologic repository.

This IWTU process has failed (after numerous attempts) to perform thus far for the 900,000 gallons of formerly liquid high-level waste (LHLW) now illegally reclassified to a less stringent TRU/Sodium-Bearing liquid waste in the INTEC HLW Tank Farm or treating the Calcine. We discuss this legality issue later. DOE falsely claims calcine treatment is contingent on IWTU as a stalling technique to avoid calcine treatment.

DOE's Stalling on Direct Vitrification Using IWTU as Pre-treatment is not Supported by its Own Analysis.

> "The ability to re-use existing facilities (i.e., IWTU) will be limited (i.e., cost-prohibitive) for more complex processing technologies (i.e., high temperature and/or high pressure) that involve several steps, especially those that require complete decontamination, dismantlement, and removal of all existing processing equipment, while retaining the structure." [49]

DOE's primary focus on "separations treatment" is to maximize waste portion that they think can be buried at INL/R-HDF [50] and reduce more costly volume of waste that will go to a future deep geologic repository out of Idaho required in the original Settlement Agreement. This unnecessarily complicates the treatment process that as we see at both INL and Hanford –do not work and adds to the over-all cost of the project and more delays. [51]

DOE routinely makes one key mistake in treatment design. They emphasize and focus incessantly on maximizing waste loading in the treated waste logs (i.e., cram as much waste into each log that it compromises its long-term durability. They do this to **minimize** the volume of waste logs and the ultimate disposal cost. They do that to the point of stupidity. If they cut the waste loading, the glass easily maintains consistency and properties. They simply focus on the wrong constraint. As a result they actually **maximize** not minimize the costs (that is good for DOE contractors on cost+ treatment agreement. They make the systems more complex and prone to failure as a result.

DOE's Hanford [52] "separations pre-treatment" of its HLLW is a decade's long boondoggle at huge taxpayer expense that is being repeated at INL. The whole "separations treatment" approach has always been about cost cutting and reducing DOE HLW waste repository constipation crisis caused by its own incompetence to do the job correctly the first time. [53] Instead of admitting going down the wrong treatment path and moving quickly to implement piolet plant scale "Direct Vitrification," "proof-of-process" projects DOE has wasted billions of scarce EM dollars on bogus separations treatment plants that don't work. Now DOE is trying to use these self-imposed delays/cost over-runs to use illegal grout-in-place "in-situ entombment" as a cheap solution. [54] DOE is making the same argument for INL HLW that is discussed below.

In EDI's view IDEQ must reject the Calcine Storage Permit and replace it with an annual Storage permit based on progress on development of a "Direct Vitrification" piolet plant scale and calcine retrieval development.

Idaho must incorporate "lessons-learned" so as not to repeat Hanford full scale rush on unproven designs. Some credible vitrification studies have already been done but rejected by DOE. [55] Also IDEQ must force DOE

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[49] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 27. Hereinafter AoA.

[50] INL/R-HDF is the Remote-Handled Waste Disposal Facility under construction near INTEC also in a flood zone.

[51] http://agportal-s3bucket.s3.amazonaws.com/uploadedfiles/Another/News/Press_Releases/Hanford-Timeline-V4.pdf

[52] HANFORD FEDERAL FACILITY Richland Operations Office,) AGREEMENT AND CONSENT ORDER Richland, Washington) (EPA Docket Number: 1089-03-04-120 Respondent) Ecology Docket Number: 89-54.

[53] United States Government Accountability Office, HANFORD CLEANUP Condition of Tanks May Further Limit DOE's Ability to Respond to Leaks and Intrusions, November 2014 GAO-15-40, Report to the Honorable Ron Wyden, U.S. Senate.

[54] Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford DOE Executive Branch GAO-17-306: Published: May 3, 2017. Publicly Released: May 3, 2017.

[55] See: Formulation Efforts for Direct Vitrification of INEEL Blend Calcine Waste Simulate: Fiscal Year 2000, J. V. Crum et.al., Pacific Northwest National Laboratory, Savannah River Technology Center, March 2001, PNNL-13483.

(via the Consent Order) to start calcine extraction - starting with oldest Bins that the Analysis of Alternatives (AoA) study claim may be problematic and prevent DOE permanently grouting in place in violation of RCRA and NWPA land disposal restrictions of HLW. [56]

The INTEC Calcine HLW and SBW tanks have never been RCRA compliant, are >54 years old (long past design life) and therefore fail to meet land-disposal restriction in RCRA. DOE must get a variance from IDEQ for continuing Calcine storage. The law states in part:

> "In accordance with 40 CFR 264.193(g), a variance may be obtained from the secondary containment requirements if it can be demonstrated that the alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous waste or hazardous constituents into the ground water or surface water at least as effectively as secondary containment during the active life of the tank system." [57]

The Calcine Bin Sets fail on all of the 40 CFR 264.193(g), criteria for a variance for the land-disposal "grout-in-place" "in-situ entombment" restriction in RCRA. In fact, the soil and groundwater under INTEC is seriously contaminated after decades of leaks, spills, and waste mismanagement. [58] This chemical and radioactive contamination has migrated in the underlying Snake River Aquifer all the way to the Magic Valley along the Snake River. [59] A typical example of ~ 14 sample Tank Farm (**near Calcine Bins**) locations in Table B-B-1, A-65 summery of years 1954 through 2003 resulted in a total of 1,623.8 cm of recharge through the Tank Farm to the aquifer below. [60]

Table 4: 1995 INTEC (ICPP) Perched Water Well Sample Data [61]

ICPP Well No.		Gross Alpha	Gross Beta	Strontium-90
CPP-55-06	[A]	7,290	191,000	65,600
MW-2 4,	[A]	700	925,000	516,000
MW-5	[A]	520	211,000	110,000
MW-020	[B]	--	---	25,800
MW-010	[B]	-	--	320,000
MW-15	[B]	--	--	17,200

Notes for above table:
[A] [INEEL-95/0056@2-162] [INEEL-95/0056 @ 5-25]
[B] DOE/ID-10660, pg. 5-67, 5-68
All unites in pico curies/liter (pCi/L)

Table 5: 2002 INTEC Perched Ground Water Sample Data [62]

Contaminate	Concentration	Regulatory Std. (MCL) [63]
Gross Alpha	1,100.00	15
Gross Beta	590,000.00	4 millirem/yr.
Tritium	40,400.00	20,000.00
Strontium-90	136,000.00	8.00

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56 U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 22. Hereinafter AOA

57 Calcine Permit at D-2f(3)(a)(ii) Proposed Alternate Design and Operation of the Containment System [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(ii)]

58 See EDI's Review of INTEC Tank Farm, Calciner and Groundwater CERCLA Cleanup Plan and Tank Farm Closure Plan, 7/14/16. http://environmental-defense-institute.org/publications/CERCLA.INTEC.pdf

59 Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters by Tami Thatcher, Updated January 5, 2017 http://environmental-defense-institute.org/publications/kimamareport.pdf

60 DOE/NE-ID-11227, Appendix B.

61 INEL-95/0056; Waste Area Group 3 Comprehensive Remedial Investigation/Feasibility Study Work Plan (final) Volume 1, August 1995, Lockheed Idaho Technologies Co.; also Chapter 5 OU 3-14 "Nature and Extent of Soil Contamination."

62 DOE/EIS-0287, Idaho HLW & FD EIS, page 4-52, 4-53 and 4-57.

63 40 CFR 140 and 141

Plutonium-238	0.0501	7.02
Americium-241	0.0374	6.34
Iodine-129	0.650	1.00
Technetium-99	476.00	3,790.00
Uranium-233/234	15.30	13.80
Uranium-235/236 0	0.142	13.80

Table 5 References: Units are pCi/L

* Beta particle/photon radioactivity shall not produce annual dose equivalent to the total body or internal organ greater than 4 mrem per year. If the dominate (gross) beta is strontium-90, the MCL of 8 pCi/L can be used.

The point of including this groundwater contamination is that decisions on the Calcine Bin Storage Permit the will permit residual post-closure calcine left in the bins must consider the fact that INTEC is already seriously contaminated - so any new waste mismanagement, leaks, spills are cumulative and therefore must be included in the Permit extension.

In the words of former ID Governor Andrus: "The issues [ID] Governor Batt and I are focused on are bigger and far more important: ***what ultimately happens to the significant quantities of nuclear waste already in Idaho, what is DOE's plan to honor commitments already made, and what happens if we agree to take on even more waste?*** DOE and IDEQ owe all of us a real discussion about these questions, followed by real answers." [64] [Emphasis in original]

IDEQ/EPA Fail to Demand DOE Initiate Calcine Retrieval Technology Calcine waste is High-Level Waste by the definition given in DOE Order 435.1 [65] Calcine Retrieval Technology is Difficult and must not be Delayed any Further

"To date, six [calcined solids storage facilities] CSSFs are being used to store the calcine. Each CSSF design is different in that each CSSF includes a range of three to seven composite bin and sub-bins. In addition to the design differences, each bin includes the following internal obstructions that may hinder the retrieval process: multiple thermos-wells, wall stiffeners, braces, and corrosion coupons. The calcine compositions in these CSSFs vary, depending on feed composition to the calcine. Therefore, the calcine types are layered in the binsets; thus, the compositions defined by CSSF are reported as composite composition." [66]

Here in Idaho we're stuck with DOE's continued obfuscation and stalling on what to do with INL's Calcine HLW despite Court rulings. DOE already is getting away with what amounts to shallow burial for HLW that requires permanent isolation in a deep geological repository. [67] DOE has developed no plan to show that grouted waste tanks are retrievable. After many decades and legal challenges, the only path forward DOE offers is – <u>in-action</u> via continuing studies (see attached list of EAs and EISs) hoping for a cheap remedy and continuing to "store" HLW that is de-facto disposal. So far DOE and the Navy have succeeded- saving billions at the expense of future generations of Idahoans and our collective environment, health and safety. [68]

"Currently, a preferred disposal option for DOE HLW has not been identified, and other options are being evaluated. Thus, the assumptions regarding disposal costs and drivers to reduce the waste form volume, may no longer be valid. Consequently, the uncertainty of the disposition path, and related final waste form requirements, resulted in an additional variable that had to be accounted for during the [Analysis of Alternatives] AoA." [69]

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[64] Letter from Cecil D. Andrus, Governor of Idaho (1971-1977 and 1987-1995 and U.S. Secretary of the Interior under President Jimmy Carter from 1977 to 1981), letter dated October 13, 2015

[65] **http://energy.gov/sites/prod/files/2013/06/f1/O-435-1_ssm-01.pdf** Page 3

[66] Formulation Efforts for Direct Vitrification of INEEL Blend Calcine Waste Simulate: Fiscal Year 2000, J. V. Crum, J. D. Vienna, Pacific Northwest National Laboratory Savannah River Technology Center, Aiken, SC 29808, March 2001, PNNL-13483, Summary. http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13483.pdf

[67] The INTEC HLW tank sediments "heals" were grouted in-place. See Nuclear Regulatory Commission 10 CFR Part 61 regulation excluding any near-surface TRU HLW or TRU LLW disposal.

[68] See EDI's website for numerous reports that document the ongoing migration of INTEC contamination from INL's miss-management of "stored" liquid and solid HLW waste into Snake River Aquifer. http://environmental-defense-institute.org/

[69] U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, Pg. 1. Hereinafter AOA.

"Retrieval is required for all feasible options considered and is not a discriminator for this AoA. Retrieval of calcine represents a significant technical and engineering challenge." [70] *As the Independent Analysis of Alternatives for Disposition of the Idaho Calcined Recommendations state:*

"a. The Calcine Disposition Project should be divided into two subprojects: a) Calcine Retrieval, and b) Calcine Processing. The project near-term priorities should focus on calcine retrieval activities, and limited technology maturation to better inform future processing decisions.

"b. A final decision regarding the processing technology should be deferred until the disposal path is better defined, as well as its expected regulatory framework, and resulting waste form performance requirements.

"c. An independent AoA should be conducted for the retrieval system. It should consider impacts of the as-retrieved calcine feed to downstream unit process steps, and how to optimally manage and subsequently condition these materials such that an acceptable feed is provided (particle size, physical uniformity, blending/chemical uniformity, etc.).

"d. Efforts should be accelerated on development and testing of the most effective retrieval technologies and systems. Significant progress can be made in advance of processing and disposal to address key retrieval risks and uncertainties.

"e. The Calcine Retrieval Subproject should consider the concept of a full-scale radioactive demonstration of the retrieval and transport system, to include retrieval from CSSF #1 to CSSF #6. This would potentially allow for RCRA closure of CSSF #1, which is considered the most suspect CSSF from a structural integrity perspective due to its concentric tube bin configuration.

"f. Additional sampling of actual calcine should be considered, especially during retrieval demonstration efforts, to support development of processing options." [71]

All of the above essential calcine retrieval processes have been known for four decades and yet to be implemented by DOE and the Navy thus adding unnecessary delays. Additionally, there are crucial determinations of the actual condition of the calcine and how it will affect retrieval. Specifically, due to numerous INTEC flooding events, water could have infiltrated into the calcine requiring additional retrieval alternatives beyond the assumption of pneumatic vacuum extraction. Thus delays unnecessarily add risk of more flood water infiltrating the Calcine Bins. This flooding risk also must eliminate DOE s cost-cutting "In Situ Entombment" alternative offed by DOE. [72]

"Interim decay storage (i.e., 100 years or less) of the calcine prior to retrieval and processing, while reducing the overall level of radioactivity, does not appear to provide any benefits related to reduction of [material at risk] MAR and/or hazard class of the facility, and will likely result in the same number of Safety Class systems for the future processing facility. Additionally, it may lead to increased difficulties in retrieval due to continued compaction and potential agglomeration of the calcined solids within the binsets." [73]

The DOE's own Independent Alternative Analysis Report states: "Key challenges related to [Calcine] retrieval includes the following:

- *"The size and number of access risers available for retrieval operations varies by bin. Additionally, the configuration of each binset requiring retrieval is different.*
- *"Clumping/caking of the calcine is expected, but is assumed to be a manageable problem. An exception would be extreme caking, resulting, for example, from large amounts of water entering a bin or sintered bonding due to the temperature and pressure environment over time.*
- *"The actual characteristics of the as-retrieved calcine will be uncertain due to differing chemical and physical properties, coupled with commingling during emplacement and retrieval."*

[70] AoA, pg. 22.
[71] AoA pg. 24
[72] *In-Place Entombment/Disposal U.S. DOE-EM Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory Volume 1- Summary Report, pg.12*
[73] AoA, Pg. 27

"The access challenges can likely be resolved through equipment development and testing. The retrieval activities also provide an opportunity to better understand the physical and chemical characteristics of retrieved calcine. This is important in the context of processing and waste form requirements. ***Until a disposal path is defined, and the related waste form/processing requirements determined, development of the most effective retrieval technology/system could proceed independently since it is a common need to virtually all processing options."*** **[74]** [Emphasis added]

The Calcine is a HLW by NWPA definition and Settlement Agreement Court Order and must be road-ready for deep-geologic disposal out of Idaho. There is no dispute here except in DOE's obfuscation to follow Court Order that EPA and IDEQ are equally complicit with.

The Case for Direct Vitrification

"The U.S. Environmental Protection Agency (EPA) has identified vitrification, the process of converting waste into a glass, as the best demonstrated available technology (BDAT) for immobilizing wastes generated during the reprocessing of nuclear fuel. The Batt Settlement Agreement between the State of Idaho, the U.S. Department of Energy (DOE), and the Navy states that all HLW calcine must be treated and considered road ready for repository storage by 2035. New technologies are necessary to successfully design a waste-treatment facility that will meet these INEEL regulatory milestones. Two requirements are to develop (1) glass formulations and (2) integrated vitrification flowsheets that will successfully immobilize INEEL HLWs. The definitions of these glass formulations and integrated flowsheets have been initiated by a cooperative testing program between INEEL, Savannah River Technology Center (SRTC), and Pacific Northwest National Laboratory (PNNL). One of the environmental impact statement (EIS) options being considered as the treatment process for immobilizing INEEL HLW is early vitrification, which includes direct vitrification (bypass pretreatment of waste) of INEEL calcine. This report documents the Fiscal Year 2000 (FY00) activities for developing glass forms to demonstrate the direct vitrification of INEEL Blend pilot plant calcine." [75]

Vitrification: In the context of radioactive waste immobilization, vitrification is the process by which glass forming chemicals (GFCs) or glass frit are combined with waste material and introduced into a vessel, either as a dry powder or slurry, which is heated in the vessel to an appropriate temperature such that a glass, glass-ceramic, or other glass-like product is formed. Several technologies can perform this process, and the efficacy of a specific technology depends on the application.

"Two primary categories of vitrification technologies have been investigated and/or implemented for radioactive waste immobilization: 1) melters that use energized electrodes within the melt pool as the heat-generating energy source, often referred to as Joule-heated ceramic-lined melters (JHCMs); and 2) inductively heated melters that use an energized external coil to produce an electromagnetic field, which in turn provides the heat-generating energy source (e.g., cold crucible induction melters [CCIMs]). Multiple variants exist within each of these two broad categories, including in-can batch and continuous processes. These were all considered during the AoA. However, the two most promising includes the conventional JHCM and CCIM, which were considered during the detailed analysis." [76]

"For the vitrification option, this resulted in selection of the CCIM due to its greater flexibility in waste form chemistry, operational temperatures, and potentially improved waste loadings. For the low-temperature stabilization option, the [chemically bonded phosphate ceramics] CBPC variant was selected due to its potential for much higher waste loadings, as compared to a saltstone-like grout waste form, and thus lower final waste form volume. Additionally, the final waste form is more robust, in general. The combined results of the two screening steps are depicted in Figure 2. [77]

Direct Vitrification is the most developed technology and meets all interim surface storage (like SNF currently

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[74] AoA, Pg. 4
[75] PNNL-13483, pg.1-1 &2.
[76] AoA, Pg. 5
[77] AoA, pg. 17

in use) as well as deep geologic disposal waste acceptance criteria (WAC). DOE keeps stalling on doing the right thing hoping for regulatory relief from a more "flexible" Congress and Executive Branch.

> "Vitrification systems, regardless of the specific technology, are assumed to be more readily maintained than the [DOE preferred] HIP process due to operational experience within the DOE as well as internationally for these technologies. HIPing has never been deployed for remote, large-scale, radioactive ceramic production." [78]

Direct Vitrification also offers compliance with NWPA and the best treatment, interim storage and disposal solution for the 900,000 gal. highly mixed hazardous TRU radioactive sodium bearing waste SBW and related tank heels. Again, this avoids more tragic "in situ entombment" already used in the INTEC tank farm and the Hanford debacles.

> **Analysis of Alternatives (AoA) Operability Assumptions for Vitrification**
>
> *"1. Start-up/Shutdown of low temperature stabilization processes is assumed to require the greatest operator interface due to the need to flush the systems, recycle water, etc.*
>
> *"2. JHCMs are not amenable to thermal cycling due to refractory cracking concerns, while cold wall induction heating systems (e.g., CCIM, In-can melting) do not have this limitation. This makes start-up/shutdown for JHCMs more problematic, but procedures are well-established from West Valley and DWPF experiences.*
>
> *"3. For a given processing option, disposal options that have less restrictive waste form requirements, will offer a higher confidence in meeting target production rates. This is primarily driven by the limited ability to perform reliable in-process sampling and analysis of the calcine solids. This will result in a greater likelihood that the waste loadings will have to be reduced to ensure an acceptable final waste form.*
>
> *"4. Vitrification systems, regardless of the specific technology, are assumed to be more readily maintained than the HIP process due to operational experience within the DOE as well as internationally for these technologies. HIPing has never been deployed for remote, large-scale, radioactive ceramic production.*
>
> *"5. Waste loadings, and thus final waste volume, for offsite treatment options represent significant risk due to uncertainty as to how the calcine feed would be processed (i.e., blended with existing HLW, processed separately after water/chemicals added to make it compatible with the existing system, fed directly as powder after significant facility modification, etc.)."*

Why DOE's Preferred HIPing Treatment Alternative Fails

> *"The current [Calcine Disposition Project] CDP proposed path forward is to pneumatically retrieve the calcine from the CSSFs and transfer it to the Idaho Waste Treatment Unit (IWTU) for processing. There it will be blended with additives and processed in a hot isostatic pressing (HIPing) system to immobilize the material. The HIPing process was identified as the preferred calcine treatment technology by DOE through the National Environmental Policy Act process, and documented in the resulting High-Level Waste (HLW) Environmental Impact Statement (EIS) Amended Record of Decision (ROD), issued December 2009. As envisioned, the HIPing process will produce a glass-ceramic waste form deemed suitable for disposition of HLW in a geologic repository,* ***although the waste form has not been qualified yet for this specific application.***
>
> *"The current baseline to immobilize the calcine via HIPing is technically immature, with significant challenges to overcome, which may represent unacceptable project risk. An important factor in the original selection of HIPing was its ability to provide the lowest volume of final waste, while producing a robust waste form.*
>
> *"Currently, a preferred disposal option for DOE HLW has not been identified, and other options are being evaluated.* ***Thus, the assumptions regarding disposal costs and drivers to reduce the waste form***

[78] AoA, pg. 28

> ***volume, may no longer be valid**. Consequently, the uncertainty of the disposition path, and related final waste form requirements, resulted in an additional variable that had to be accounted for during the AoA."* [79] [Emphasis added]

Note above highlights, DOE's obsession on costs and related volume reduction rather than long term waste forms that will survive the toxic life of the HLW and legal requirements of the NWPA deep geologic repository.

"**In general, while producing a very robust waste form, due to the combined pressure and temperature levels, HIPing is assumed to represent the greatest safety risk of all the processing options considered during the AoA."** [80] [Emphasis added][pg.7]

Analysis of Alternatives (AoA) Safety Assumptions for HIPing DOE Preferred Treatment

"1. High temperature and high pressure processes (e.g., HIPing) represent the greatest safety risk.

"2. Low temperature stabilization processes (e.g., MgPO4) represent the lowest safety risk.

"3. Disposition strategies that require more frequent transportation or multiple transportation steps represent greater risk. This will be driven by final waste form volume and treatment location (i.e., offsite treatment).

"4. Processes that produce more robust waste forms represent lower risk during transportation than those that produce less robust waste forms (e.g., direct HIP versus direct packaging).

"5. Offsite processing options represent an increased safety risk because this disposition strategy will require two shipments: from Idaho to the treatment facility and from the treatment facility to the disposal facility.

"6. Introduction of dispersible powders into the operating vitrification plants, which are designed to manage wet slurries only, will introduce new hazards that may significantly impact existing DSAs.

"7. Achieving acceptable levels (i.e., ALARA principles) of contamination and radiation to allow personnel entry into the IWTU cells for installation of new equipment will likely be cost prohibitive and is not feasible." [81]

AoAs "Alternative Analysis Conclusions:

"1. Selection of the most appropriate processing technology is highly dependent on the disposal path, and the associated waste form performance requirements. A fully informed final decision regarding processing of the calcine cannot be made until the disposal path is known along with the associated regulatory framework.

"2. In general, salt bed formation disposal of DOE-only HLW appears to provide the most flexible and cost-effective disposal path, regardless of processing technology.

*"3. Package for direct disposal offers the best alternative for all disposal scenarios, when the baseline criteria weightings are used. **However, if regulatory or stakeholder concerns have a greater influence, the process options that produce more robust waste forms are preferred.***

"4. [Cold crucible induction melter] CCIM vitrification provides the best processing option if a robust waste form is preferred.

*"5. The current baseline of HIPing appears to represent the least preferable processing technology for all disposal options based on the assumptions and supporting criteria. **HIPing represents the highest operational safety risk (e.g., high pressures and temperatures) of all the processing options.***

*"6. [Deep bore hole] DBH disposal is technically feasible, **but represents much more***

[79] AoA, Pg. 1

[80] AoA, Pg. 7

[81] AoA, pg.27

uncertainty related to the regulatory framework and overall waste form requirements that will be established*. Additionally, the DBH configuration does not appear to be cost effective for calcine disposal due to the volume of waste. Calculation estimate that approximately 80 boreholes would be required.*
"7. Package for Direct Disposal is the lowest cost and most technically mature option." [82]
[Emphasis added]

The above AoAs (Alternative Analysis) conclusions show how DOE's policy makers are constantly revealing how their arbitrary regulatory interpretation and disposal site short-cuts are deliberately slowing the treatment decision. I.e., DOE tried to convince North Dakota on accepting deep bore hole for HLW and were immediately rebuffed. When DOE says above:

> *"However,* ***if regulatory*** *or stakeholder concerns have a* ***greater influence****, the process options that produce more robust waste forms are preferred," their utter disregard for the law, regulations, states, environmental groups, and Tribes legitimate environmental concerns, is made clear. DOE's primary driver above all is cost savings – not long-term environmental stewardship. [Emphasis added] Idahoans cannot allow this policy to compromise our future sole source aquifer*."

High-Level Waste EIS Accident Analysis Tank-Bin Sets

> "CPP-729 Bin set 1; Maximum plausible accident is: Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations. Bounding operations accident is: An external event results in: An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF." [83]

The accident doses for all 7 Calcine Bin Sets are the same. The same HLW EIS Table C.4-7. Facility disposition accidents summary for CPP-713 Vault for Tanks VS-WM-187, 188,189, and 190 for Bounding Operations accident, External event results in 0.34 rem (MEI), 23 rem (NIW), 3,500 rem (OSPP, and 1.8 LCF. See comparison table below.

Where LCF = latent cancer fatality; MEI = maximally exposed individual; NIW = noninvolved worker; OSP = offsite population. [84]

Comparison of SBW Tank Vault and Calcine Bin accident doses

CPP-713 vaults for SBW tanks (VES-WM-187, 188, 189, and 190)	**Calcine Bin Set # 1**
An external event results in 0.34 rem (MEI), 23 rem (NIW), 3,500 rem (OSP), and 1.8 LCF.	An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF.

Notes for above Table: LCF = latent cancer fatality; MEI = maximally exposed individual; NIW = noninvolved worker; OSP = offsite population;

MEI of 0.5 is maximally exposed individual --- this is defined usually at the fence or boundary of a facility and the individual is there for plume passage. Shine and inhalation are calculated. Later ingestion of crops or contaminated water is **not** included in the MEI. Remember the windblown calcine and contaminated water does not stop at the facility boundary. IDEQ needs to understand the calcine material that can be dispersed in terms of radionuclide and curie amounts, the characteristics of the material - the calcine is a very soluble powder-like material that will be extremely difficult or impossible to remediate. These doses don't tell the whole story. These analyses do not look at crop losses, unusable land, continued contamination that blows in the wind or migrates in the aquifer.

NIW (noninvolved worker) dose of 34 rem is bad; a very serious exposure with potential for serious health effects, but DOE would conclude that it wouldn't be lethal. Not to worry. The EPA maximum contaminate limit (MCL) for radionuclides is based 4 mrem/year public exposure, or 0.004 rem.

[82] AoA, pg. 22
[83] DOE/EIS-0287 Table C.4-7. Facility disposition accidents summary, Pg. C.4-55 &56
[84] DOE/EIS-0287 Table C.4-7, Pg. C.4-55

LCF is latent cancer fatality. This is based on industry cancer risk rates for the calculated exposure. Most people are assumed to evacuate so the doses are low. There is no apparent to show/examine the details of this particular analysis. The actual cancer risk is higher if newer cancer rates are used. The LCF also neglects the other health harms of increased heart disease, genetic effects, etc.

OSP is offsite population dose of 5,900 rem is also a serious dose to the general population that must be made public so they can make informed decisions about INL operations.

The above dose table shows that dose from accidental release from only Calcine Bin Set #1 is significantly higher than 4 highly radioactive sodium-bearing waste tanks which like the Calcine Bins use ridiculous, "Materials at risk is low levels of radioactive and hazardous materials."
The 34 rem NIW is a very serious dose to other workers, but DOE would conclude that it wouldn't be lethal. Is this potential exposure fact communicated to those workers?

Informative as this above dose data is, it's based on bogus assumptions such as: The Calcine in Bin Sets "materials at risk is low levels of radioactive and hazardous materials." The tables below listing all the hazardous chemicals and the radionuclides show just how dangerous this material is. These doses don't tell the whole story. These analyses do not look at crop losses, unusable land, continued contamination that blows in the wind (remember calcine is in fine granular form) what DOE calls "contaminate mobility" or (as a soluble) that will easily migrate in the aquifer.

The "external event accident" that they chose looks very unlikely -- implausible. So DOE chose the worst consequences, made the probability look very small without acknowledging that the Calcine Bins were built ~ 1963 (54 years) without adequate seismic consideration. The probability of a very serious event is probably much higher than they made it look which is not apparently stated. The types of initiating events that the calcine bins are vulnerable to and the fact that these initiating events are not remote possibilities, but could be 1 in 150 year events depending on the particular analysis of flooding depth and likelihood and seismic hazard curve and bin set fragility.

Where is the Calcine Bin Set Safety Analysis?

INTEC like other INL facilities has probably conducted safety analysis bordering on the ridiculous to try to minimize the appearance of a safety problem. These are reasons why DOE won't let the public see their Documented Safety Analysis --- they probably don't want to release it and expose how inadequate the safety analysis is. Without the DOE's documented safety analysis and supporting documents, it just isn't realistic to evaluate the hazard issues. The DOE has never included aquifer contamination migration is safety analysis and tends to exaggerate the length of time to reach community wells once in the aquifer.

Flood Hazard Analysis is Required by RCRA

IDEQ fails to offer the public "in one concise document" what the permit covers. In EDI's view, the subject permit must be rejected until DOE/INL first addresses the potential flood hazard and incorporates sufficient measures to protect the INTEC (Calcine Bin Sets) and other INL facilities as required by Idaho Code §39-4409(5).

Specifically, corrective action is required prior to permit approval - as stated in DEQ's Fact Sheet:

> "Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

The Calcine Permit incorrectly claims that "The hydrology conditions at the INL are addressed in the *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement.* [85] A copy of this document has already been provided to

[85] DOE/EIS - 0203F, Volume 1, Appendix B.

DEQ." [86] Hydrogeology is discussed but RCRA **disallows** disposal in a flood zone. DOE cherry-picked what it wanted to use from the Koslow report and deliberately chose NOT to use the results of higher flood PMF-Induced Overtopping Mackay Dam failure. [87] We discuss this issue below.

Flood Issues Not Fully Analyzed in the Calcine Storage Permit

DOE habitually ignores flood issues in all its documentation including this Calcine Storage Permit. There are IMMEDIATE flood hazards that not only affect ALL INL facilities but specifically the vulnerabilities of its HLW inventories and the Calcine Bin Sets as previously noted in the above retrievably discussion. DOE offers no emergency INTEC flood plan. I.e., what response plan will handle a flood that "floats" the calcine bins and severs the riser pipes?

Significant flooding from the Mackay Dam has already been identified in HLW FEIS as a risk to various nuclear facilities at INL/INTEC, such as the INTEC tank farm where liquid radioactive waste is stored. And of great concern, flooding of underground high-level waste tanks at INTEC may cause release of radioactive material by shearing piping and cause extensive release of radioactive liquid over the aquifer or calcine waste over the aquifer and above ground. [88]

The Calcine Storage Permit should be denied on this issue alone.

Previous analyses of INL's flood hazard posed by a probable maximum flood (PMF) generated by high seasonal runoff coupled by overtopping/failure of Mackay Dam clearly document an immediate hazard not only for downstream residents but also INL facilities. The capacity of various improvements to the INL Diversion Dam designed to shunt flood water away from INL facilities are also in question in addition to questions about long-term institutional maintenance.

The US Geological Survey (USGS) released a 1998 report that modeled the **median** 100-year flow rates in the Big Lost River (that flows by the ICPP now called INTEC) downstream of the INL Diversion Dam (6,220 cf/s). The USGS report cross section number 22 at the ICPP puts the median flood elevation at 4,912 feet.[89] Again, this is only the mean flow rate (as opposed to the maximum rate of 11,600 cf/s) of just a 100-year flood, and **not** including any additional cascading events like the failure of Mackey Dam.

The USGS flood map (see attached maps) show the northern half of the INTEC under water. The USGS flood map shows the INTEC elevation of 4,917 feet and the USGS predicted elevation of 4,912 feet through the middle of the ICPP. The USGS study also employed current modeling technics and plotted 37 separate cross sections on the INL site. The INTEC as a whole is about as flat as a table top with only a couple feet change in elevation north to south.[90]

The crucial point here is that even the slightest variation in a Big Lost River flood would put the INTEC Calcine Bins underwater assuming the bins were on the surface – which they are not since they are partially buried. Proportionally less variation in floods would inundate the INTEC the deeper the bins are buried below the surrounding terrain.

Given the significance of flooding issues on all INL facilities and the risk flooding poses for the **continued**

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86 Calcine Permit at D-2f(3)(a)(iii) Hydrogeologic Setting of the Facility [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(iii)]

87 Engineering Design File, Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-year Flood, ID-EDF-33996, 10/31/03, pg.2. "The binsets have been identified as Safety Significant per PC-2 per SAR-104 [8] and SAR-106 [9]." "However, the performance category is not used in this analysis since the design basis flood event and scope of the analysis are governed by RCRA regulations." But it was not accurately done.

88 The HLW/EIS [pg. 4-54] states that "... in the event of a design basis flood with sufficient magnitude and duration, it may be possible that one or more buried [high-level] 300,000 gallon waste tanks could float." Another potential effect could be the failure of high-level waste calcine bin sets. Shearing of service lines and the release of radioactive liquids is another potential hazard in addition to lack of access to tanks needed to receive flood waters pumped from inundated waste facilities.

89 Preliminary Water-Surface Elevations and Boundary of the 100 Year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory, Idaho, US Geological Survey, Water-Resources Investigations Report 98-4065, DOE/ID-22148

90 Topographic Map of Block 21, National Reactor Testing Station (now called INL) showing works and structures, U.S. Atomic Energy Commission, Idaho Operations Office, shows three feet change in elevation between the north and south end of the ICPP.

migration of hazardous and radioactive contaminates into the underlying Snake River Plain Aquifer, IDEQ must require that a new independent three dimensional flood study using current modeling methods be conducted as a permit extension requirement.

DOE's Calcine Storage Permit acknowledges "The design basis flood is a 100-year flood coincident with a Mackey Dam failure. The flood water elevation for the postulated flood is 4916 ft. and the flood water depth at INTEC is approximately 4 ft." [91]

This calcine report notes the bottom of Bin Set 3 (CPP-746) at 4865 ft. above sea level which means it will be ~50.5 ft. underwater in a probable maximum flood (PMF).

Idaho Department of Water Resources (IDWR) clearly warns that Mackey Dam could have a problem this year. However, the following issues remain uncorrected.

1.) What IS the Emergency Plan other than the people for contact? Why is it not publicly available even using a Public Records Request?

2.) Were corrections from prior years' inspections made? What was done?

3.) Also it seems like more than one inspection might be necessary given the potential for over topping and the fact Mackay Dam is "high risk".

4. There's an issue as to whether Mackey Dam owners can dump the necessary amount of water to be protective. Where's the analysis for that?

5. IDWR 3/14/17 letter to Big Lost River Irrigation District, RE: Mackey Dam 2017 snow water equivalent that states in pertinent part:

"The purpose for this letter is to encourage you to release as much water as possible from the Mackay Reservoir without flooding downstream properties. ***The reason for my concern is that the runoff forecast volume of 350,000 acre-feet (NRCS-30%) is more than seven times the entire capacity of the reservoir, and the current rate of release(± 400 cfs) is too small to prevent the emergency overflow spillway from discharging uncontrollably to pass all of this expected runoff****. This year, the near record volume of water that presently exists in the snowpack may combine later with unseasonably warm temperatures to create near record maximum flow through the spillway."*

"As you are aware, the maximum spillway capacity is approximately 4,370 cfs measured at the top of the concrete training wall. Exceeding this rate of flow may result in severe erosion of adjacent fill materials. Consequently, the sooner you are able to controllably release the maximum quantity of water from the reservoir, the more likely you will be able to reduce peak discharges through the spillway; I am aware that you intend to increase releases from the outlet as soon as the Big Lost River channel downstream from the dam is clear of ice and other potential obstructions."

Despite this clear warning, there is no indication that Mackey Dam owners will act; or even if they did belatedly respond, that the capacity of either the outlet gates (400 cf/s) could lower the reservoir enough to keep the emergency spillway from overflowing in the potential flood.

The State of Idaho has experience ignoring disasters waiting to happen. In 1976, the earthen Teton Dam began eroding due to a leak at its base, then burst, resulting in 11 deaths and over a billion dollars in property damage. Teton Dam, built during the same era and of similar design, was only 125 miles away from Mackay Dam. News reports at the time mentioned that the Teton Dam owners were warned but refused to release water because their agriculture needs required the water later in the summer.

The State of Idaho only has authority to take control of dams in an emergency condition. EDI has written letters to Governor Otter and Attorney General Wasden about the Mackey Dam RE: "Preventable Disaster" however there has been on response. EDI even requested a copy of the Emergency Plan from IDWR required of the dam owners, and were improperly denied. [92]

The DOE documents presented to IDEQ for RCRA floodplain review present misleading, incomplete, inconsistent facts and conclusions, and fail to comply with the state and/or federal requirements for

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[91] Engineering Design File, Hydrostatic and Hydrodynamic Forces at INTEC CCSF During a 100-Yeat Flood, [ID-EDF-3996, 10/31/03, pg. 1]

[92] John Falk, PE, Idaho Department of Water Resources, Email to Broscious, 3/2/17

information to be supplied under the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act of 1969 (NEPA) and Floodplain/Wetlands Environmental Review Requirements of 10 CFR 1022 *et seq*.

The Calcine Storage Permit offers no apparent actions for protection to be taken in the eventuality of a flood. DOE/INL and IDEQ have been cognizant of this problem for decades, and should have decades ago dealt with the problem. Rejection of this permit as presented is an opportunity for IDEQ to correct this imminent hazard that threatens Idaho's sole source aquifer, public health and safety, and the environment when the calcine leaches out during a flood.

IDEQ must consider what additional terms and conditions that should be taken for the flood dangers posed by Mackay Dam, up to and including eminent domain proceedings, relevant to the omnibus provision of RCRA since this is a RCRA Permit proceeding. Section 3005(c) (3) of RCRA (codified at 40 CFR 270.32(b) (2)) requires that each hazardous waste facility permit contain the terms and conditions necessary to protect human health and the environment. This provision is commonly referred to as the "omnibus authority" or "omnibus provision." It is the means by which additional site-specific permit conditions may be incorporated into RCRA permits should such conditions be necessary to protect human health and the environment.

Incomplete Calcine Storage Permit Information

1. Permit calls for removal of calcine and closure but there is no apparent time-line or explanation of how the calcine will be removed and what DOE plans to do with the calcine removed from the bins. Why the decades-long delay?
2. There appears to be a distinction between calcine bin sets in terms of land disposal restrictions that suggests different disposition for different bin sets; (i.e., calcine generated from SNF reprocessing and calcine produced from "sodium-bearing waste"). What are DOE's plans?
3. Is any of this removed calcine destined for the Remote-Handled Waste Disposal Facility and/or WIPP? If so, no clear waste acceptance criteria (WAC) is offered for these facilities and if the calcine meets their WAC.
4. Previously, INTEC calcine was classified as high-level mixed waste. The permit has no apparent statement on this calcine radioactive waste class, direct vitrification treatment requirement, or restrictions to disposal in a deep geologic repository per NWPA requirements.
5. The permit section on flooding only analyzes a 100-year PMF which is grossly inadequate.
6. There are no apparent plans on what to do when the INTEC is flooded, and what affect compromised Calcine Bin leached contents will have on the retrieval, the aquifer and the human environment.
7. The closure plan has no apparent explanation for how the contents of the earlier bin sets (without retrieval piping) will be extracted. Will they be grouted in place like DOE did the high-level waste tanks creating an illegal HLW shallow disposal in violation of Nuclear Regulatory Commission 10 CFR Part 61 regulation, NWPA, RCRA and CERCLA any near-surface disposal?
8. What chemical reaction will flood water contact have on calcine, and treatment?
9. What impact will wet calcine have on retrieval during closure?
10. Why hasn't DOE/INL started transferring calcine from the problematic Bin Sets 1, 2, and 3 to the other Bin Sets with unused capacity? See table below.
11. The Settlement Agreement Consent Order has had little impact on forcing DOE to implement treatment of the huge Liquid HLW and HLW Calcine inventory. Why?
12. DOE provides no Calcine Bin Set Safety Analysis.

DOE <u>1983</u> Calcine Treatment Preferred Alternative is not implemented

> *"The Decision Management Team's recommended Preferred Alternative for calcine was to retrieve the calcine presently stored in the six bin sets at INTEC, vitrify it, and place it in a form to enable compliance with the current legal and regulatory requirement to have* ***HLW*** *road ready by a target date*

> *of December 31, 2035. Concurrent with the program to design, construct, and operate the vitrification facility for mixed transuranic waste/ SBW, DOE would initiate a program to characterize the calcine, and develop methods to construct and install the necessary equipment to retrieve calcine from the bin sets. DOE would focus technology development on the preferred calcine treatment technology of vitrification, and the feasibility and merits of performing calcine separations as well as refine cost and engineering design." [emphasis added]* [DOE/EIS-0287, Pg. B-2]

The above **1983** Calcine vitrification plan is the most realistic because it appropriately links both the INTEC HLW tank waste and the Calcine and provided estimates of HLW volumes to be generated through **2015**. Subsequently, the DOE Idaho Operations Office completed the study (DOE 1983) in 1983. That was >34 years ago and DOE is no closer today to offering a solution. What does it take for DOE to move - another law suit and Court Order?

The Permit states: "The [INTEC] area is relatively flat and receives little rainfall. However, poor drainage patterns can produce localized flooding during periods of rapid snowmelt and/or heavy rainfall." [93] So DOE/INL is relying in this permit on questionably reliable; a.) flood information; b.) reliance on INL Diversion Dam to shunt floods away from INL; and institutional control adequate to maintain the Diversion Dam for the hundreds of thousands of years the Calcine will be toxic.

The Engineering Design File used in the Permit acknowledges: "The floodwater elevation for the postulated flood is 4,916 ft. and the flood water depth at INTEC is approximately 4 ft." [94] Also stated is the elevation of Bin Set # 1 is 4,867. That means the Bin Set # 1 will be ~56 ft. below the flood water which will add significant hydrologic pressure on the non-water tight concrete casing with the potential of floating the bins, severing connecting coolant piping and exposing workers to unshielded radiation. [Pg.3 and 4]

The Permit states: "Since a 100-year flood with a Mackay Dam failure is the maximum credible flood associated with a 100-year peak flow in the Big Lost River (exceeding RCRA requirements for a design basis flood event), load factors for floodwater forces and soil pressure were set equal to one.

> "A structural evaluation of the bin set vaults was used to check whether the vault walls are able to withstand hydrostatic and hydrodynamic forces resulting from the postulated 100-year flood. The concrete walls of bin sets 1 to 7 meet the structural requirements given in ACI-318 [4]. The structural capacity of the walls ensures that washout of hazardous waste from these bin sets will be prevented." [95]
>
> "The only pathway for floodwater infiltration into a bin set vault is at pipe penetrations, which are sealed and watertight.
>
> "The floodwater elevation for the postulated 100-year flood coincident with a Mackay Dam failure is 4916 ft. in reference to NGVD29 (Koslow and Van Haaften, [2]). Since the elevation at grade level is approximately 4912 ft., the floodwater depth is 4 ft.
>
> "The wave height of shallow water waves generated by a 60 mph wind with a water depth equal to 4 ft. is approximately 2 ft. from crest to trough (Fig. 10-16 in Brater and King [3]). The maximum water level during the postulated 100-year flood is 4917 ft. (still water level + 1/2 wave height).
>
> "WCF Bin Sets 1 -3 were built from 1959 to 1969 and NWCF Bin Sets 4-7 were built from 1976 to 1985." [96] [Pg. 3]

Despite the above false assurances that the Calcine Bin Sets will structurally not collapse in the postulated flood, there is no apparent detailed analysis of whether floodwater will infiltrate the concrete enclosure and float the tanks inside and sever the piping. This is important given the age stated as: "WCF Bin Sets 1-3 were built from 1959 to 1969 and NWCF Bin Sets 4-7 were built from 1976 to 1985." There is no apparent confirmation of

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[93] INL CSSF HWMA/RCRA Permit Reapplication Attachment 1 - Section B, Facility Description Volume 22 –INTEC May 2016, pg. iii.

[94] Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-yr Flood, EDF File 3996, pg. 1.

[95] ENGINEERING DESIGN FILE, Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-Year Flood, EDF No. 3996, pg. 5.

[96] ENGINEERING DESIGN FILE, Hydrostatic and Hydrodynamic Forces on the INTEC CSSF During a 100-Year Flood, EDF No. 3996, and pg. 3.

how reliable this old “water-tight” sealant data is given its age. **There is no analysis for how regional earthquakes have affected Calcine Bin Sets piping and seals over time.**

“Although the Calcined Solids Storage Facility (CSSF) bins are not currently receiving any waste, this permit reapplication allows for the continued use of Bin Sets 1, 2, 3, 4, and 5 for storage and Bin Sets 6 and 7 for storage and to receive future waste transfers.

“From December 1963 to June 2000, the calciners at the INTEC were used to convert approximately 7,920,000 gal of liquid mixed waste into approximately 155,600 ft3 of granular calcine solids. In the calciner processes liquid wastes were injected into a high-temperature (400 to 600o C) air fluidized bed of granular solids. The liquid portion of the waste evaporated and the solids adhered to the granular material-producing calcine. Exhibit D-1 provides a diagram of the typical calciner process flow.

“Calcined solids were pneumatically transferred from the calciner facilities to the CSSF via air transport lines. In the CSSF, the solids are stored in stainless-steel bins located in underground or partially underground concrete vaults to isolate them from the environment. Exhibit D-2 provides the calcine solids flow path from the Waste Calcining Facility (WCF) to the CSSF. Exhibit D-3 provides the calcine solids flow paths from the New Waste Calcining Facility (NWCF) to the CSSF.” [97]

IDEQ has the duty under RCRA, 42 USC § 6901 (b) to avoid risking from the following:

“[T]he placement of inadequate controls on hazardous waste management will result in substantial risks to human health and the environment;

“[I]if hazardous waste management is improperly performed in the first instance, corrective action is likely to be expensive, complex, and time consuming;

“[C]certain classes of land disposal facilities are not capable of assuring long-term containment of certain hazardous wastes, and to avoid substantial risk to human health and the environment, reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes.”

To that purpose, IDEQ must immediately enforce and implement the DOE/INL Settlement Agreement Consent Order to put the Calcine into “road-ready” containers for ultimate disposal in a geologic repository. Additionally, the first step must be to transfer the Calcine from the problematic Bin Sets 1 and 2 into the empty Bin Set #7 and not continue stalling on the four decades long failure to operate the Integral Waste Treatment Facility.

Calcine Storage Facility Inventory [Part A Permit Application Vol.22, pg. 3a]

Bin Set No.	**Inventory** in cubic meters	**Capacity** in gallons/ cubic meters
Bin Set No 1	235	62,086
Bin Set No 2	895	236,459
Bin Set No 3	1,133	299,388
Bin Set No 4	502	132,628
Bin Set No 5	1,025	270,805
Bin Set No 6	1,563	412,944
Bin Set No 7	1,784	471,322

[97] INL CSSF HWMA/RCRA Permit Reapplication Attachment 1 - Section B, Facility Description Volume 22 –INTEC May 2016, pg. 1

Total	5,353	7,137 cm 1,885,595 gallons

Table 1. Summary of High-Level Waste Calcination and Storage at the Idaho National Laboratory (Staiger and Swenson, 2011) [98]

Calcined Waste Production Facility	Operating	Volume of Liquid HLW	Volume of Calcined Waste	Storage Facilities
Waste Calcine Facility	1963–1981	4,091,000 gal (15,490,000 L)	77,300 ft^3 (2,190 m^3)	CSSFs I, II, III
New Waste Calcine Facility	1982–2000	3,642,000 gal (13,790,000 L)	78,000 ft^3 (2,210 m^3)	CSSFs IV, V, VI

Table C.7-2. Bin set total chemical inventory (fission and activation species decayed to 2016).[a] Idaho HLW & FD EIS, DOE/EIS-0287.

Constituent	Total mass (kg)	Constituent	Total mass (kg)
Actinium	1.2×10^{-6}	Molybdenum	2.9×10^{4}
Aluminum	9.7×10^{5}	Neodymium	1.4×10^{3}
Americium	4.4	Neptunium	46
Antimony	10	Nickel	2.6×10^{3}
Arsenic	3.7	Niobium	2.6
Astatine	8.5×10^{-20}	Palladium	110
Barium	770	Plutonium	1.3×10^{3}
Beryllium	3.6	Polonium	2.8×10^{-9}
Bismuth	2.7×10^{-9}	Potassium	2.8×10^{4}
Boron	4.0×10^{4}	Praseodymium	380
Bromine	29	Promethium	5.7×10^{-3}
Cadmium	4.7×10^{4}	Protactinium	2.4×10^{-3}
Calcium	1.1×10^{6}	Radium	2.7×10^{-5}
Californium	1.0×10^{-12}	Rhodium	140
Cerium	850	Rubidium	170
Cesium	740	Ruthenium	1.9×10^{3}
Chlorine	4.5×10^{3}	Samarium	280
Chromium	8.8×10^{3}	Selenium	51
Cobalt	1.6	Silver	8.3
Curium	3.6×10^{-3}	Sodium	1.3×10^{5}
Dysprosium	3.3	Strontium	2.6×10^{3}
Erbium	1.8	Technetium	280
Europium	20	Tellurium	140
Fluorine	8.4×10^{5}	Terbium	0.94
Francium	3.1×10^{-14}	Thallium	0.36

98 U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD CALCINED HIGH-LEVEL RADIOACTIVE WASTE

Gadolinium	15	Thorium	6.1
Gallium	14	Thulium	0.14
Germanium	1.2	Tin	43
Holmium	1.1	Uranium	1.7×10^4
Indium	4.0	Ytterbium	1.8
Iodine	1.4×10^3	Yttrium	260
Iron	2.2×10^4	Zinc	71
Lanthanum	440	Zirconium	5.6×10^5
Lead	360	NO_3	2.5×10^5
Lithium	18	PO_4	2.4×10^4
Manganes	1.2×10^3	SO_4	5.3×10^4
e Mercury	1.2×10^4		

Why is there is no definition for "chemical inventory (fission and activation species)"

Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016). Idaho HLW & FD EIS

Constituent	Total activity (Ci)	Constituent	Total activity (Ci)	Constituent	Total activity (Ci)
H-3	15	Sm-148	9.0×10^{-9}	Th-227	0.085
Be-10	0.033	Sm-149	2.9×10^{-9}	Th-228	1.6
C-14	0.038	Sm-151	4.5×10^5	Th-229	1.4×10^{-4}
Co-60	1.5×10^3	Eu-150	5.3×10^{-3}	Th-	1.4
Ni-63	6.8×10^4	Eu-152	430	230	5.0
Se-79	9.9×10^4	Gd-152	5.3×10^{-10}	Th-232	2.3×10^{-7}
Rb-87	9.1×10^{-3}	Eu-154	2.9×10^4	Th-234	5.0
Sr-90	7.9×10^6	Eu-155	3.9×10^3	Pa-231	0.11
Y-90	7.9×10^6	Ho-166m	0.014	Pa-233	690
Zr-93	680	Tm-171	1.1×10^{-9}	Pa-	5.0
Nb-93m	630	Tl-207	0.085	Pa-234	6.3×10^{-3}
Nb-94	270	Tl-208	0.16	U-232	1.6
Tc-98	7.3×10^{-4}	Tl-209	1.9×10^{-6}	U-	0.057
Tc-99	4.6×10^3	Pb-209	1.4×10^{-4}	233	130
Rh-102	9.1×10^{-3}	Pb-210	0.013	U-235	3.2
Ru-106	4.4×10^{-3}	Pb-211	0.085	U-236	11
Rh-106	0.029	Pb-212	1.6	U-237	1.5
Pd-107	9.1	Pb-214	0.027	U-238	3.1
Ag-108	1.1×10^{-5}	Bi-210m	5.2×10^{-17}	U-240	1.6×10^{-7}
Ag-108m	1.3×10^{-4}	Bi-210	0.013	Np-235	5.1×10^{-17}
Ag-109m	3.8×10^{-17}	Bi-211	0.085	Np-237	470
Cd-109	3.8×10^{-17}	Bi-212	1.6	Np-238	0.017
Cd-113m	1.6×10^3	Bi-213	1.4×10^{-4}	Np-239	50
In-115	2.7×10^{-8}	Bi-214	0.027	Np-240m	1.6×10^{-7}
Sn-121m	68	Po-210	0.013	Pu-236	0.027
Te-123	1.3×10^{-10}	Po-211	1.7×10^{-4}	Pu-238	1.1×10^5
Sb-125	130	Po-212	0.29	Pu-239	4.8×10^4
Te-125m	38	Po-213	1.4×10^{-4}	Pu-240	2.0×10^3
Sn-126	310	Po-214	0.027	Pu-241	4.8×10^4
Sb-126	43	Po-215	0.085	Pu-242	130
Sb-126m	310	Po-216	1.6	Pu-243	1.1×10^{-13}

I-129	1.6	Po-218	0.027	Pu-244	1.6×10^{-7}
Cs-134	67	At-217	1.4×10^{-4}	Am-241	1.2×10^{4}
Cs-135	360	Rn-219	0.085	Am-242m	6.1
Cs-137	8.8×10^{6}	Rn-220	1.6	Am-242	5.8
Ba-137m	8.5×10^{6}	Rn-222	0.027	Am-243	50
La-138	6.8×10^{-8}	Fr-221	1.4×10^{-4}	Cm-242	4.8
Ce-142	9.4×10^{-3}	Fr-223	0.018	Cm-243	5.0
Ce-144	8.6×10^{-5}	Ra-223	0.085	Cm-244	250
Pr-144	1.4×10^{-3}	Ra-224	1.6	Cm-245	0.071
Pr-144m	1.7×10^{-5}	Ra-225	1.4×10^{-4}	Cm-246	4.6×10^{-3}
Nd-144	4.6×10^{-7}	Ra-226	0.027	Cm-247	5.2×10^{-9}
Pm-146	2.3	Ra-228	2.3×10^{-7}	Cm-248	5.5×10^{-9}
Pm-147	5.3×10^{3}	Ac-225	1.4×10^{-4}	Cf-249	4.0×10^{-9}
Sm-146	8.6×10^{-5}	Ac-227	0.085	Cf-250	1.7×10^{-9}
Sm-147	3.0×10^{-3}	Ac-228	2.3×10^{-7}	Cf-251	6.3×10^{-11}

a. Source for above table: Valentine (2000).

Manual counting of above Total Table C.7-3 [99] Bin set total inventory of radionuclides (decayed to 2016) only counting >2 Ci = **33,987,941 Ci.** This represents an important factor requisite for appropriate evaluation of the subject Permit.

Why is this crucial information NOT in the IDEQs Fact Sheet or in the Calciner Permit but is found in the Idaho High-level Waste Management EIS? Is it because the public would be shocked to know how lethal the calcine actually is and treatment delays are very risky for Idaho?

"Radionuclides that contribute the majority of the activity for wastes managed in the [Calcined Solids Storage Facility] CSSF include Sr-90, Y-90, Ba-137m, and Cs-137. Activity of typical calcine is approximately 10 mCi/g. The exposure rates associated with the calcine routinely exceed 10 rem/h on a 15-mL sample and can pose a potentially serious hazard to workers at the INL, if appropriate protective measures such as time, distance, and shielding are not applied." [100]

In short, this Calcine is deadly and thus must receive appropriate priority to vitrify it into a waste form that can be temporarily stored like the current SNF in "road-ready" canisters for transport out of Idaho to a deep geologic repository.

Table 2. Calcined Solids Storage Facility (CSSF)–Total, useable and filled CSSF volumes.

CSSF	Total ($ft.^3$)	Usable	Filled	% Full
1	8,300	8,000	7,800	96
2	31,600	30,000	30,000	100
3	40,000	39,900	39,500	99
4	17,700	17,200	17,100	100
5	36,200	35,600	35,600	100
6	55,200	53,200	25,600	48
7	63,000	63,000	0	0

[99] Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS, D0E/EIS-0287 Appendix C. 7, pg. C.7-4.

[100] INL CSSF HWMA/RCRA Part B Permit Reapplication Attachment 2 - Section C, Waste Characteristics Volume 22 May 2016.

Why is this data not in the Calcine Storage Permit to remind everyone how radioactively/ chemically hazardous it is?

The below Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS, D0E/EIS-0287 Appendix C. 7, pg. C.7-4. Table C.4-7 is crucial information because it will end up as calcine yet it's NOT in the Permit! Idaho High-level Waste EIS calculated facility disposition summary Table C.4-7 showed a comparison of CPP-713 vaults for sodium-bearing waste tanks with Calcine Bin Set #1. [101]

[101] Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) decayed to 2016 can be found at Idaho High-Level Waste & Final EIS, D0E/EIS-0287 Appendix C. 7, pg. C.7-4.

Appendix C.7 **- New Information -**

Table C.7-4. Calculated radionuclides activities for SBW (curies per liter) decayed to 2016.[a]

Radionuclide		Radionuclide		Radionuclide	
Hydrogen-3	1.2×10^{-4}	Samarium-147	2.9×10^{-11}	Thorium-227	8.1×10^{-10}
Beryllium-10	3.1×10^{-10}	Samarium-148	8.5×10^{-17}	Thorium-228	1.5×10^{-8}
Carbon-14	3.6×10^{-10}	Samarium-149	2.8×10^{-17}	Thorium-229	1.3×10^{-12}
Cobalt-60	8.1×10^{-6}	Europium-150	5.0×10^{-11}	Thorium-230	1.3×10^{-8}
Nickel-63	6.0×10^{-4}	Samarium-151	4.2×10^{-3}	Thorium-231	4.7×10^{-8}
Selenium -9	2.2×10^{-5}	Europium-152	4.0×10^{-6}	Thorium-232	1.9×10^{-15}
Rubidium-87	8.6×10^{-11}	Gadolinium-152	5.0×10^{-18}	Thorium-234	4.1×10^{-8}
Strontium-90	0.15	Gadolinium-153	3.1×10^{-31}	Protactinium-231	1.1×10^{-9}
Yttrium-90	0.15	Europium-154	5.5×10^{-5}	Protactinium-233	6.4×10^{-6}
Zirconium-93	6.5×10^{-6}	Europium-155	5.4×10^{-5}	Protactinium-234m	4.1×10^{-8}
Niobium-93m	6.0×10^{-6}	Holmium-166m	1.3×10^{-10}	Protactinium-234	5.3×10^{-11}
Niobium-94	1.2×10^{-4}	Thulium-171	1.0×10^{-17}	Uranium-232	1.5×10^{-8}
Technetium-98	6.9×10^{-12}	Thallium-207	8.1×10^{-10}	Uranium-233	5.4×10^{-10}
Technetium-99	1.7×10^{-4}	Thallium-208	1.5×10^{-9}	Uranium-234	1.8×10^{-6}
Rhodium-102	8.7×10^{-11}	Thallium-209	1.8×10^{-14}	Uranium-235	2.2×10^{-8}
Ruthenium-106	2.6×10^{-10}	Lead-209	1.3×10^{-12}	Uranium-236	7.4×10^{-8}
Rhodium-106	2.6×10^{-10}	Lead-210	1.2×10^{-10}	Uranium-237	1.4×10^{-8}
Palladium-107	8.6×10^{-8}	Lead-211	8.1×10^{-10}	Uranium-238	2.0×10^{-8}
Silver-108	1.1×10^{-13}	Lead-212	1.5×10^{-8}	Uranium-240	1.5×10^{-15}
Silver-108m	1.2×10^{-12}	Lead-214	2.5×10^{-10}	Neptunium-235	4.8×10^{-25}
Silver-109m	3.6×10^{-25}	Bismuth-210m	4.9×10^{-25}	Neptunium-237	2.0×10^{-6}
Cadmium-109	3.6×10^{-25}	Bismuth-210	1.2×10^{-10}	Neptunium-238	1.6×10^{-10}
Silver-110	6.2×10^{-31}	Bismuth-211	8.1×10^{-10}	Neptunium-239	4.8×10^{-7}
Silver-110m	4.8×10^{-29}	Bismuth-212	1.5×10^{-8}	Neptunium-240m	1.5×10^{-15}
Cadmium-113m	1.5×10^{-5}	Bismuth-213	1.3×10^{-12}	Plutonium-236	2.5×10^{-10}
Indium-115	2.5×10^{-16}	Bismuth-214	2.5×10^{-10}	Plutonium-238	7.1×10^{-4}
Tin-119m	1.9×10^{-29}	Polonium-210	1.2×10^{-10}	Plutonium-239	1.6×10^{-4}
Tin-121m	6.4×10^{-7}	Polonium-211	1.6×10^{-12}	Plutonium-240	2.3×10^{-5}
Tellurium-123	1.2×10^{-18}	Polonium-212	2.7×10^{-9}	Plutonium-241	5.8×10^{-4}
Antimony-125	6.0×10^{-6}	Polonium-213	1.3×10^{-12}	Plutonium-242	4.7×10^{-8}
Tellurium-125m	3.6×10^{-7}	Polonium-214	2.5×10^{-10}	Plutonium-243	1.0×10^{-21}
Tin-126	2.9×10^{-6}	Polonium-215	8.1×10^{-10}	Plutonium-244	1.5×10^{-15}
Antimony-126	4.0×10^{-7}	Polonium-216	1.5×10^{-8}	Americium-241	7.4×10^{-5}
Antimony-126m	2.9×10^{-6}	Polonium-218	2.5×10^{-10}	Americium-242m	5.7×10^{-8}
Iodine-129	1.3×10^{-7}	Astatine-217	1.3×10^{-12}	Americium-242	5.5×10^{-8}
Cesium-134	1.9×10^{-6}	Radon-219	8.1×10^{-10}	Americium-243	4.8×10^{-7}
Cesium-135	3.4×10^{-6}	Radon-220	1.5×10^{-8}	Curium-242	4.5×10^{-8}
Cesium-137	0.084	Radon-222	2.5×10^{-10}	Curium-243	4.7×10^{-8}
Barium-137m	0.081	Francium-221	1.3×10^{-12}	Curium-244	2.4×10^{-6}
Lanthanum-138	6.5×10^{-16}	Francium-223	1.7×10^{-10}	Curium-245	5.9×10^{-10}
Cerium-142	8.9×10^{-11}	Radium-223	8.1×10^{-10}	Curium-246	3.6×10^{-2}
Cerium-144	1.2×10^{-11}	Radium-224	1.5×10^{-8}	Curium-247	4.9×10^{-17}
Praseodymium-144	1.3×10^{-11}	Radium-225	1.3×10^{-12}	Curium-248	5.2×10^{-17}
Praseodymium-144m	1.6×10^{-13}	Radium-226	2.5×10^{-10}	Californium-249	3.8×10^{-17}
Neodymium-144	4.3×10^{-15}	Radium-228	2.1×10^{-15}	Californium-250	1.6×10^{-17}
Promethium-146	2.2×10^{-8}	Actinium-225	1.3×10^{-12}	Californium-251	5.9×10^{-19}
Samarium-146	8.1×10^{-13}	Actinium-227	8.1×10^{-10}	Californium-252	7.7×10^{-30}
Promethium-147	4.9×10^{-5}	Actinium-228	2.1×10^{-15}		

a. Source: Valentine (2000).

Are Calcine and Treatment Bi-products High-level Waste (HLW)?

1) The calcine waste is by definition HLW. See definition above in DOE O 435.1 section. DOE cannot take the "high level waste components" out of it. HLW is NOT the high activity portion, i.e., Cs-137 as DOE staff seems to want to believe. HLW is defined in NWPA based on what it came from. Separations are a useless exercise in search of cheap remedies**.** Judge Winmill tentative ruling (stayed) on DOE Order 435.1 reclassification of Hanford HLW is instructive.

U.S District Court Judge Winmill concluded that the separations process at Hanford matches what is described in statute. The liquid waste that DOE calls low activity waste (in 1995 - when they tried and failed to call it low level waste) is high level waste. Accordingly, it must go to deep repository. DOE still plans to try to reclassify it under Order 435.1 as LLW and bury it at Hanford/INL in the near surface. With the Trump administration in charge they might well succeed so IDEQ must get pro-active.

2) The legislative history of the atomic energy and nuclear waste policy acts makes it clear that the reason for deep disposal is the long half-life of the waste. That is the technetium, iodine and actinides. DOE thinks these are low hazard. They are exactly wrong.

3) The calcine can NOT be safely stored for 300-500 years to allow the cesium 137 and Strontium-90 to decay away and take the bulk of the heat with them because**,** as discussed earlier in the AoA discussion**,** the Calcine composition due to compaction, water infiltration**,** and future flooding**,** it may be too late for extraction. Just what DOE is hoping for – so it can be grouted in place and/or the policy makers will not be around to answer for their actions.

IDEQ should not allow the accomplishment of what clearly constitutes illegal disposal of HLW under NRC 10 CFR part 61.

Background History is a Huge Factor in Understanding this Permit

DOE/INL is a major generator of high-level (HLW) radioactive waste since its inception in 1949. DOE and its predecessor have never been willing to appropriately deal with this waste unless forced by Federal Court Order. From December 1963 to June 2000, Calciners at the INTEC were used to convert approximately 7,920,000 gal of liquid mixed hazardous (HLW) into approximately 155,600 ft3 of granular calcine solids. [102]

This huge volume of liquid high-level waste (LHLW) was the product from chemical/acid reprocessing of irradiated reactor fuel for the production of highly enriched uranium/plutonium for nuclear bombs and other military applications. Eleven underground tanks were used to store this highly toxic/radioactive waste in INTEC Tank Farm that also – like the Calciner Bins never could be RCRA compliant as hazardous waste storage units. The Calcine Bins cannot meet RCRA compliance as any hazardous materials waste storage unit much less used for some 54 years for some of the most deadly man-made toxic material; thanks to complicity of State regulators who actively sought authority from EPA to administer RCRA. [103]

As previously noted, the 7 Calcine Bin Sets total mixed HLW inventory of radionuclides (decayed to 2016) only counting >2 Ci = ~ **33,987,941 Ci.** **[104]** See the above Table C.7-3. Bin set total inventory of chemicals and radionuclides below. This is evidence enough of the calcine lethality and critical role regulations play in protecting the public.

"Radiation exposure at Calcine Bin Set #1 from an external event (i.e., earthquake) results in 0.50 rem [minimally exposed individual] (MEI), 34 rem; [noninvolved worker] (NIW), 5,900 rem; [offsite population]

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[102] HWMA/RCRA Part B Permit Re-application for the Idaho National Laboratory Volume 22 - Calcine Solids Storage Facility (CSSF) EPA ID NO. ID4890008952, Revision O - May 2016 Book 1 office Idaho Cleanup Project, Pg.1.Hereinafter Calcine Permit

[103] Federal Register Volume 77, Number 40 (2/29/12),Proposed Rules],[Pages 12228-12231] [http://www.gpo.gov/] [FR Doc No: 2012-3916]
ENVIRONMENTAL PROTECTION AGENCY, 40 CFR Part 271,[EPA-R10-RCRA-2011-0973; FRL-9633-8]Idaho: Proposed Authorization of State Hazardous Waste Management, Program; Revision, ACTION: Proposed rule, 40 CFR Part 271, [EPA-R10-RCRA-2011-0973; FRL-9633-8], Idaho: Proposed Authorization of State Hazardous Waste Management Program; Revision.

[104] Idaho HLW & FD EIS Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016), pg. C.7-3, D0E/EIS-0287 Appendix C.7, pg. C.7-4. Hereinafter D0E/EIS-0287.

(OSP), and [latent cancer fatality] 3.0 LCF." [105] In other words, it's deadly radioactive! Now DOE wants to extend its Calcine Storage Permit for another 10 years for a total of ~64 years; long past their design life. Given this history, it's a good bet that another extension will be requested in 2027. This delay is an avoidable risk imposed on Idahoans.

The Laws Intended to Force Action on the Legacy of Federal Government's Resistance to Deal with its Waste Generation

The U.S. Congress passed numerous laws starting in the 1970s in an attempt to force federal agencies to be accountable for their actions that include National Environmental Policy Act (NEPA), Federal Facilities Compliance Act (FFACO), Federal Facilities Agreement and Consent Order (FFA/CO), CERCLA, RCRA, [106] and Nuclear Waste Policy Act of 1982 (NWPA) to name only the lead legislative Acts.

As result there have been no less than 21 [107] Environmental Impact Statements or Environmental Assessments directly related to INL's nuclear waste programs that all promised to address the mixed/radioactive waste treatment and resulting contamination remediation. To date, there has been very limited accomplished except a lot of reports, talk, promises and court battles. Now comes DOE with yet another policy to kick the can further down the previable road by requesting that Idaho extend this Calcine high-level waste (HLW) permit another decade.

In addition to the above Congressional legislation specifically designed to reign-in the federal government we see one of the better local examples of push-back on DOE and its predecessors. His name is former ID Governor Cecil Andrus; who initially filed suit in 1991 against DOE and later supported by both Governor Phil Batt and Governor Dirk Kempthorne into the Ninth Circuit Court of Appeals that ultimately produced the Settlement Agreement Consent Order in 1995. It took three successive Idaho Governors to see this process through based in part on what they read in the first INL EIS in 1977. [108] It's a shocking read about the highly secretive INL and more candid than the current variety of EISs.

Our recent Idaho Governors saw how the federal governments' (Congress and DOE) promises are hollow. The issue being; when does perpetual storage become "de-facto" dumping? The result is that Idaho is de-facto nuclear waste dump and Idahoans future is compromised. Andrus had the political will to – as he said – send the biggest – meanest looking State Troopers out to block a spent nuclear fuel (SNF) shipment from Public Services Colorado reactor from crossing the border. Governor Andrus continues his efforts by filing a suit against DOE for denying FOIA documents on its SNF shipment plans at INL which is a significant testament to his long held view of DOE **actual policy is to leave nuclear waste in Idaho**. [109] This Calcine Permit extension is only the most recent example to DOE's "MO." [110]

ID Attorney General Alan Lance was forced in 2002 to go back to Court to force DOE to comply with all the terms of the 1995 Settlement Agreement. Lances' office asked the U.S. District Court to issue an order declaring that the 1995 agreement includes nuclear waste buried at INL. Lance stated:

> *"The agreement requires the federal government to remove all INL transuranic waste no later than 2018 and all SNF by 2035. Although the court-enforceable agreement clearly states that all transuranic waste must be removed, the DOE has taken the position that buried waste is not covered by the agreement. This is extremely important because DOE maintains that the agreement does not require removal of an estimated 30,000 cubic meters of buried transuranic waste. Regrettably, the department is*

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105 DOE/EIS-0287 Table C.4-7. Facility disposition accidents summary, Pg. C.4-55. "Calcine Bin Set #1 Bounding operations accident; An external event results in 0.50 rem (MEI), 34 rem (NIW), 5,900 rem (OSP), and 3.0 LCF. MEI = maximally exposed individual; NIW = noninvolved worker; OSP = offsite population." The exposure rate is the same for all 7 Bin Sets.

106 Comprehensive Environmental Response, Compensation, and Liability Act, 1999.

107 See attached list of EIS/EA related to DOE's INL.

108 ERDA-1536; Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research & Development Administration, September 1977 and ERDA-1552; Final Environmental Impact Statement, Safety Research Experiment Facilities, INEL, September, 1977, US Energy Research & Development Administration.

109 Case 1:15-cv-00453-BLW Document 24 Filed 08/08/16

110 Another example is EDI's Notice of Intent to Sue Over DOE's Failure to Comply with the Resource Recovery and Conservation Act, 42 U.S.C. § 6901 et seq. and the Clean Air Act in operation of the New Waste Calcining Facility at the Idaho National Engineering Laboratory, April 11, 2000. EDI's legal action prompted the IDEQ to force DOE to close the NWCF.

unwilling to accept that the agreement means what it says. Since the day Governor Batt and I signed the agreement the State of Idaho has been clear and consistent in stating that the agreement will be vigorously enforced." [111]

What the previous ID Governors realized was – once nuclear waste is allowed in it's nearly impossible to get it out regardless what the federal government pledges to do in court. They lie because there's no accountability. The long history of litigation attests to the fact that the federal government is playing a long game of "catch me if you can," because no judge will put us in jail.

Since the US Nuclear Navy's Naval Reactors Facility is a major contributor to INL's nuclear HLW waste problem, they are also battling Idaho's Settlement Agreement in Court because it restricts shipment of the Navy's reactor spent nuclear fuel (SNF). The Navy even fought and lost Idaho's demand for an EIS on the impact on Idaho's environment, health and safety. [112] Again, the Navy tried to violate a court enforceable agreement that they and DOE originally signed. The bottom line is the federal agencies don't care about the law or Idahoans; they just need a place to cheaply dump their nuclear waste.

Current Idaho Attorney General Laurence Wasden is doing his part by rejecting DOE's requests to send more SNF to INL in violation of the Settlement Agreement. Credible – even heroic – as these actions are, they still have only stalled the process of protecting Idahoans. Decade after decade, the federal government lies, obfuscates accountability.

Listening to the 2/6/17 audio recordings of Idaho House Energy Committee grilling Deputy Attorney General Kathleen Trever on why AG Wasden is denying DOE request for more SNF waste shipments, is tragic to hear the collective ignorance demonstrated by legislators on this crucial issue. DOE is the largest single employer in Idaho with huge economic influence. This discussion is crucial within the context of this Calcine Storage Permit extension because it demonstrates repetition of all the above history of nuclear waste generation and lack of resolution.

In EDI's view**,** IDEQ must reject the Calcine Storage Permit and replace it with an annual storage permit based on progress in development of; 1.) retrieval technology; 2.) "Direct Vitrification" piolet plant scale so as not to repeat Hanford full scale rush on unproven designs. Also IDEQ must force DOE (via the Consent Order) to start calcine extraction **-** starting with the oldest Bins that AoA claims may be problematic and to prevent DOE from permanently grouting in place in violation of FFCA, CERCLA, RCRA and NWPA. The retrieval process must be done regardless of the treatment chosen. Why wait? Since Bin Set 7 (the newest of the 7) is empty it can be used to develop retrieval systems by transferring calcine from the Bin Set 1 (the oldest and most vulnerable) to Bin Set 7.

The State of Idaho has allowed DOE to stall implementing "the Direct Vitrification Alternative" for over 50 years (based on 1977 EIS) despite near continuous legal challenges by allowing DOE to attempt to deploy various "separations/steam-reforming treatment" at the Integrated Waste Treatment Unit (IWTU). This failed to process the current 900,000 gallons of TRU/Sodium-Bearing liquid waste [113] in the INTEC HLW Tank Farm. These tanks are over 64 years old, single-walled, with leaking concrete vaults. **"**The high infiltration rate predicted by the simulations is consistent with the need to pump the tank vault sumps. Approximately 0.5 cm/year recharge across the entire tank farm area (total area including tanks and surrounding area) is removed from the sumps even though the vaults have concrete roofs." [emphasis added] [114]

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[111] State of Idaho Office of Attorney General Alan G. Lance, press release, 4/18/02.

[112] Civil No. 91-0035-S-HLR (Lead case) Civil No. 91-0054-S-HLR, Order Modifying Order of June 28, 1993.

[113] SBW is a liquid mixed radioactive waste (contains hazardous and radioactive constituents) produced primarily from INTEC decontamination and cleanup activities. SBW also includes approximately one percent (by volume) commingled 1st cycle reprocessing waste, approximately two percent 2nd cycle reprocessing waste, and approximately four percent 3rd cycle reprocessing waste. SBW contains large quantities of sodium and potassium nitrates; however, the radionuclide concentrations for liquid SBW are generally ten to 1,000 times less than for liquid HLW. [Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management]. Notice of Preferred Sodium Bearing Waste Treatment Technology, Federal Register /Vol. 70, No. 148 /Wednesday, August 3, 2005 /Notices, DEPARTMENT OF ENERGY Office of Environmental Management

[114] DOE/NE-ID-11227, Appendix B.

DOE steadfastly claims the tanks do not leak; however no credible data is provided distinguishing surface infiltration into the tank vaults from leaks. Regardless, the presence of water in the tank vaults should disqualify leaving the tank sludge/heals in place as a RCRA hazardous waste landfill as planned. It's long past time to implement Idaho's direct vitrification preferred option.

IDEQ is obligated to provide the public "in one concise document" on what the Calcine Storage Permit covers and avoid the public/environmental hazard that the delay in Calcine treatment presents for road-ready transport out of Idaho. Also, the permit must be **rejected** until DOE/INL first addresses the immediate potential flood hazard and incorporate sufficient measures to protect the INTEC and other INL facilities as required by Idaho Code §39-4409(5). Specifically, corrective action is required prior to permit approval - as stated in DEQ's Fact Sheet.

> "Corrective Action Determination: Idaho Code §39-4409(5) requires, in accordance with IDAPA 58.01.05.008 [40 CFR § 264.l0l (a)], the owner/operator of a hazardous waste facility to institute corrective action as necessary to protect human health and the environment for all releases of hazardous wastes and hazardous constituents from any solid waste management unit at the facility, regardless of the time at which the waste was placed in the unit."

The imminent threat of Mackey Dam failure on INL, INTEC, Calcine Bins and any persons' living downstream is real. It seems that the only alternative to obtaining the Mackey Dam Emergency Plan is litigation. IDEQ has a duty to prevent what would be a major catastrophe for the public and INL personnel who are being deliberately kept in the dark about this imminent hazard presumably for purely political reasons. Even if the state required daily inspections during the flood season, knowing what the emergency plans are - there would be some warning system necessary for evacuation of downstream residents and INL nuclear facility operators.

EDI agrees with former ID Governor Andrus when he stated:

> "As you know, I have happily spent many years of my life serving Idaho and her citizens. As your 4-term governor elect, one of my proudest achievements was opposing efforts by the federal Department of Energy to use Idaho as a dumpsite for nuclear waste – laying the groundwork for my successor and friend, Governor Phil Batt, to negotiate the historic 1995 Batt Agreement." [115]

Section IV. C.1 INTEC Remediation Waste Area Group 2

The INTEC (INTEC is interchangeable to ICPP) mission since 1952 has been reprocessing spent reactor (SNF) fuel to extract fissile material (primarily uranium) for military programs. Spills, leaks, and releases over the years resulted in significant contamination of the surface soils and underlying groundwater. INTEC releases 979,486,072 gal/year in system leaks to flush contaminates to aquifer. [DOE/ID-10660,pg. 5-4] Additionally, CPP- 02 released 3,698,408 gal./yr. [DOE/ID-1066002, pg. 5-16] A Remedial Investigation/ Feasibility Study Final Work Plan [INL-95/0056, referenced below as A] for the ICPP was completed in August 1995. The three-party INTEC cleanup Record of Decision was released in 1999 [DOE/ID-10660, Section 5, referenced below as B] was issued. The following table shows surface soil sample excerpts from these studies.

[115] October 13, 2015 Letter from Cecil D. Andrus, former Governor of Idaho.

INTEC CPP Cleanup Site	Contaminate	Concentration pCi/g
CPP-15 Solvent Burner [B] Tank Farm Soil Steam Flush [A]	Am-241 Cs-137 Eu-154 Sr-90 Pu-238 Pu-239-240 Pu-241 U-235	16,600 102,000,000 565,000 56,800,000 276,000 12,600 106,000 9,000
CPP-89 Soil Storage Area [A]	Cs-137 Sr-90	7,730 10,800
CPP-26	Cs-137 Sr-90	11,000 4,900
CPP-34 Soil Storage Area [A]	Cs-137 Sr-90	2,000 6,000
CPP-34 Soil Storage Area [A]	Cs-137 Sr-90	2,000 6,000
CPP-79 Tank Farm Valve Box A-2 12 meters/40 feet below surface Total Tank Farm contaminated soils [A Pg. 5-4]	Sr-90 Cs-137 Am-241 Pu-238 Pu-239	5,410,000 33,700,000 16,600 276,000 89,900
CPP-04/05 Soil around CPP-603 Settling Tank [A]	Cs-134 Cs-137 Ce-144 Co-60 Eu-152 Eu-154 Eu-155	1,450 26,500 2,390 2,390 35,000 35,000 7,600
CPP-19 CPP-603 to CPP-604 Line Leak [A]	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90	408,000 21,600 87,600 53,500 9,620 125,000

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804] INL-95/0056 pg. 2-115

The ICPP Remedial Investigation/Feasibility Study lists 100 chemical/radiological release sites. Of the 100 release sites, 13 are related to the tank farm. The estimate of radioactivity in decayed values in the surface soils within the ICPP compound is 50,000 curies plus 22,200 curies released to the aquifer. [EMSSAB @ 5] Contaminates migrating from the ICPP are found in the following perched water sample data.

Total Tank Farm contaminated soil originally was (111,835 cm) or (146,275 cu. ft.) but later investigations designated as "additional soils" is (84,606 cu m) or (110,660 cu yds) down to 40 ft.. [INTEC-RI/FS, 1998, pg.5-4]

ICPP Well Sample Data

ICPP Well	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Strontium-90 (pCi/l)
CPP-55-06	7,290	191,000	65,600
MW-2	4,700	925,000	516,000
MW-5	520	211,000	110,000

[INL-95/0056@2-162] EPA Maximum Concentration Limit (MCL) for gross alpha is 15 pCi/l; for gross beta 8 pCi/l; for Strontium-90 MCL is 8 pCi/l. [INL-95/0056 @ 5-25]

For more than forty years this INTEC facility processed spent reactor fuel to reclaim enriched uranium for nuclear military programs. The legacy of these operations remains in the form of massive soil and groundwater contamination as well as stored high-level radioactive waste. Soil samples show radioactive contamination 10 million times higher than regulatory standards.

The most hazardous waste is the two million gallons of high-level liquid left in 11 underground tanks. This waste is the ultimate witch's brew of acids, solvents, and radioactive materials. Radiation emanating from these tanks is so intense that a lethal dose could be received just by standing beside a tank. Most of this liquid waste, as well as the tanks holding it, date back to the early 1950s. The design life of the tanks was 20-30 years. Dozens of tank service line leaks have contaminated the soil and groundwater. The Congressional General Accounting Office identified INL's tanks along with Hanford's tanks as having a significant explosive hazard due to gases that are generated in the tanks.

ICPP also stores the majority of the reactor spent fuel at INL. All but one of these storage facilities are recognized as having significant vulnerabilities. For instance, the CPP-603 water pool that keeps fuel elements under 20 feet of water to provide a radiation shield, is leaking more than a hundred gallons of contaminated water into the ground every day. Corrosion caused fuel support systems to fail, allowing the whole assemblies to fall to the bottom of the pool. This could cause a criticality or uncontrolled nuclear reaction to occur.

Trying to develop a cleanup plan for the ICPP while ongoing operations continue to contaminate the site is ludicrous. For example, millions of gallons of radioactive waste water every day are still being dumped in old unlined percolation ponds for "disposal". This waste water drives radioactive and chemical contaminates down to the Snake River Aquifer. Publicly, DOE claims it has no plans to restart ICPP fuel processing. Yet a 1/17/96 ID Division of Environmental Quality ICPP permit notice says that the ICPP "assigned objectives included .... recovery of highly enriched uranium from fuel elements discharged from Naval Nuclear Propulsion Reactors, Research and Test Reactors (foreign and domestic) as well as from other unique fuels that cannot be processed elsewhere." [DEQ@2]

One of the most discouraging policies currently being used by DOE to minimize cleanup expenditures is to assume that the federal government will maintain "institutional control" over the site and thereby restrict public access. Now DOE can claim that there is a minimal hazard because unauthorized persons cannot get near the pollution. Hundreds or thousands of years must pass before the radioactivity will burn off, yet DOE is confident that fences and guards can be maintained.

The Nuclear Regulatory Commission, which controls commercial nuclear facilities, assumes that "institutional control" cannot be assumed, and therefore requires deep geologic disposal to insure no one would be injured. Unfortunately, even these commercial standards are now under attack by vested interests wanting to cut disposal costs.

Congressional cuts to DOE cleanup requirements contrast to increased spending on military nuclear weapons and non-nuclear programs. According to the Center for Defense Information, Congress appropriated $27 billion for nuclear war in 1995 alone. Between 1940 and 1995 the U.S. spent an estimated $3.5 trillion to prepare for nuclear war.

High-level Tank Farm Remediation

Since the beginning of the nuclear age, the unsolved problem of what to do with the radioactive waste has haunted the alchemists. The veil of secrecy let the problems go unnoticed thereby allowing the federal government to delay facing the inevitable waste problem. Only recently has the truth started to emerge and the awesome extent of the contamination problem revealed. The Department of Energy (DOE) is now obliged to comply with a number of Federal Court Orders and signed agreements with the State of Idaho and the Environmental Protection Agency. One of the many compliance areas is the treatment and disposition of its high-level liquid and solid radioactive waste at the Idaho Chemical Processing Plant (ICPP). This is the plant where the irradiated reactor fuel was dissolved and uranium, barium and other isotopes were extracted for the military. (See Section I(E)(3)).

Faced with legal deadlines, DOE is now generating plans on how to meet these court-ordered requirements. In October of 1996 DOE released a document called “Regulatory Analysis and Proposed Path Forward for the INEL High-level Waste Program.” [DOE-ID-10544] This plan lays out in detail what the Department’s intentions are for high-level waste disposition. From an environmental advocate’s perspective, this plan is a shocking rerun of the terminated Hanford tank waste grouting program. This canceled program involved mixing Hanford’s high-level liquid wastes in their tank farm with cement (grout) and dumping it back into the ground.

There are three main categories of radioactive waste, high-level, transuranic, and low-level. Under each of these main waste categories there are numerous subgroups. Different federal regulations apply to the disposal of different waste categories. Because of this regulatory framework, considerable emphasis is given to properly assigning the right category or class to a given waste. Unfortunately, the regulations are not as explicit in defining waste categories as one would hope.

The Nuclear Regulatory Commission defines high-level waste by the process that created it, as opposed to specific characteristics. High-level is, (1) irradiated reactor fuel, (2) the waste generated by the processing of irradiated reactor fuel, (3) the solids into which the liquid wastes were converted.

Another wild card in this process is the regulation on the characteristics of treated wastes. Each high-level repository must have what is called a waste acceptance criterion. This means all waste shipped to that repository must meet certain standards to ensure the contamination will not migrate and compromise the dump. Since DOE does not have a high-level dump yet there are no waste acceptance criteria. The Yucca Mt. Nevada site is still under evaluation. Currently, the collective wisdom is that waste vitrified into a glass form will meet any repository criteria.

Despite the uncertainty of not having high-level waste acceptance criteria, DOE must move forward in selecting treatment technologies and start building the treatment plants. Court ordered compliance agreements with enforceable deadlines are the current drivers. Had DOE followed through with its 1977 INEL Environmental Impact Statement commitments to vitrify the high-level wastes into a glass form, the Department would not be in its current bind. DOE’s Record of Decision on its 1995 INEL Environmental Impact Statement (EIS) states that: “The technology selected [for high-level waste] is radionuclide partitioning for radioactive liquid and calcine waste treatment, grout for immobilizing the resulting low activity waste stream, and glass (vitrification) for immobilizing the resulting high-activity waste stream.” [ROD(1995)] The EIS further acknowledges that:

“The removal of the final approximately 5,000 to 20,000 gallons of high-level liquid waste (that is, the heel) from the five tanks proposed for replacement (VES-WM-182 through WM-186) would be an existing normal Tank Farm Project.”...“Since no materials were found that were completely compatible with the tank heels, and the mechanisms required to ensure mixing would be more complicated than simple removal. Also, one cannot ensure that the grout would prevent migration of hazardous elements (that is heavy metals) into the environment.” [DOE/EIS-0203-F Vol.2 Part B C-4.3.1-3]

A similar high-level waste treatment program at the Hanford Nuclear Reservation in Washington State generated so much public opposition that DOE was forced to cancel the project. [HEAL(a)] The question of waste classification played a crucial role in ending the Hanford grouting program. DOE tried in 1990 to delist much of its high-level liquid waste saying it was not really high-level and therefore could be mixed with cement (grout) and dumped back into the ground in concrete cribs. The Oregon and Washington State regulator’s position is that the tank farm waste is high-level and therefore, regardless of what DOE’s separations treatment is, it must be managed and disposed as high-level wastes. [Dunning]

DOE is trying to pull the same high-level - low-level nonsense at INL apparently thinking Idahoans are not aware of the Hanford escapade. The radionuclide partitioning technology is a process of separating out the transuranic elements (heavier than uranium) from the rest of the waste and calling it "high-activity." This "high-activity" waste would then be vitrified (made into glass) and eventually shipped to a geologic repository. The "low-activity" waste (everything else) would be mixed with cement and dumped back into the high-level tanks at the ICPP or into the ground at the INL Radioactive Waste Management Complex. The driver to this treatment approach is money. DOE says the separations approach is cheaper because the volume shipped to a geologic repository is small and the volume dumped back into the ground is large. The National Academy of Sciences' analysis of the comparative costs between vitrification and extensive separations suggests that direct vitrification is the least expensive. [NAS(1996)] The Department also thinks that it can ship the small volume of high activity waste to another site to be vitrified, thereby avoiding building a plant at INL. Since DOE is building a vitrification plant at Hanford, the Department likely will ship INL's high-activity waste there for treatment and avoid spending the $3 billion on vitrification plant in Idaho. If DOE follows through with this plan to ship to Hanford, Dirk Dunning of the Oregon Department of Energy says his state's jurisdiction over Hanford and transportation will kick in.

Another driver is waste repository capacity. Even if DOE can open Yucca Mt., its design capacity is not sufficient to hold the accumulated volume of commercial power reactor waste plus the military high-level waste (HLW). INL's radioactive waste is considered military because it was generated in support of the nuclear weapons programs. DOE now acknowledges that ". no [INL] HLW will be sent to the first repository by 2035. The second repository will take 30 years to license and open." [DOE-ID-10544@2]

Because of this waste constipation, DOE is looking for every excuse to reduce the volume of high-level waste requiring repository space. To complicate the problem further, DOE is not looking for another repository site that will be needed even if Yucca Mt. opens.

The show stopper of the Hanford grouting program occurred when the States of Washington and Oregon and the Yakima Indian Nation filed a petition with the Nuclear Regulatory Commission (NRC) for a rule making on the classification of the Hanford tank wastes. [Petition] DOE backed down when the grouting (mixing with Portland cement) of the tank wastes did not meet the disposal requirements for high-level waste in the NRC regulations. The NRC did subsequently release a vaguely worded discussion paper in an attempt to answer the Petitioner's request. [Fed.Reg.]

Hanford now is planning to vitrify both the high and low activity parts of its high-level wastes. The low-activity parts are to be stored on-site in a retrievable form. Thomas Tebbs with the Washington Department of Ecology believes this is a step in the right direction but is a waste of resources to separate the high and low wastes; it would be best to vitrify the whole volume together in one operation.

DOE's cleanup shortcuts at INL make it clear that the culture within the Department has not changed. Shortcuts taken over the last four decades are the reason we now see cleanup cost pushing $29 billion [BEMR(c)] to partially remediate the site under Superfund. Every year, every decade that passes, the costs only escalate. The worst part of delaying environmental restoration is that the pollution migrates away from the source every day. The further contaminates migrate the more unlikely any corrective action can be taken.

DOE's INL high-level waste (HLW) planning document perpetuates this shell game by stating: "The sodium-bearing and other mixed liquid wastes stored in the ICPP Tank Farm should not be classified and managed as HLW." [IDO-14362, IDO-14295, IDO-1414307, IDO-14300, IDO-14567] This sodium-bearing waste constitutes about three-quarters of the total high-level volume (~ 1.9 million gallons) in the ICPP tank farm. The Environmental Defense Institute's review of the quarterly report of the ICPP's former operator, Phillips Petroleum Co., shows clearly the chemicals used to dissolve the reactor fuel rods were sodium nitrate and sodium hydroxide. Wastes generated in the fuel dissolution process went to the tank farm. There is no question that this waste meets the Nuclear Regulatory Commission definition of high-level waste.

INL is unique from Hanford and other DOE sites because it used a calcining treatment process that converts most of the high-level liquid waste into a granular form stored in seven large underground silos at the ICPP. The Calciner is a incinerator that burns off the liquid portion and mixes the residual ash with granular calcine material so it can be pneumatically easily handled. Unfortunately, the sodium-bearing waste is not readily calcined unless it is diluted with aluminum nitrate. DOE put off calcining the sodium-bearing waste until it was faced with court-ordered deadlines.

The sodium-bearing waste volume in the ICPP tank farm is about 1,648,400 gallons.[DOE-ID-10544@6]

DOE's recent attempt to reclassify or delist this high-level waste is illegal because it meets the Nuclear Regulatory Commission definition that includes the waste generated by reprocessing spent reactor fuel and the concentrated wastes from subsequent extraction cycles, or equivalent.

Between 1954 and 1963 the Idaho Chemical Processing Plant (ICPP) dissolved two-day cooled Materials Test Reactor (MTR) fuel. This fuel reprocessing program was known collectively as the RaLa runs, INL's equivalent to Hanford's Green Runs. Over this period, more than 113 separate process campaigns were run for the separation of barium-140 delivered to the Oak Ridge National Laboratory and Los Alamos for military programs. The RaLa campaigns used unique chemical separation processes from other ICPP nitric, sulfuric, or hydrofluoric acid uranium extraction campaigns. "This [RaLa] process involved the dissolution of MTR assemblies in a sodium hydroxide-sodium nitrate solution leaving a precipitate of sodium diuranate and fission products." [IDO-14445@14] Early Atomic Energy Commission documents leave no doubt that the sodium-bearing high-level waste in the ICPP tank farm is the result of spent nuclear fuel reprocessing and therefore appropriately designated as high-level. Admittedly, a certain amount of the sodium-bearing waste is from decontamination flushes. However, it is still a product of irradiated reactor fuel reprocessing containing all the characteristics of HLW. DOE's own characterization of the sodium-bearing waste acknowledges that it exceeds the low-level Class C definition because of its high alpha emitter constituents. [DOE-ID-10544@8] Uranium and plutonium are alpha emitters.

Even more troubling is DOE's attempt to use "cementitous [grouting] solidification for treatment" of this high-level waste. The discredited Hanford experience [Hanford] where hundreds of millions of dollars were wasted on a high-level waste grouting program appears to be conveniently forgotten at DOE Idaho Operations Office. Internal DOE Hanford contractor reports revealed that the physical integrity of the grout would not last long. When radionuclides decay, they give off heat and radiation.

"Under the expected disposal conditions...the grout will remain at elevated temperatures for many years. The high temperatures expected during the first few decades after disposal will increase the driving force for water vapor transport away from the grout; the loss of water may result in cracking ... as the grout cools... (it) may draw moisture back into the grout mass. The uptake of moisture may have detrimental impacts on the behavior of the grout." [HEAL(b)]

Additionally, DOE's attempt to reclassify the sodium-bearing waste may be a violation of the State Agreement with DOE that orders the Department to calcine all the waste in the ICPP tank farm. The order states that: "DOE shall commence calcination of sodium-bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012." [Batt(a)] Even if DOE fulfills its commitment to calcine the sodium-bearing wastes the issue remains about the classification of the partitioned "low-activity" part that DOE wants to mix with concrete and dump back into the old waste tanks. All the calcine (~3,800 cubic meters) is slated for the same chemical separations process to divide the "high-activity" from the "low-activity" parts.

Another very troubling part of DOE's plan is to leave the high-level tank farm sediments (heels) in the tanks. "The ICPP Tank Farm heels will not be removed and the Tank Farm will be closed under RCRA [Resource Conservation Recovery Act]." [DOE-ID-10544@3] DOE thinks that: "The closed Tank Farm would probably meet the subtitle D landfill standards for industrial waste." [DOE-ID-10544@13] Subtitle D is a municipal garbage dump classification. It is obvious to the most pedestrian observer that garbage and radioactive waste are different. This literally translates into INL becoming a permanent high-level waste dump site.

The tank heels can be removed by conventional dredging techniques or use the Hanford Tank Sluicer Mechanism. DOE believes: "However, it is not practical to remove all of the heels from the INL tanks, decontaminate the equipment, and remove all surrounding soils due to technological, economic, and health and safety factors involved." [DOE-ID-10544@20]

The Environmental Defense Institute (EDI) believes that the best approach is directly to vitrify the whole volume of the sodium-bearing liquid and the calcine high-level wastes without any partitioning or separation of "high-activity and low-activity" wastes. Sediments and all tank heels must be included in the waste to be vitrified. The State of Idaho must fully review the failed Hanford grout program before committing to a similar project at INL.

A reasonable person may ask, "doesn't EPA Region 10 cover both Hanford and INL?" Why are these regulators, who are involved in all the decisions with both sites, not communicating with the Idaho State regulators? Are there no "lessons learned" at the EPA? Part of this problem revolves around the different regulatory authorities that are applied. The INL Tank Farm falls under the jurisdiction of the Resource Conservation Recovery Act (RCRA) the regulation of which Idaho has primacy. EPA granted Idaho this authority, however, EPA maintains review authority if the State does not appropriately enforce the regulation. So for the time being, EPA is sitting on the sidelines with respect to the INL Tank Farm wastes.

Another reason the Environmental Defense Institute disagrees with DOE's separating the high activity and low activity parts is the chemistry. Part of the problem is the complexity of the chemistry involved in separating or partitioning radionuclides from each other in this high-level witch's brew. INL scientists recently completed the first stage of a multi-year project called Efficient Separations and Processing Program that preprocesses high-level waste and is funded at a half million per year through DOE's Office of Science and Technology. This project reportedly "separates highly radioactive elements from waste, reducing the volume of high-activity waste that must be disposed of at a repository." [STAR] This separations/ partitioning process is also called Transuranic Extraction (TRUEX). Despite the proliferation implications of this program, the grouted residual from this solvent extraction process is destined for low-level burial; or the preferred option is dumping it on top of the waste tank heels. A Science Program Symposium in Richland, Washington on June 26, 1996 sponsored by DOE showed that the Department is still struggling with the basic science of chemical separation and the applied technology is still in the hypothetical stage. This means that millions of additional R&D dollars will be required to test the technology.

The INL Pit 9 waste treatment plant could not get the chemical separations/ partitioning to work. DOE was forced recently to announce a two-year delay while the chemists and engineers go back to the drawing board. This Pit-9 reburial of the residuals of chemical separations approach does not enjoy public acceptance for many reasons. First, the classification of low-level waste has no connection with environmental, health and safety hazards. [IEER(c)@89] It is merely a catchall category for all waste not classified as high-level or transuranic. Secondly, the public demands that the entire volume of the waste be processed directly into a stable vitrified form so that the inevitable interim on-site storage does not continue the migration of contaminates into the environment. Remember, DOE thinks maybe a second repository will be available in forty years. The Final Report from the Hanford Tank Waste Task Force got it right by recommending:

"The high cost and uncertainty of high-tech pretreatment and R&D threatens funding for higher performance low-level waste form, vitrification, and cleanup."..."Put wastes in an environmentally safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup."..."Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository."..."Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." [Hanford@11]

Another reason why waste must not remain at the ICPP is the risk of flooding. A 1996 DOE Environmental Assessment (EA) for TAN Pool Stabilization noted that the maximum probable flood is considered conservative as the last flood (12,000 years ago) with the magnitude of 35,000 cubic feet per second.[DOE/EA-1050 @B-4] This flood would easily overflow the diversion dam capacity of 9,300 cubic feet per second. The EA predicted that the ICPP would be two feet under water during such a flood. However since the ICPP is 130 feet lower in elevation than the Big Lost River Channel, it is likely to be under more than two feet of water. [IDO-22056@8]

In summary, the repeated mantra "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. [HEAL(c)] DOE is wasting precious resources by refusing to recognize the public's demand for real solutions to the radioactive waste problem. DOE must "get on with cleanup" and apply research and development (R&D) to technologies that will put all radioactive waste into a stable vitrified form for on-site storage for the near-term because there are no guarantees on any repositories coming on line soon. Additionally, the DOE is remiss in not investing in the essential R&D on emissions control that will be key to health and safety issues in all waste processing.

Vitrification processing cannot be avoided in stabilizing and preparing the waste to meet future repository acceptance criteria. To ensure that the nuclear legacy mortgage is paid, the Department must make its case to

Congress for specific funding for INL Waste Immobilization Vitrification Plant. Idaho State and Environmental Protection Agency regulators must aggressively challenge DOE's attempt to reclassify formerly high-level waste as low-level and learn from the Hanford debacle.

Section IV.C.1.a **INL's Calcine Waste** by Tami Thatcher

The 1995 Idaho Settlement Agreement [116] requires packaging of the calcine in order to ship it and requires shipping the calcine to an as of yet unidentified repository by 2035. IDEQ needs to plan for the contingency that the DOE is tardy, and must address seismic weakness of the calcine storage, rather than allow the lack of a repository for the calcine high level waste to become an excuse to delay repackaging of the calcine to a road-ready condition. [117]

The LINE Commission 2013 report [118] makes the strong push for Idaho to put repackaging of the calcine behind reactor research funding for the INL. The LINE Commission report fails to represent the interests of Idahoans and does not disclose how continued calcine storage leaves Idaho vulnerable to accidents including severe Natural Phenomena Hazards events that can cause release of the calcine. The serious hazard posed by calcine waste storage is not discussed in any meaningful way but is instead waived away in LINE presentations and is not presented in IDEQ distributed literature concerning the calcine. The presumed low risk is not backed up by any meaningful disclosure of an adequate risk analysis. Idahoans must examine the facts.

While it is significant that the 4,400 cubic meters of calcine granular solids is not currently leaching into the aquifer, numerous buried waste sites at INL have leaked and are leaking and the INL's INTEC liquid high-level waste (HLLW) tank farm and other INTEC locations have leaked radionuclide and chemical contamination into soil and the Snake River Plain aquifer. It is important to recognize the extraordinary high quantity of calcine high-level waste generated from reprocessing SNF producing 7,733,000 gal. (29,280,000 L) of HLLW. [119] That is essentially an enormous amount of spent nuclear fuel minus the uranium-235 and volatiles. The hazard posed by the 30 million curies [120] of highly soluble and readily dispersible form of the calcine material must be respected. The **basic inability to mitigate a release from a calcine bin set must be recognized and emphasized** along with recognition of the inevitable far-reaching devastating **long-term environmental consequences that cannot be remediated** should a serious breach of one or calcine bin sets occur.

While the calcine bin sets are not in the dire shape of leaking tanks at Hanford, LINE Commission speakers should not placate Idahoans with comparisons of Idaho's waste problems to the already horrible and continuing to deteriorate state of environmental devastation at Hanford's DOE waste site that will never be remediated. Calcine blowing in the wind, with its powdered laundry detergent granularity, would be difficult or impossible to remediate.

IDEQ must require the DOE to put the calcine into a less vulnerable condition and must do so with more urgency, not less, because of the lack of a designated repository for the high-level calcine waste.

The DOE emphasizes that the bulk of the calcine radioactivity will decay away in a few hundred years; there

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[116] See more about Idaho's Settlement Agreement at https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement.aspx

[117] EDI filed a Notice of Intent to Sue DOE Sue 4/11/2000 Over DOE's Failure to Comply with the Resource Recovery and Conservation Act, 42 U.S.C. § 6901 et seq. and the Clean Air Act in operation of the New Waste Calcining Facility at the Idaho National Engineering Laboratory. DOE subsequently closed the NWCF.

[118] See the Leadership in Nuclear Energy Commission reports and the 2013 report at LINE Exec Summary: http://gov.idaho.gov/mediacenter/press/pr2015/pdf/LINE%20Exec%20Summary.pdf The LINE commission report narrative downplays the hazards posed and the lack of a designated repository for permanent disposal of calcine, arguing instead for the State of Idaho to ignore the calcine, delay repackaging and forget about the 1995 Idaho Settlement Agreement. Specifically, the 2013 LINE report states: "Thus, the state should be open to alternative approaches for the calcine; this could include the possibility of keeping the calcine in its current, safe storage configuration so long as any change in plans brought commensurate value to the state of Idaho, such as redirecting the funds saved to other INL [research] projects."

[119] U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD CALCINED HIGH-LEVEL RADIOACTIVE WASTE. See attached report.

[120] Ibid. Based on the value given in Carter *et al.* (2013, Table F-1), decay corrected to January 1, 2017. As with all government reports there is a significant discrepancy between this 30 million curie and DOE's report of 33.1 million curies likely due to how decay factors are applied.

are 33.1 million curies (assuming decay to 2016). The strontium-90 and cesium-137 do make up the bulk of the radioactivity, driving shielding needs and do pose a huge environmental hazard if released now. But often ignored in presentations to the public is the toxicity over millennia from other radioisotopes in the calcine, should they be allowed to migrate to the aquifer. If calcine were allowed to leach into soil from the vaults containing the bin sets, the calcine will leach into the aquifer. There would, realistically, be no cleaning up the contamination. Once in the aquifer, the contamination flows downstream to communities, even if the contamination lies deeper in the aquifer than is typically monitored or acknowledged.[121]

It is instructive to compare the quantities and radioisotopes of stored calcine to the waste buried at the Radioactive Waste Management Complex that will not be exhumed. [122] [123] Leaving aside the Sr-90 and Cs-137, the analysis of the buried waste migration at RWMC to the aquifer show that the dominant long-lived and mobile radioisotopes contributing the most to radiation dose come primarily from drinking water come from carbon-14, chlorine-36, iodine-129, technetium-99, neptunium-237, uranium, plutonium and americium-241.

The full inventory of calcine chemical and radionuclides are provided at the end of this letter in two tables from DOE/EIS-0287. [124] A comparison of radionuclide inventories for RWMC, the replacement for RWMC (the Remote-Handled Low-Level Waste Facility), [125] and calcine stored at INL are provided in Table 1 to highlight important radionuclides.

Table 1. Calcine bin set total radionuclide inventory comparison to the waste that will remain buried at RWMC and to the replacement for RWMC.

[121] Geophysical Logs and Water-Quality Data Collected for Boreholes Kimama-1A and -1B, and a Kimama Water Supply Well near Kimama, Southern Idaho By Brian V. Twining and Roy C. Bartholomay, 2011 Prepared in cooperation with the U.S. Department of Energy (DOE//ID 22215) Data Series 622. http://pubs.usgs.gov/ds/622/pdf/ds622.pdf Herein are presented deep aquifer contamination consistent with historical Idaho National Laboratory waste water releases, yet there is no stated recognition of that fact.

[122] U.S. Department of Energy, 2007. Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11243. Idaho National Laboratory, Idaho Falls, ID and U.S. Department of Energy, 2008. Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11244. Idaho National Laboratory, Idaho Falls, ID. (https://www.inl.gov/about-inl/general-information/research-library/ Search the DOE-ID Public Reading Room for the reports.

[123] See that the publically available administrative record for RWMC cleanup does not contain the assessment of radionuclide migration and radioactive doses after 10,000 years. The pre-10,000 year contaminant migration is artificially suppressed for the first 10,000 years and then rapidly escalates and stays elevated for hundreds of thousands of years. See the Administrative Record at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents for documents associated with this cleanup action, including "Record of Decision" documents and EPA mandated Five-year Reviews at http://ar.inel.gov or http://ar.icp.doe.gov

[124] Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement, DOE/EIS-0287, September 2002. http://energy.gov/nepa/downloads/eis-0287-final-environmental-impact-statement

[125] US Department of Energy, "Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site," Final, DOE/EA-1793, December 2011. http://energy.gov/sites/prod/files/EA-1793-FEA-2011.pdf

Radionuclide (half life)	**Calcine Inventory (curies)**	**Buried (existing) RWMC Inventory (curies)**	**Buried (future) Replacement RH-LLW Inventory (curies)**
Carbon-14 (5730 year)	0.038	731	432
Chlorine-36 (301,000 year)	0	1.66	260
Iodine-129 (17,000,000 year)	**1.6**	0.188	0.133
Technetium-99 (213,000 year)	**4600**	42.3	16.7
Neptunium-237 (2,144,000 year)	**470**	0.141	0.003
Uranium-232 (68.9 year)	1.6	10.6	0.00036
Uranium-233 (159,000 year) Product bred from U-235 and thorium, also decay of Np-237	0.057	2.12	0.0001
Uranium-234 (245,500 year) Pu-238 decay product	**130**	63.9	0.0012
Uranium-235 (703,800,000 year)	**3.2**	4.92	0.005
Uranium-236 (23,400,000 year) Pu-240 decay product	**11**	1.45	0.0001
Uranium-237 (0.0185 year to Np-237)	**1.5**	-	-
Uranium-238 (4,470,000,000 year)	3.1	148	16.2
Thorium-228 (1.92 year to radium-224) Natural thorium decay and Pu-240 decay product	1.6	10.5	-
Americium-241 (423 y decays to Np-237)	12,000	215,000	0.38
Plutonium-238 (87.7 year)	**110,000**	2080	-
Plutonum-239 (24,000 year)	**48,000**	64,100	-

Notes for above Table 1
* Calcine inventory from DOE/EIS-0287; RWMC buried waste inventory from DOE/NE-ID-11243/11244 (figures cited may not be the latest estimates); replacement remote-handled facility INL-EXT-11-23102.
Bold highlighting of calcine inventory indicates a similar or larger inventory than the buried RWMC waste. The RWMC buried waste is estimated by the DOE to yield 100 mrem/yr doses in drinking water for millennia unless a perfect soil cap limits the estimated doses to be 30 mrem/yr. Importantly, the inevitable spikes in contamination due to flooding have not been accounted for despite RWMC flooding

in 1963 and 1969. The dose estimates are not conservative. The assumed dilution factors are not consistent with past INL aquifer contamination migration. Calcine migration Kd coeffients may be different than used for RWMC and may worsen the effect of calcine in the soil.

Table 2. Perspective on the quantity of radionuclides in the stored calcine.

Radionuclide (half life)	Inventory (curie)	Maximum Contaminant Level	Dilution volume (Liter) [b]	Number of Aquifers to Dilute
Sr-90/Y-90 (Sr-90 29.1 year)	15,800,000	8 pCi/L	1.975E+18 1,975,000,000 billion	809
Cs-137/Ba-137m (30.2 year)	17,300,000	160 pCi/L	1.081E+17 108,000,000 billion	44
C-14 (5,730 yr)	0.038	2000 pCi/L	1.90E+7 0.019 billion	<<1
Cl-36 (301,000 yr)	0	700 pCi/L	0	0
I-129 (17,000,000 yr)	1.6	1 pCi/L	1.6E+12 1600 billion	<<1
Tc-99 (2213,000 yr)	4600	900 pCi/L	5.11E+12 5110 billion	0.002
Np-237 (2,144,000 yr)	470	15 pCi/L[a]	3.13E+13 31,300 billion	0.0128
U-234 (245,500 yr)	130	15 pCi/L[a]	8.67E+12 8,670 billion	0.00355
Am-241 (432 yr to Np-237)	12,000	15 pCi/L[a]	8.0E+14 800,000 billion	0.378
Plutonium-238 (87.7 year)	110,000	15 pCi/L[a]	7.3E+15 7,300,000 billion	3
Plutonum-239 (24,000 year)	48,000	15 pCi/L[a]	3.2E15 3,200,000 billion	1.3

Table 2 Notes:

a. The unit of 1 picoCurie/liter is 1.E-12 curie/liter. The limit is 15 pCi/L for total alpha (40 CFR 141). For uranium, total natural uranium limit of 30 microgram/liter for all combined uranium isotopes.

b. Aquifer volume of 2.44E+15 liters is assumed.

c. The dilution volume ignores soil adsorption and migration delay timing; it is provided to give some perspective on the amount of waste involved. It ignores that fact that the entire aquifer is not going to be involved with dilution, although waste in the aquifer can fan out and involve a considerable portion of the aquifer downstream.

Table 2 above provides some additional perspective on the large inventory of radioactive material in the calcine bin sets. It would require 1,975,000,000 billion liters of water (or over 800 Snake River Plain aquifers) to dilute the strontium-90/y-90 in calcine storage to federal drinking water standards. It would require 7,300,000 billion liters of water (or over 3 Snake River Plain aquifers) to dilute the Pu-238 stored in the calcine to federal drinking water standards. It should also be pointed out that these figures are presented as though only a single contaminant were present. In reality, the health detriment of the combination of all contaminants in the drinking water must be considered. This is a point often overlooked by the Idaho Department of Environmental Quality as IDEQ surveys the contamination in the aquifer, dismissing any result below federal drinking water standards which have, for tritium and hexavalent chromium been found to not be protective of human health, especially when consumed over a lifetime. [126] The graph of the migration of the buried waste at RWMC that will remain at

[126] See www.environmental-defense-institute.org for discussion of more stringent tritium and hexavalent chromium regulations and public health goals that the current EPA federal drinking water standards.

RWMC buried in soil is shown below in Figure 1. The contamination migration is not realistically modeled by the DOE nor is it conservatively modeled. Flooding and fast paths of contaminant migration are ignored. [127] The ingestion doses will undoubtedly exceed the 30 to 100 mrem/yr radiation doses shown, intermittently at least.

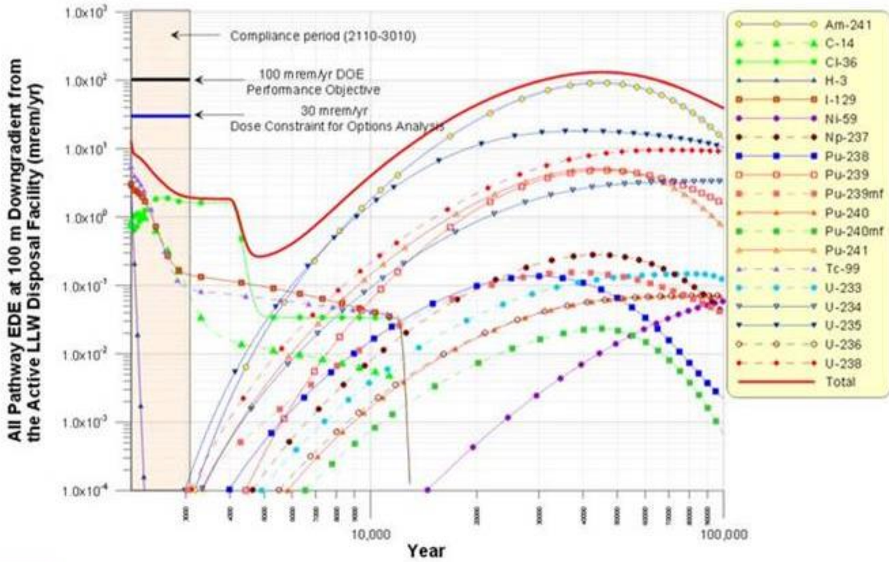

Figure 4-2. All-pathways effective dose equivalent 100 m downgradient from the Radioactive Waste Management Complex boundary from year 2110 to year 100,000 with cover infiltration rate equal to 1 cm/year.

Figure 1. All-pathways radiation dose for the Radioactive Waste Management Complex from DOE/NE-ID-11243 and DOE/NE-ID-11244. Americium-241, uranium-235, uranium-238, and plutonium-239 are top contributors to ingestion dose after 10,000 years. Beware, however, that contamination migration by the DOE appears to be modeled with a bias toward delaying the release timing to be after 10,000 years. The EPA ignores post-10,000 contamination in its INL CERLCA cleanup.

Despite the overly optimistic statements made about the grouting below portions of the RWMC and untrue statements presented in LINE presentations about the short half life of the material, the buried radioactive waste that is not being exhumed from the RWMC will continue to contaminate the Snake River Plain aquifer, essentially forever. EPA cleanup standards are discussed in relation to INL CERCLA cleanup but are rarely met and will not be met over the long term, after 10,000 years, beneath the RWMC.

A revealing history of calcine storage seismic evaluation is presented in 2003 report INEEL/EXT-02-1548. [128] It is a "kick the can down the road" approach to seismic evaluation typical of high hazard INL nuclear facilities. There are seven bin sets, each designed and constructed differently; see figure at end of this letter from INEEL/EXT-02-1548. Each bin set for containing calcine is inside a concrete vault that is usually at least partially above ground. Initially, both the bin set and the vault were to be seismically evaluated for bin set 1.

Bin set 1, designed and built first, was found in 1989, upon visual inspection by EQE Engineering to be extremely seismically fragile. The INL then focuses on evaluation of the concrete vault which consultants conclude would "not collapse" in a severe seismic event. Yet unsaid is that structural failure of bin set 1 would be expected and the concrete vault would be cracked. Importantly, the calcine in bin set 1 would not be confined following a small seismic event.

It is evident that as early as 1989, it was recognized that the importance of confining the calcine merited applying stringent seismic design criteria similar to a nuclear reactor, more stringent than the Performance

[127] Johnson TM et al., *Geology*, "Groundwater "fast paths" in the Snake River Plain aquifer: Radiogenic isotope ratios as natural groundwater tracers," v. 28; no. 10; p. 871-874, October 2000.

[128] Department of Energy Idaho Operations Office, INEEL/EXT-02-01548, "Structural Integrity Program for the Calcined Solids Storage Facilities at the Idaho Nuclear Technology and Engineering Center," May 2003. Find it at https://inldigitallibrary.inl.gov

Category 2 later adopted to argue that the calcine bin set 1 vault is satisfactory. Performance Category 2 seismic design criteria should never have been argued to be sufficient for the seismic performance requirement for INL calcine bin sets.

A 1994 report [129] explains that "Currently, Bin Set 1 is being evaluated to determine the seismic qualification of the bins and vault. Based on this study, retrieval of calcine from Bin Set 1 and transporting it to Bin Set 6 could be required." This is stated despite the inspection in 1989 that by visual inspection would have shown bin set 1 to be seismically fragile.

For the other calcine bin sets, the argument then shifts to more stringent seismic design criteria having been specified in safety analysis documents, but these safety analysis documents are unavailable to the public and cannot be reviewed as the basis for adequacy of the other calcine bin sets or vaults. At least it was recognized that the calcine storage facilities for bin sets 2 through 7 needed to meet seismic design criteria more stringent than PC-2. The fact that more stringent seismic design criteria were adopted for calcine storage facilities 2 through 7 is positive; **yet not all INL designed tank systems were actually adequately designed despite having adopted more stringent criteria**. Subsequent detailed design and installation should have been reviewed by qualified nuclear industry seismic structural engineering experts yet no evidence of seismic expert review of each bin set is evident except for bin set 1 which is obviously found to be seismically weak.

The charade continues to this day concerning the seismically weak calcine bin set 1 (both bin set and also the vault). The ability of the vault to withstand a PC-2 seismic event does not alleviate the problem that bin set 1 is expected to not withstand even a small and likely PC-2 seismic event and the spilled calcine in the concrete vault will not be confined by the vault. It should be obvious why the hand waving occurs during LINE Commission meetings rather than facts about the seismic vulnerability of the calcine bin sets, in particular, bin set 1.

Design standards for pre-1990 tank structures constructed at the INL have typically been found to be seismically inadequate. Despite pressure to find otherwise, it appears highly questionable whether the early calcine bin sets would be capable of withstanding any anticipated or likely seismic event. Given the extremely large inventory of hazardous material, the release of which cannot be remediated, it would be much more appropriate for the interests of protecting Idaho to require a higher level of seismic capability to withstand a more serious seismic event.

Structural consensus codes and standards have changed substantially since the bin sets were originally commissioned, especially for calcine bin sets and vaults 1 through 3. An unbiased assessment of the calcine bin sets is likely to conclude that one seismic event centered near the INTEC site that approaches the magnitude of historical seismic events in the area, will likely result in spilling highly radioactive calcine across the Idaho desert, which can then be dispersed to populated areas via prevailing winds. The IDEQ needs to recognize the serious seismic vulnerability of the calcine storage at the INL and must refuse to accept inadequately supported seismic analyses that do not use evaluation to standards commensurate with the long-term environmental hazard posed to the environment by a release of the calcine.

IDEQ must require expedited repackaging of the calcine stored at the INL even if shipment of the calcine is not expected to occur in time to meet the 2035 shipment milestone stipulated in the Idaho Settlement Agreement. [130]

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[129] Department of Energy Idaho Operations Office, WINCO-1192, "ICPP Tank Farm System Analysis," January 1994. Find it at https://inldigitallibrary.inl.gov

[130] U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD CALCINED HIGH-LEVEL RADIOACTIVE WASTE http://www.nwtrb.gov/facts/Calcined_HLW.pdf

Appendix C.7 - *New Information* -

Table C.7-2. Bin set total chemical inventory (fission and activation species decayed to 2016).[a]

Constituent	Total mass (kg)	Constituent	Total mass (kg)
Actinium	1.2×10^{-6}	Molybdenum	2.9×10^{4}
Aluminum	9.7×10^{5}	Neodymium	1.4×10^{3}
Americium	4.4	Neptunium	46
Antimony	10	Nickel	2.6×10^{3}
Arsenic	3.7	Niobium	2.6
Astatine	8.5×10^{-20}	Palladium	110
Barium	770	Plutonium	1.3×10^{3}
Beryllium	3.6	Polonium	2.8×10^{-9}
Bismuth	2.7×10^{-9}	Potassium	2.8×10^{4}
Boron	4.0×10^{4}	Praseodymium	380
Bromine	29	Promethium	5.7×10^{-3}
Cadmium	4.7×10^{4}	Protoactinium	2.4×10^{-3}
Calcium	1.1×10^{6}	Radium	2.7×10^{-5}
Californium	1.0×10^{-12}	Rhodium	140
Cerium	850	Rubidium	170
Cesium	740	Ruthenium	1.9×10^{3}
Chlorine	4.5×10^{3}	Samarium	280
Chromium	8.8×10^{3}	Selenium	51
Cobalt	1.6	Silver	8.3
Curium	3.6×10^{-3}	Sodium	1.3×10^{5}
Dysprosium	3.3	Strontium	2.6×10^{3}
Erbium	1.8	Technetium	280
Europium	20	Tellurium	140
Fluorine	8.4×10^{5}	Terbium	0.94
Francium	3.1×10^{-14}	Thallium	0.36
Gadolinium	15	Thorium	6.1
Gallium	14	Thulium	0.14
Germanium	1.2	Tin	43
Holmium	1.1	Uranium	1.7×10^{4}
Indium	4.0	Ytterbium	1.8
Iodine	1.4×10^{3}	Yttrium	260
Iron	2.2×10^{4}	Zinc	71
Lanthanum	440	Zirconium	5.6×10^{5}
Lead	360	NO_3	2.5×10^{5}
Lithium	18	PO_4	2.4×10^{4}
Manganese	1.2×10^{3}	SO_4	5.3×10^{4}
Mercury	1.2×10^{4}		

a. Source: Valentine (2000).

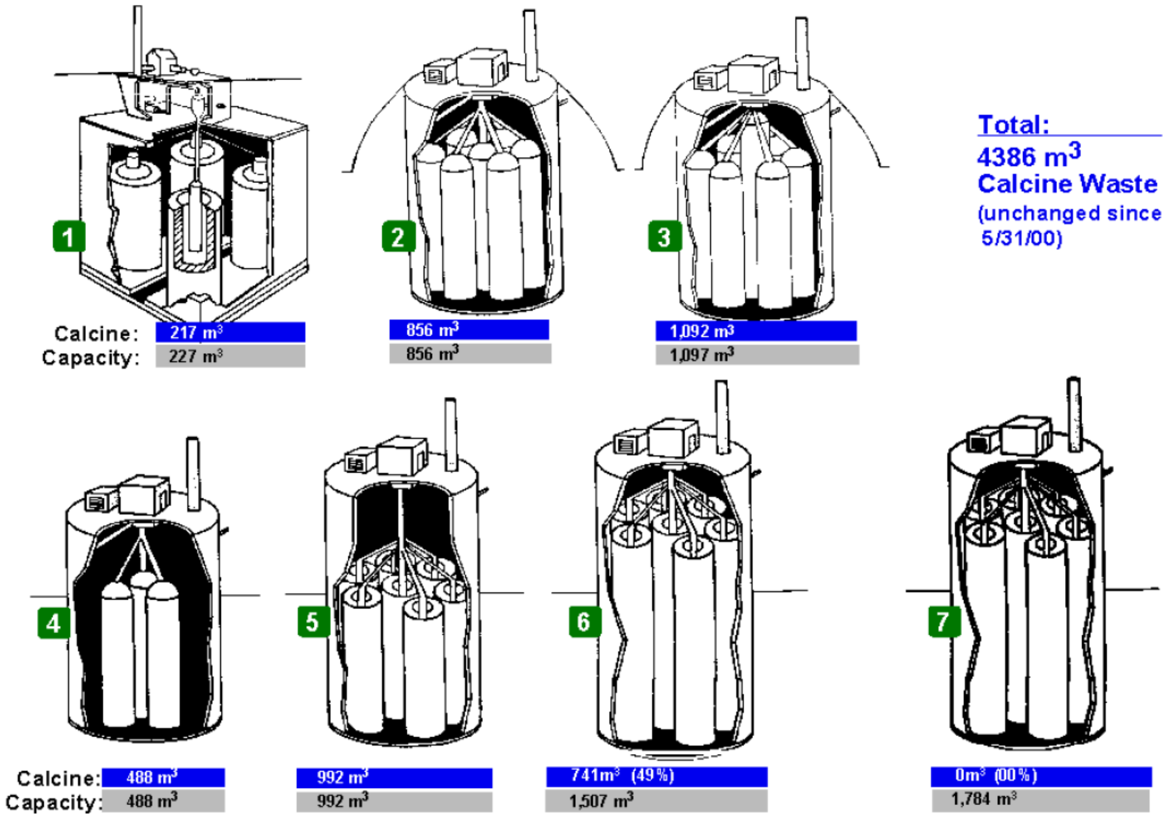
- New Information - Idaho HLW & FD EIS

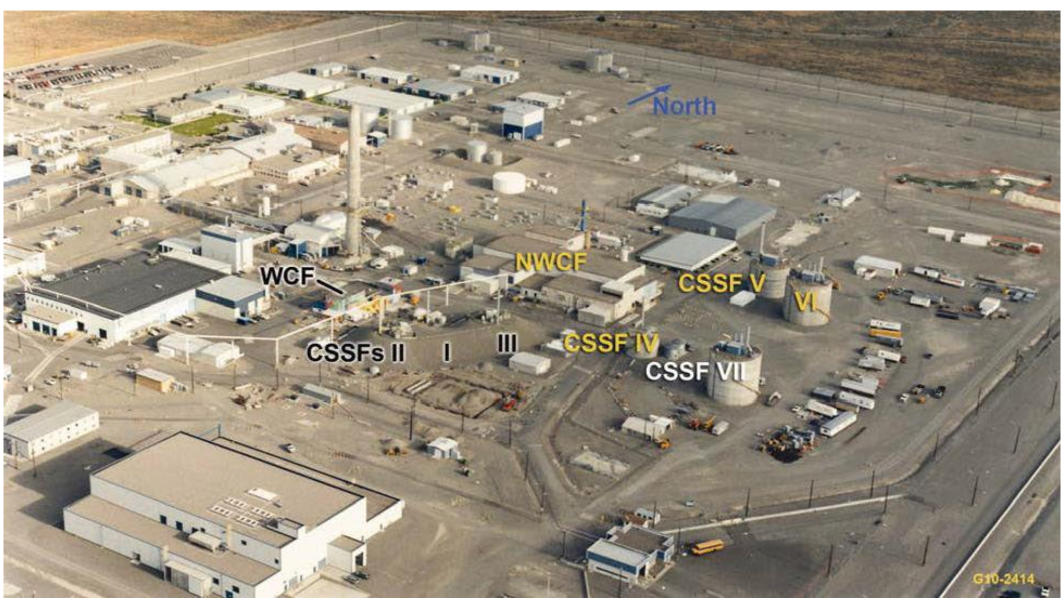
Table C.7-3. Bin set total inventory of radionuclides (decayed to 2016).[a]

Constituent	Total activity (Ci)	Constituent	Total activity (Ci)	Constituent	Total activity (Ci)
H-3	15	Sm-148	9.0×10^{-9}	Th-227	0.085
Be-10	0.033	Sm-149	2.9×10^{-9}	Th-228	1.6
C-14	0.038	Sm-151	4.5×10^{5}	Th-229	1.4×10^{-4}
Co-60	1.5×10^{3}	Eu-150	5.3×10^{-3}	Th-230	1.4
Ni-63	6.8×10^{4}	Eu-152	430	Th-231	5.0
Se-79	9.9×10^{4}	Gd-152	5.3×10^{-10}	Th-232	2.3×10^{-7}
Rb-87	9.1×10^{-3}	Eu-154	2.9×10^{4}	Th-234	5.0
Sr-90	7.9×10^{6}	Eu-155	3.9×10^{3}	Pa-231	0.11
Y-90	7.9×10^{6}	Ho-166m	0.014	Pa-233	690
Zr-93	680	Tm-171	1.1×10^{-9}	Pa-234m	5.0
Nb-93m	630	Tl-207	0.085	Pa-234	6.3×10^{-3}
Nb-94	270	Tl-208	0.16	U-232	1.6
Tc-98	7.3×10^{-4}	Tl-209	1.9×10^{-6}	U-233	0.057
Tc-99	4.6×10^{3}	Pb-209	1.4×10^{-4}	U-234	130
Rh-102	9.1×10^{-3}	Pb-210	0.013	U-235	3.2
Ru-106	4.4×10^{-3}	Pb-211	0.085	U-236	11
Rh-106	0.029	Pb-212	1.6	U-237	1.5
Pd-107	9.1	Pb-214	0.027	U-238	3.1
Ag-108	1.1×10^{-5}	Bi-210m	5.2×10^{-17}	U-240	1.6×10^{-7}
Ag-108m	1.3×10^{-4}	Bi-210	0.013	Np-235	5.1×10^{-17}
Ag-109m	3.8×10^{-17}	Bi-211	0.085	Np-237	470
Cd-109	3.8×10^{-17}	Bi-212	1.6	Np-238	0.017
Cd-113m	1.6×10^{3}	Bi-213	1.4×10^{-4}	Np-239	50
In-115	2.7×10^{-8}	Bi-214	0.027	Np-240m	1.6×10^{-7}
Sn-121m	68	Po-210	0.013	Pu-236	0.027
Te-123	1.3×10^{-10}	Po-211	1.7×10^{-4}	Pu-238	1.1×10^{5}
Sb-125	130	Po-212	0.29	Pu-239	4.8×10^{4}
Te-125m	38	Po-213	1.4×10^{-4}	Pu-240	2.0×10^{3}
Sn-126	310	Po-214	0.027	Pu-241	4.8×10^{4}
Sb-126	43	Po-215	0.085	Pu-242	130
Sb-126m	310	Po-216	1.6	Pu-243	1.1×10^{-13}
I-129	1.6	Po-218	0.027	Pu-244	1.6×10^{-7}
Cs-134	67	At-217	1.4×10^{-4}	Am-241	1.2×10^{4}
Cs-135	360	Rn-219	0.085	Am-242m	6.1
Cs-137	8.8×10^{6}	Rn-220	1.6	Am-242	5.8
Ba-137m	8.5×10^{6}	Rn-222	0.027	Am-243	50
La-138	6.8×10^{-8}	Fr-221	1.4×10^{-4}	Cm-242	4.8
Ce-142	9.4×10^{-3}	Fr-223	0.018	Cm-243	5.0
Ce-144	8.6×10^{-5}	Ra-223	0.085	Cm-244	250
Pr-144	1.4×10^{-3}	Ra-224	1.6	Cm-245	0.071
Pr-144m	1.7×10^{-5}	Ra-225	1.4×10^{-4}	Cm-246	4.6×10^{-3}
Nd-144	4.6×10^{-7}	Ra-226	0.027	Cm-247	5.2×10^{-9}
Pm-146	2.3	Ra-228	2.3×10^{-7}	Cm-248	5.5×10^{-9}
Pm-147	5.3×10^{3}	Ac-225	1.4×10^{-4}	Cf-249	4.0×10^{-9}
Sm-146	8.6×10^{-5}	Ac-227	0.085	Cf-250	1.7×10^{-9}
Sm-147	3.0×10^{-3}	Ac-228	2.3×10^{-7}	Cf-251	6.3×10^{-11}

a. Source: Valentine (2000).

Calcine Solids Storage Facilities





Section IV.D. Advanced Test Reactor Complex Cleanup

The Advanced Test Reactor Complex (ATRC) (formerly the Test Reactor Area (TRA) or the Reactor Technology Center (RTC); (these names are interchangeable) is one of the major high-level waste sites - in on-site radioactive solid waste (spent nuclear fuel) and percolation pond disposal sites relative to curie content. DOE summary data between 1952 and 1983 cite 5 million Ci of solid waste disposed. [EGG-WM-10903 @6-25][ID-10054-81] ATRC supports the Advanced Test Reactor, Advanced Reactor Critical Facility Reactors, Hot Cell Facility, Nuclear Physics Research Program, Advanced Reactivity Measurement Facility, and Coupled Fast Reactivity Measurement Facility Reactors.

Previously, the now (closed) D&D Engineering Test Reactor, Materials Test Reactor were located at the ATRC. The reactors used chromium (VI) in the coolant and discharged between (1952-72) 55,353 lbs. of Cr (VI). [Analytica ID-12782-1 @4-26] Accidental chemical spills have also contributed to site contamination. For instance, recent disclosures by the Oil Chemical and Atomic Workers Union revealed a 680 gallon sulfuric acid spill. The union cited nine other worker health and safety violations at the Advanced Test Reactor.

The ATRC has fifty-one Solid Waste Management Units. These include leaching ponds, underground tanks, rubble piles, cooling towers, waste injection wells, French drains, and assorted spills where hazardous and mixed radioactive/hazardous wastes exist. These waste sites have been in continuous use for over 40 years and have created ground water contamination under the ATRC. The culture of secrecy and non-accountability made it possible to willfully allow problems to go unsolved. For instance, the ATRC's reactor fuel cooling canal at the Materials Test Reactor had a severe leak that was not drained and repaired until a decade after it was discovered. This leak allowed large quantities of contaminated coolant water to escape to the soil below the ATRC, and initially was not identified in the Cleanup Plan as a contamination source. The largest contributor to groundwater contamination under the ATRC was the radioactive waste injection well that was not closed until 1984. Discontinuing the use of injection wells due to pressure from the State increased volumes of contamination in the leach ponds proportionally.

Advanced Test Reactor Complex (ATRC) Groundwater Liquid Waste Volumes Disposed

Disposal Site	**Period Used**	**Total Discharge (gal)**
Warm Waste Pond	1952 - 1996	5.35×10^9
Cold Waste Pond	1982- 1996	2.13×10^9
Chemical Waste Pond	1962 - 1996	726×10^8
Sanitary Waste Pond	1952- present	310×10^6
Injection Well -05	1964-1982	3.89×10^9
Injection Well - USGS-53	1960-1964	2.2×10^8
Totals		8.45×10^{10} or 84.5 billion gallons

[ATRC Record of Decision [ROD] (a) pg. 5]

ATRC (formerly called TRA) also leads (volume and activity) the list of INL facility areas for radioactive liquid waste discharges - 84.5 billion gallons between 1952 and 1990. ATRC [ROD @5] Between 1952 and 1981 ATRC released 50,840 Ci to the soil or 83% of total INL liquid discharges. This figure does not include short-lived radioactivity with less than 2-3 day half-life. [Ibid. @14] Idaho State University monitoring found ATRC highest in tritium concentrations. ATRC injection well No.53 received waste containing 31,131 lbs. of hexavalent chromium between 1964-1982. In the same time period, ATRC injection well No.05 got 55,353 lb. of Cr (VI). The size of the contamination plume under ATRC is larger than DOE acknowledges. Well No. 65 south of [and beyond acknowledged plume] ATRC had the highest results ranging from 43, 5000 to 48,200 pico curies per liter. [IDEQ Oversight (a) pg.21]

The State challenges DOE's characterization of the size of the perched water contamination plumes because of the location and depth of the monitoring wells. The State's "review strongly suggests that wells along the north and northeast margin of the network are too deep to intercept or represent water levels in the perched water zone."... "That is, the perched water zone may extend farther to the north and northeast than previously recognized" by DOE. [Oversight (a)@31] The volume of the perched water plume is estimated at 4.3 billion gallons. This plume is connected to the Big Lost River flood zone. Hydrology studies during flooding of the Big Lost River and ATRC monitoring well static levels revealed that recharge to the ATRC groundwater occurred at a rate of 30 - 35 feet per day. [EGG-WM-10002 @ 3-109] At this transmissivity rate, contaminates could move nearly 2 ½ miles per year. Other monitoring data supports these findings. "Chromium-51 was detected in monitoring well USGS-56 at a concentration of 0.33 pCi/mL [330 pCi/L]. Well USGS-56 is located in close proximity to the [ATRC] Retention Basin where concentrations of up to 2,540 pCi/mL [2,540,000 pCi/L] of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area." [EGG-WM-10002 @ 4-129]

Selected ATRC Perched Water Chemical Sample Data
[TRA, ROD, 12/92@13& Analytica ID-12782-1][40 CFR Sec. 141.61]

Chemical	Concentration ug/L	EPA Standard ug/L
Arsenic	42.8	50
Barium	10,300.0	2
Beryllium	136.0	1
Cadmium	177.0	0.005
Chromium	4,480.0	0.1
Copper	1,930.0	1,000
Iron	546,000.0	300
Lead	4,260.0	50
Manganese	92,000.0	50
Mercury	394.0	2
Sulfate	4,880,000.0	250,000
Zinc	10,700.9	5,000
Aluminum	430,000.0	?
Xylene	31,000.0	10
Magnesium	400,000.0	?

* The Asterisk (*) on the below ATRC perched water sample data table indicates EPA's new proposed Drinking Water standards (40 CFR Part 141 and 142).

Advanced Test Reactor Complex Area Perched Ground Water Sample Data

Nuclide	**Concentration pCi/L**	**EPA 1976 Standard pCi/L**	**Number Times over EPA Std.**
Cobalt-58	601	1,590.0*	0
Cobalt-60	12,200,000	100.00	122,000.0
Zinc-65	105,000	300.00	350.0
Cesium-134	62,400	8.13*	7,675.0
Cesium-137	21,000,000	119.0*	176,470.0

Europium-152	108,000	60.00	1,800.0
Europium-154	130,000	200.00	650.0
Europium-155	20,400	600.00	34.0
Americium-241	16,700	6.34	2,634.0
Manganese-54	336	300.00	0
Chromium-51	2,540,000	6,000.00	423.0
Scandium-46	4,140	863.0*	4.7
Iron-59	2,600	200.00	13.0
Zirconium-95	11,500	200.00	57.0
Niobium-95	12,000	300.00	40.0
Ruthenium-103	3,970	200.00	19.8
Rhodium-106	4,980	30.00	166.0
Silver-108	14,400	90.00	160.0
Antimony-124	150	60.00	2.5
Cerium-141	6,140	300.00	20.4
Ytterbium-175	3,500	300.00	11.6
Hafnium-181	136,000	200.00	680.0
Tantalum-182	3,180	100.00	31.8
Lead-203	1,680	1,000.00	1.6
Plutonium-239	12	15.00	0
Uranium-234	520	13.9*	37.0
Strontium-90	18,000	8.00	2,250.0
Tritium	3,940,000	20,000.00	197.0

[Administrative Record, TRA Summary Tables of Chemical and Radiological Analysis, Appendix G-484 and 485, Analytica-ID-12782-1 @ D-615 to D-632] [EPA-570/9-76-003] *[FR-7/18/91 Proposed MCL] Expressed in Pico Curies per liter (pCi/L)

These new proposed nuclide limits in drinking water, which EPA attempted to promulgate in 1991, are substantially higher than the 1976 limits. For instance, tritium MCL will be increased from 20,000 to 60,900 pCi/l. It should be noted that the federal government is the largest polluter of radionuclides so it is in their interest to raise the limits on their own waste sites. EPA attempted to raise the allowable limits in 1985, but the courts found that they were not protective of human health, and EPA was forced to withdraw the standard. As of this writing, the 1976 rule is still the only enforceable regulation.

The decision by the Agencies (DOE, ID, EPA) to do nothing on interim actions on the ATRC perched water is an affront to common sense and demonstrates blatant disregard for Idaho's most valuable resource - groundwater. Contaminated water in the perched zones must be pumped and treated to minimize further migration into the rest of the aquifer. The federal government must never again be allowed to foul our waters and just walk away. Monies currently being channeled into nuclear materials production would more than adequately fund environmental restoration such as pump and treat. It is unconscionable for Idaho & EPA to approve such a position. The Environmental Defense Institute recommends this pump and treat immediate action because as the Congressional Office of Technology Assessments states:

"Contaminates may also form or absorb onto colloidal particles, which allows them to move with, or faster than the average groundwater flow. Flow can result from an apparently unrelated force, such as the flow of water and contaminates due to a thermal or electrical gradient instead of the expected hydraulic gradient. Chemical reactions and biotransformation may occur, possibly changing the toxicity or mobility of contaminates. Some contaminates dissolve and move with the water; some are in the gas phase; others are non-aqueous phase liquids; some are more dense than water and may move in a direction different from groundwater; others may be less dense than water and float on top of it." [OTA (a) @ 38]

Advanced Test Reactor Complex Warm Waste Pond

A major contaminated area at Advanced Test Reactor Complex (formerly called TRA) is the Warm Waste Pond which has three separate cells dug in 1952, 1957, and 1964 respectively. These are unlined percolation pits where contaminated waste water was dumped and allowed to absorb into the ground. Even though EPA determined that this percolation pond was in violation of federal law, DOE continued to use it up until 1995 when it was capped.

The "low levels of radioactivity" the DOE describes as going to the Warm Waste Pond are actually not so low. Three separate contractors sampled pond sediments. One found cesium-137 and cobalt-60 in concentrations of 55,750 and 50,292 pCi/g respectively. [EGG-ER-10610 @ 3-3][EGG-WM-10000@11] The second sample tests showed Cs-137 and CO-60 in concentrations of 110,000 and 100,000 pCi/g respectively in sediment fines. [NRT 910521-N/C @ 2-5] The third treatability samples showed Co-60 and Cs-137 at 50,292 and 113,497 pCi/g. [EGG-WM-10000 @11] Currently, “The service waste activity is allowed to average no more than three times drinking water tolerance in any isotope with the exception of very short-lived ones like Iodine-131." [IDO-14532 @ 49]

Continued use of the Warm Waste Pond up until 1995 clearly demonstrates DOE's misguided priorities and total disregard for environmental degradation. DOE continued to add radioactive contaminates to a site that has been identified for cleanup for over fifteen years. The continued use of the pond insures that water will continue leaching previous contaminates further down into the aquifer. Moreover the Environmental Protection Agency (EPA) and the State of Idaho are remiss in their respective enforcement responsibilities for not closing down the Test Reactor Area ponds. According to the ATRC Warm Waste Pond Hazardous Conditions and Incidents Report, “After November 1980 it was in violation of RCRA since we had no interim status.” [TRA Hazardous] EPA and the State have full justification to declare these ponds RCRA hazardous mixed waste sites as the following paragraph illustrates.

"EPA is authorized [under RCRA] to issue a corrective action order, which can suspend or revoke the authority to operate an interim status Treatment/Storage/Disposal facility or to seek appropriate relief (including an injunction) from a US District Court.” [OTA (a) @ 28]

"Over the past 5 years, DOE has gradually been required to acknowledge that cleanup of the Nuclear Weapons Complex [including INL] is subject to regulation by EPA (or the States) to the extent that hazardous materials are involved or a site is placed on the Superfund's National Priority List (NPL). Until 1984, DOE claimed that it was exempted from regulation under hazardous waste laws such as RCRA because of its Atomic Energy Act authority relating to national security and sovereign immunity from State regulation. A 1984 Tennessee Federal court decision rejected this claim and ordered DOE to comply with all RCRA provisions." [OTA (a) @ 34] Congressional passage of the Federal Facility Compliance in 1992 further clarified the law removing sovereign immunity as a federal defense against compliance with environmental laws.

ATRC (formerly TRA) Warm Waste percolation pond received (5.35×10^9) 5.35 billion gallons between 1952 and 1992 at a rate of 40 gallon/minute. [TRA ROD@5] The high volumes of water were due to the once through cooling for the reactors that were then diluted before discharge. This also accounts for the high chromium contamination in the groundwater because chromium was used to retard corrosion in the reactor cooling systems. Between 1961 and 1985 a total of 32,660 curies were released to the pond. [TRA Hazardous] Warm Waste Pond sediments at the two foot level contained 75.1 pCi/g of Plutonium-235-240. [Analytica ID-12782-1 @ 4-33] ATRC pond algae registered 100 mR/hr. Ducks (usually 25 at anyone time) using the pond registered the following radionuclide concentrations. [ERDA-1536 @ III-75-76]

A DOE Occurrence Report [131] stated that "Contaminated Soil Outside Warm Waste Evaporation Pond at the ATR Complex. "On May 12, 2016, the Advanced Test Reactor (ATR) Control Room Supervisor received a report from the Radiological Control Manager that contaminated soil was discovered outside of the contamination area north of the ATR evaporation ponds. Pre-work surveys were being performed in preparation for the ATR Complex Warm Waste Evaporation Pond liner replacement project. A radiological buffer area had been established to support surveys of the area surrounding the evaporation pond contamination area. A normally unoccupied area was surveyed and contamination was found in the soil. Further surveys off of the pond berm elevation, and downwind of the pond, found contamination levels to be as high as 250,000 disintegrations per minute /100 centimeters squared. Following the discovery, the area was posted as a soil contamination area. Surveys of the road around the evaporation pond were conducted and no contamination was found. Management was notified."

ATRC Duck Tissue Using Evaporation Pond Samples

Nuclide	**Concentration**	**Nuclide**	**Concentration**
Cesium-137	890 pCi/g	Cerium-141	390 pCi/g
Cobalt-60	540 pCi/g	Iodine-131	18 pCi/g
Zinc	1,100 pCi/g	Cesium-134	38 pCi/g

[ERDA-1536 @ III-75-76]

DOE calculated in 1977 that an individual eating a duck would receive 20 mRem to the thyroid and 25 mRem (milli-rem) whole body exposure. [ERDA-1536 @ III-75-76] In a later 1988 study of ATRC waterfowl, "Three thousand one hundred forty-one individuals representing 22 species of waterfowl were observed on the ATRC ponds from January 1974 through 1978." "If each of the 3,141 waterfowl had transuranic concentrations equal to the averages in the experimental waterfowl, 1,300 nCi of transuranic [including plutonium-238/239/240] would have been removed during this period or an annual average of 305 nCi" and "... if one of the bone samples that was approximately 100 times the other samples was excluded from the average." Additionally, "...if the 3,141 individuals in the wild [duck] population had similar [Sr-90] activity, a total of 292 uCi of Sr-90 would have been exported in the 51-month period or an annual average of 68.7 uCi." The dose to a person eating a duck from the Sr-90 alone would be whole-body 12 mrem and thyroid 7 mrem. "The mean dose rate to experimental ducks on the ATRC ponds was 69 mRad from Sr-90 and transuranic nuclides in body tissues."... "Water fowl at the TRA ponds potentially export greater quantities of transuranic from this area than do other species of wildlife. The maximum yearly export of transuranic radionuclides by small mammals and coyotes at the ATRC was 35 pCi (Haliford) and 70 nCi (Arthur and Markham)." [Markham @ 522] Pacific Northwest Laboratory studies on internal exposure of dogs found that there was no minimum amount of plutonium that did not cause death. [Parks] State radiation standard limit is 4 mRem/yr for beta emitters. Safe limits for cesium-137 are 10 pCi/g. [EG&G-WM-8804] Chromium released to ATRC ponds was 500 ppb. The chromium standard at the time was .05 ppb or 10,000 times over regulatory standards. [ERDA-1536 @III-79]

Advanced Test Reactor Complex (ATRC) Summary of Site Risks

DOE remediation plan's listing of contaminants fails to list Iodine-129 and Plutonium-238, 239, and 240 which were found in ATRC leach pond plankton in concentration ranges (CRs) from 40,000 to 400,000. Distribution coefficients for Pu isotopes in sediments ranged from 13,000 to 150,000. [DOE/ID-12111 @39] Due to I-129's 17-million year half-life, and Plutonium's 24 thousand-year half-life, these isotopes are considered permanent contaminates.

DOE's plan also fails to quantify the range of contamination in ATRC perched water in its Community Relations Plan mailings. EDI concurs with the State's criticism of DOE for using only the MEAN (average)

[131] NE-ID--BEA-ATR-2016-0014 FINAL

concentration levels. By only offering the mean, DOE dilutes the data and offers a lower average number as opposed to offering the highest concentration number which best characterizes the risk. Readers of the plan deserve more information than they "exceed federal safe drinking water standards" or a footnote stating a standard of 4 mRem/yr. The proposed EPA standard for Cesium-137 (not stated in the plan) is 119 pCi/L.

There is no justification for DOE to eliminate from consideration in the plan, radioactive isotopes that had half-lives of more than five years. [TRA Plan @ A-6] This also holds true for the non-inclusion of Cesium (half-life of 30 yrs) in the exposure assessment. The current cesium levels of 21 million pCi/L mean that by the year 2023, the concentration levels will be 10.5 million pCi/L. In other wards it will take 540 years before the cesium will decay to below proposed EPA drinking water standard of 119 pCi/L.

ATRC lies immediately (less than 2 miles) up gradient to the Big Lost River. Considerable uncertainty exists as to contaminate transport time within the aquifer due to the existence of lava tubes etc. in a very non-homogenous geology of the Snake River Plain Aquifer. Moreover, DOE's contention that "there is no current use of the perched water or contaminated Snake River Aquifer in the vicinity of TRA" and the decision to consider the potential use of the area for only a 125 years period, is unjustified and unacceptable.

A six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes which move water rapidly through the aquifer and exit at Thousand Springs on the Snake River. Under normal conditions the entire volume of the Big Lost River literally disappears into the porous Snake River Plain. This is a very graphic example of the porosity of the ground under the INL. Also see Section I (F) on aquifer contamination.

ATRC Risk Assessment

Human health risk information appears not to consider the combined cancer risks for non-radionuclide and radionuclide from inhalation. Since the radionuclide component already "approaches the upper National Contingency Plan (NCP) limit"[TRA Plan @3], the combined risks (synergistic effect) may push it over the limit.

"The carcinogenic risks due to the external exposure to radionuclides were found to be significantly above the recommended NCP target risk range."[TRA Plan] This statement, as with other vague un-quantified statements, deserves specific numbers attached to it due to their obvious significance. EPA's standards are nearly two decades old and do not reflect current knowledge about the health risks to exposure to low levels of radiation. Therefore, the conservative 1 chance in a million in getting cancer must be used, not the 1 in 10,000 industrial standard.

Human health risks assessments additionally do not consider migratory water fowl using the ATRC waste ponds. I-129 and other gamma-emitting nuclide in tissues of ducks from the Test Reactor Area (ATRC) leaching ponds have been known by INL at least since 1981. [Health Physics 40: 173-181, 1981] DOE acknowledges I-129 concentration AVERAGES of .3 pCi/gm. [TRA ROD (b)@35]

According to the Office of Technology Assessment (OTA), INL has not attempted extensive ecological site characterization. "Although selected studies have been done on effects with potential relevance to the cleanup, there appears to be no systematic attempt to inform the cleanup process through ecological studies at INL. The routine monitoring program there, is designed primarily to determine radionuclide pathways to human receptors and includes very little biological monitoring. Routine contaminant-level monitoring in animals is limited to game animals obtained from road kills." [OTA (a) @ 205]

Since the soil ingestion assessment for "cesium approached the upper limit of the recommended NCP target risk range" [TRA Plan @ 3] DOE must specify which "worst-case conditions" were used. Since, "It could take over 400 years for the cesium to naturally decay to an acceptable level," then cesium must be given appropriate consideration. [TRA Plan @ 7]

DOE's statement that any wastes generated or isolated during remediation activities "will be properly disposed of" is not only inadequate; it is based on credibility that DOE no longer can claim. Therefore, a full discussion must describe the required "cradle to grave" waste process. "DOE's current decisions lack credibility because of past failures by DOE and its predecessor agencies to deal effectively with environmental contamination and to make full public disclosure regarding the contamination and its impacts." [OTA (a) @ S-14]

The fact that DOE has known for decades that it was contaminating the environment and deliberately avoided compliance with environmental law, warrants challenges to its credibility. According to the Office of Technology Assessment of INL, "Characterization work is proceeding at a slow pace and is probably limited by funding. Investigation and testing of more conventional stabilization and containment techniques could be pursued more aggressively." [OTA (a) @ 34] Below are examples of DOE Occurrence Reports related to the ATR.

1995 Aug. 24; The Advanced Test Reactor Emergency Fire Water Injection System would be rendered inoperable during a design basis earthquake. The purpose of the injection system is to pump water into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during an earthquake.

2007 Oct. 29: At the Advanced Test Reactor, "dampers" are used to prevent the release of radioactive material from the facility in the event of an incident. Several years ago, backup dampers were upgraded to provide the same kind of protection as primary dampers. While both the backup and primary dampers would close in the event of a release at ATR, current safety documentation only requires that one or the other is in service during reactor operations. This is inconsistent with a higher-level safety requirement, and is under review. (NE-ID-BEA-ATR-2007-0023).

Oct. 29: As part of an ongoing evaluation process to ensure that safety documentation at the Advanced Test Reactor is consistent, three issues were identified. These deal with how much pressure the reactor confinement system can withstand; an improper evaluation of the heating, ventilation and air conditioning system performance during a radiation release; and improper evaluation of the effect of negative air pressure on the confinement system. Both the ATR contractor and DOE have evaluated these issues and found there is no impact to the safe operation of ATR. An evaluation of the issues and how to correct them is ongoing. (NE-ID-BEA-ATR-2007-0022).

2010, June 15: A need for further safety analysis was determined at the Advanced Test Reactor. As part of ongoing review of the safety documentation at the reactor, it was determined the existing analysis does not look at what would happen in the unlikely event that all five experiment loops in the reactor **failed during an earthquake.** The preliminary analysis showed that this accident is already enveloped by other accidents in the unlikely category and it does not have any effect on safe reactor operation (NE-ID—BEA-ATR-2010-0009).

Advanced Test Reactor Complex Warm Waste Pond Interim Action Record of Decision

The December 1991 ATRC Warm Waste Pond Record of Decision (ROD) is deficient. The ROD did not include the immediate secession of use of the ATRC leach ponds. EDI supports immediate secession of use of the leach ponds in combination with pumping contaminated perched water to a water treatment system for removal of ALL contaminates. EDI supported the physical separation and vitrification of pond sediment contaminates. These separated wastes must be safely stored in a monitored, retrievable form after vitrification. However, the remedy criteria for removal of sediments of 690 pCi/gm must be equal to or less than the State radiation exposure standard of 4 mRem/yr. Tragically, even the ROD plan to implement chemical extraction was revoked by a March 1993 notice of "Explanation of Significant Difference for the Warm Waste Pond Sediments Record of Decision." Treatability tests found that:

"The goal of reducing cesium activity to less than 690 pCi/gm activity for the treated sediment returned to the pond would result in a dramatic increase in the amount of treatment residuals that could not be returned to the pond cells, resulting in the need for long term storage, as no disposal location had been identified. This increase in the amount of sediments requiring long-term storage would, therefore, result in a decrease in the short-term effectiveness of this physical/ chemical treatment remedy. This increased storage would significantly elevate the project costs above the original estimates in the Proposed Plan. Further, the effectiveness of acid extraction was marginally achievable only under extremely rigorous (i.e., boiling acid and long retention times) conditions bringing into question the implement ability of the project" [TRA ROD(c)]

In plain English, what this decision means is this. DOE is once again walking away from a cleanup site because they do not want to store the waste generated, and they do not want to pay the additional costs to cleanup the site to safe standards. The Significant Difference Notice also states that the State and EPA have agreed to a contingency plan to exhume contaminated sediments in one of three cells within the Warm Waste Pond and dump it in the other two cells. Then DOE plans to cover all the cells with soil - not an impermeable cap - just soil. "...The soil cover is to be placed over the Warm Waste Pond to reduce the radiation field and mitigate the potential for blowing dust. The need for an infiltration barrier is not demonstrated and therefore, no cap is needed to meet this objective." [INL Reporter 3/93 @4]

EG&G's 1993 treatability study of the Warm Waste Pond sediments showed extremely effective extraction results for Co-60 that ran as high as 9,270,000 pCi/L and Cesium-137 residuals that ran as high as 27,000,000 pCi/L. [EGG-ER-10616 @4-51] Of course there will be increased storage costs involved with these extracted wastes due to the extreme radioactivity that by definition will require similar management that highly radioactive spent reactor fuel requires. That is, theoretically, the whole idea of cleanup - safe isolation of contaminates from the environment. DOE's final solution supported by the State and EPA was, "transfer of contaminated sediment from the 1964 [Warm Waste Pond] cell and consolidation into the 1952 cell. Contaminated soil from the following INL sites was also dumped into the 1957 cell; 788 cubic yards (603 cm) from MFC containing Cs-137 @ 800 pCi/g; 1,178 cubic yards (901cm) from BORAX ditch containing Cs-137 @ 95.4 pCi/g; 1,279 cubic yards (978 cm) from EBR-I containing Cs-137 @ 364 pCi/g; 1,947 cubic yards (1,489 cm) from TRA-NSA containing Sr-90 @ 7,755, Eu-152 @ 913, Am-241 @ 684, Cs-137 @ 404, Eu-154 @ 146, Co-60 @ 74 pCi/g; 2,737 cubic yards (2,093 cm) from TAN Area B containing Cs-137 @ 75, Sr-90 @ 160 pCi/g; 2,208 cubic yards (1,88 cm) from TAN Technical Support Facility containing Cs-137 @ 39, Sr-90 @ 405 pCi/g. Contaminate soil from the ICPP was also dumped at the Warm Waste Pond. These percolation pond cells were then to be backfilled with six inches of soil to grade level. [DOE/ID-10531 @3-23] A reasonable observer would conclude that DOE has created another shallow radioactive dump site and nothing has been cleaned up.

If one accepts the agency's contention that the original plan to treat the sediments in a chemical extraction process is not feasible, then EDI proposes that the sediments must be exhumed and interned in a monitored retrievable storage (MRS) facility until the mixed waste treatment is operational. The worst contaminates in the top three feet would thereby be isolated from the environment. At some future time when vitrification treatment technology is developed to handle the waste then the MRS can be opened up and the material removed for treatment. After the sediments are removed from the pond, a membrane could be laid to delineate contaminate zones from backfill should the need arise to exhume additional sediments. An impermeable cap must then be placed on top of the backfilled pond to eliminate infiltration of precipitation that could leach additional contaminates into the aquifer. Unfortunately, none of this was done.

None of the agencies dispute that the Warm Waste Pond posed a significant threat to health and safety, and they recognized the need to initiate an interim remedial action to mitigate the threat. The agency's action consolidating the sediments in one or two cells of the pond clearly did not isolate the threatening contaminates from the environment, and therefore is not acceptable. Moreover, now the volume of the waste is tripled due to commingling of backfill and cap soils over the contaminated sediments making later cleanup actions unlikely.

At Hanford, DOE was forced by the regulators to construct the Environmental Restoration Disposal Facility (ERDF) that is a fully compliant RCRA Subtitle C Hazardous waste and NRC compliant low-level waste dump. The ERDF has a double liner, leach monitoring and collection wells, and an impermeable cap. This approach would work for INL if an on-site location can be found that is not above the Snake River Plain Aquifer.

ATRC Compliance with Applicable or Relevant and Appropriate Requirements (ARAR's)

Both the State and EPA have clearly turned a blind eye to enforcing ARAR's when they agreed to go along with DOE's refusal to cleanup the Warm Waste Pond. In this case the term enforcement agency is an oxymoron. Corporate America should be justifiably outraged at the double standard exercised by enforcement agencies. DOE acknowledges Cesium-137 concentrations of 110,000 pCi/gm in the sediments. [NRT-91052-NC@2-5] The standard for Cesium-137 is 10 pCi/gm. [EG&G-WM-8804] That represents 11,000 times over the standard that is established to protect human health and the environment. If DOE is allowed to walk away from this contaminated site like they did with the ATRC perched water which contained Cesium-137 in excess of 176,470 times the standard, what will get cleaned up? What legacies do these actions leave for future generations 540 years from now when the cesium has decayed to "safe" levels?

EDI challenges the Plan's statement that, "The sediment is not hazardous waste as described in RCRA, based upon tests conducted in 1990." [TRA Plan @ 7] Clearly, the sediment is a hazardous mixed waste as defined by court challenges to DOE's obfuscation of RCRA definitions. The agencies contend that even though there are RCRA listed contaminates DOE's tests show that they do not leach and therefore RCRA does not apply. No independent tests have been conducted to confirm DOE's claim to non-leachability. This begs the question as to how these contaminates got into the perched water zones in such high concentrations if it did not leach through the soil. DOE continues to circumvent RCRA requirements that specifically specify safe handling, treatment, disposal, and waste site closure standards. For instance, the Warm Waste Pond plan would not even pass EPA's Subtitle D municipal garbage landfill standards.

The ATRC pilot study goals state: "minimize or eliminate any characteristic which makes the [warm waste pond] waste RCRA hazardous, including treatment if necessary." [TRA ROD@30] This is indisputable evidence that there are RCRA classified constituents in the pond, and DOE's goal is to avoid RCRA requirements. RCRA closure requirements are further circumvented by not providing a non-permeable cap on top of the pond after extraction operations. This is important to keep precipitation from leaching residual contaminates still suspended in the sub-soils.

The Plan brazenly proclaims - without protest from the State nor EPA - that, "the new lined evaporation pond must be operational before significant cleanup can begin on cells currently in use." This statement clearly and unequivocally identifies EPA and the State with complicity with DOE's highest priority being continued operation - not protection of human health and the environment.

The Congressional Office of Technology Assessment found that, “Doe’s various priority systems have certain fundamental flaws and have yet to prove themselves useful in decision-making. The priority scheme used in the Five-Year Plan groups activities into four very broad categories. Most DOE activities fall into some portion of the first two categories primarily, ongoing activities ..."... "Yet, at present, the greatest uncertainty concerns the variables that should be given highest priority in these systems - reducing health and environmental risks." [OTA(a) @ 62-63]

The priority system developed by DOE's Office of Waste Operations provides the categories in descending order of importance for action and funding. In category number one, DOE puts "maintains ongoing activities." [DOE(b)] Again, DOE's priority system reflects the same misguided emphasis on continuing "operation" and "maintaining on-going activities" in priority number 1 over its legal obligations to comply with environmental regulations in priority number 3. INL's current crisis can be attributed to its historic failure to emphasize environmental compliance.

Other ATRC also called TRA Contamination Areas

Test Reactor Area had four separate groups of underground hot waste tanks (TRA-15, TRA-16, TRA-19, and TRA-603/605). TRA-15 has four tanks contained in two concrete basins that occupy about 624 square feet (58 square meters). Leaks in tanks 1 and 2 plus waste piping leaks resulted in extensive soil contamination that included the following pCi/g concentrations: alpha @ 40; beta @ 6,640; Sr-90 @ 2.280; U-234 @ 2,000. [DOE/ID-10531 @3-10] One of the tanks was removed in the 1960's after it leaked extensively.

TRA-16 is an underground hot waste storage tank. The contents of the tank were found to be ignitable waste contaminated with low levels of radionuclides, primarily uranium isotopes. The tank was emptied and excavated in 1993 and dumped at the RWMC.

TRA-19 has four Materials Test Reactor (MTR) underground rad tanks that had service line leaks including a significant incident in August 1985 that caused extensive soil contamination. Soil samples for gamma contamination (Co-60, Cs-134, Cs-137, and Eu-154) ran as high as 1,3000,000 pCi/g. [DOE/ID-10531 @3-14] TRA-603/605 tank was used for all the warm waste from the MTR

ATRC-04; “Warm Waste Retention Basin is composed of one large rectangular underground concrete structure divided into two cells by a common concrete wall and holds 720,000 gallons (2,725,200 L). The basin received waste in route to the Warm Waste Pond, and was designed to delay passage of reactor system flush water to allow sufficient time for radionuclides with half-lives of less than a few hours to decay.” “It is known that the Basin has been leaking since the 1970's. There have been a number of documented releases from the Retention Basin in the past, including pipeline leakage and leakage from the Basin at a estimated rate of 86,000 gallons (325,526 L) per day. Contamination from the Basin enters the perched water zone beneath TRA.” [DOE/ID-10531 @3-24] The Basin was not removed from service until August of 1993 despite the known leaks. Soil contamination around the Basin in pCi/g include: Cs-137 @ 9,150; Co-60 @ 1,320; Sr-90 @ 416: Pu-238 @ 5.08;

Pu-230-240 @ 3.79. [DOE/ID-10531 @3-25] "Well USGS-56 is located in close proximity to the retention basin where concentrations of up to 2,540 pCi/mL (2,540,000 pCi/L) of chromium-51 have been detected in the shallow perched zone wells. Thus, detection of chromium-51 is not considered unusual in USGS-56; however, this indicates rapid transport time from the shallow zone to the deep zone in this area." [EGG-WM-10002 @ 4-129] It must be noted that chromium contamination is what forced EPA to designate INL a Super Fund Site and put it on the National Priorities List. Other contaminates in the deep perched zone are Co-60 at 800 pCi/L; Sr-90 at 180 pCi/L; and U-234 at 14.2 pCi/L. [Ibid @ 4-115/4-116/4-129]

The Materials Test Reactor Canal (OU-2-8/ TRA-37) is located in the basement of the MTR. "The canal installed in 1952 leaked significant quantities of water contaminated with radionuclides for approximately eight years." [INL-94-0026 @a-8]

Advanced Test Reactor Complex (ATRC) Cleanup Cost

EPA's comments on the costs challenge DOE's estimates. "Several of the most significant costs are not adequately backed up by the cost summary and calculations." EPA lists twelve items as inflated, unsupported, or not needed. [EPA(b)]

DOE contractors that knowingly violate the law and create the polluted sites requiring Superfund cleanup are now being paid to cleanup their own mess. Former Congressman Mike Synar (D-OH) has stated that these contractors are "being paid at a profit to pollute."... "In any other Superfund situation, a private firm would be penalized for its pollution - by footing the bill itself for the cleanup." [Environmental Magazine 3/93 @42] The cost of actual cleanup is only part of the pork offered these polluters. Costs for remedial investigations, sampling programs, pilot studies, and community involvement put additional millions of dollars into DOE contractor profits.

Congressional Office of Technology Assessment (OTA) recommended that Congress "authorize an institution other than DOE to regulate those aspects of radioactive waste management activities not subject to DOE authority, and over which no other agency has authority, in order to enhance the credibility and effectiveness of those programs." "By limiting DOE self-regulation and providing appropriate independent regulation of radioactive waste management at the [DOE] Weapons Complex, Congress could provide a credible and effective mechanism for addressing the issues, problems, and prospective solutions related to the safe treatment, storage, and disposal of existing and future radioactive waste." [OTA(a) @141-142]

Radiological Release to Advanced Test Reactor Complex Evaporation Ponds by Tami Thatcher [132]

"An unspecified amount of what would be remote-handled waste was flushed to the open air radioactive warm waste evaporation pond outside the fence at the Idaho National Laboratory's Advanced Test Reactor Complex and discovered last year. There is no description of how long this had been going on when the radioactive material was finally noticed. The evaporation pond was not designed or intended to handle the radioactive material. There is no description of the total amount and what radionuclides were flushed. There is no description of the size of the area outside the pond that was contaminated. And there is no description of how many years would need to elapse before the radionuclides would not require institutional control.

"Anything and everything had been flushed to the retention basin and percolation ponds at the ATR Complex from its operating reactors, spent fuel pools and hot cell and laboratory operations commencing in 1952. From the percolation ponds, radionuclides migrated into the soil and groundwater below. The contamination was the most extensive in perched water above the aquifer. The long-touted improvement to use a lined evaporation pond beginning in 1993 instead of percolation ponds was described by the state, by the CERCLA cleanup and by the US Geological Survey to exemplify cleaner operations at the INL. They just failed to mention that while the lined evaporation pond did not push contaminants already in the soil and perched water into the aquifer, the retention basin where waste water was routed on the way to the evap pond that had been used for the earlier percolation ponds still had substantial leakage. In addition, other piping and fuel storage pool leakage had contributed substantially to soil and perched water contamination at the ATR Complex. Deep and shallow injection wells were also used at the facility. Lawn irrigation continues to accelerate contaminant migration.

"Despite discovering extensive americium-241 contamination in the perched water investigated as part of

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[132] Tami Thatcher, Environmental Defense Institute newsletter article *Radiological Release to ATR Complex Evap Pond* August 2017. http://www.environmental-defense-institute.org/publications/News.17.August.pdf

CERCLA cleanup in the 1990s at the ATR Complex, [133] the Department of Energy, state and federal Environmental Protection Agencies put their heads in the sand and ignored the transuranic contamination at the ATR Complex. It was not until 2015 that a soil investigation was conducted that torpedoed the Department of Energy's earlier statements that the ATR Complex would be allowed unrestricted use by 2095. [134]

" In the tardy 2015 investigation of soils at the ATR Complex, several long-lived radionuclides were found in the soil where the retention basin was located prior to demolition. [135] The soil contamination was 17 times higher for americium-241 than would allow unrestricted use, see Table 1 Below. This means it would take 17 half-lives for natural decay to lower the soil concentration sufficiently to reach the unrestricted use exposure level of 187 picoCurie/gram soil. The half-life of americium-241 is 430 years — but it decays to neptunium-239 which has a half-life of 2.1 million years. There are several other decay progeny before becoming non-radioactive. In other words, it will take longer than forever to reach unrestricted use levels.

"Plutonium-239 levels were also found above unrestricted use concentrations in soil analyzed in 215 and would take forever to decay to unrestricted use levels.

"Subsequent to early mid 1990s CERCLA investigations, the US Geological Survey monitoring and reporting specifically of shallow and deep perched water inexplicably omitted monitoring of americium or an alpha radionuclides in the shallow perched water at the ATR Complex. [136]

"Eventually, the contaminants in the soil and shallow perched water will migrate downward into the aquifer. Because DOE has wanted to promote the idea that all the significant radiological contamination would naturally decay away within 100 years, the DOE, INL contractors, the state, and the EPA have all actively avoided mentioning the long-lived radionuclide contamination. The cesium-137 and cobalt-60 radioactivity and others will decay away within 400 years. But the long-lived plutonium-239 and americium-241 contamination at ATRC in the soil will never decay to unrestricted use concentrations (see Table 1 below).

"At INL's INTEC facility, asphalt covers are installed to reduce the driving of known contamination into the aquifer. At INL's ATR Complex, no such action has been taken. At INTEC, a lined disposal facility called the Idaho CERCLA Disposal Facility is used for disposing of CERLCA wastes. At the ATR Complex, resins are left underground in buried piping and no one gets excited if the radioactively laden resins are flushed to the open air evaporation pond undetected possibly for years.

"DOE-ID Operational Summaries are posted online, albeit currently nearly one year late. [137] The final public Occurrence Reports can be found in a database in the Department of Energy's Dashboard. [138]

26002, Rev. 1., prepared July 2015. This NSI states that the retention basin cannot be released for unrestricted use by 2095. Nor can it be released for unrestricted use in 2310 as a 2011 DOE 5-yr review indicated. The document incorrectly states that institutional controls will require 24,100 years to elapse.

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133 Lewis, S.M, et al., EG&G Idaho, "Remedial Investigation (RI) Report for the TRA Perched Water System OU 2- 12," EGG-WM-10002, June 1992. https://ar.icp.doe.gov/ This and draft CERCLA evaluation documents in the early 1990s found perched water levels of Americium-241 at the Test Reactor Area of 2110 picoCuries/liter, far exceeding 15 pCi/L that relates to alpha emitters.

134 See. https://ar.icp.doe.gov/ See WAG 2 Operable Unit 2-13. Various documents beginning around 1997 discuss continuing institutional controls "for at least 100 years." There are public relations brochures saying natural radioactive decay would eliminate the health risk within 1000 years. And proposed actions would make no other actions required after 100 years. See NSI-260002 and other recent documents that have revised these previous statements.

135 Federal Facility Agreement and Consent Order (FFA/CO) New Site Identification (NSI), "TRA-04; TRA-712 Warm Waste Retention Basin System (TRA-712 and tRA-612)," Site Code: TRA-04, Document Number: NSI-26002.

136 Linda C. Davis, US Geological Survey "An Update of the Distribution of Selected Radiochemical and Chemical Constituents in Perched Ground Water, Idaho National Laboratory, Idaho, Emphasis 1999-2001. The is NO Americium monitoring at the Test Reactor Area now called the ATR Complex. There is not even gross alpha monitoring in the perched water found to have exceeded the MCL for americium in CERCLA studies conducted just a few years before this report was written although it was not released until 2006.

137 DOE-ID Operations Summaries, http://www.id.doe.gov/NEWS/OperationsSummarys.htm retrieved May 25, 2017, with no report of events since August 2016.

138 Department of Energy Final Public Occurrence Reports as of May 2017. See https://energy.gov/ehss/policy-guidance-reports/dashboards

But they have forgotten that americium-241 decays to neptunium-237 and so have underestimated to time for americium-241 to decay to levels not requiring institutional controls by a few million years.

“**Table 1.** Past retention basin soil sample results compared to concentrations allowing unrestricted use and an estimate of potential resin radioactivity concentrations.

Radionuclide (Half Life)	2015 Retention Basin soil samples (pCi/g)	CERCLA Unrestricted Access level (pCi/g)	Years Until Unrestricted Use	Note
Americium-241 (432.2 y)	3210	187	**1,772	These estimated years indicated in the NSI is incorrect because of the continuing decay progeny, notably Np-237. Potential resin concentration is 7000 pCi/g.
Neptunium-237 (2.1 million y)	(would increase over time due to Am-241 decay)	13		Np-237 contamination concentrations are restrictive than Am-241.
Plutonium-239 (24,065 y)	520	259	24,100	Potential resin concentration is 6000 pCi/g.
Plutonium-238 (87.7 y)	671	297	103	Pu-238 would decay to acceptable levels after one half life. Potential resin concentration is 5000 pCi/g.
Cesium-137 (30.2 year)	45000	6	388	Cs-137 would decay to acceptable levels after 13 half lifes. Potential resin concentration is 2 million pCi/g.
Europium-152 (13 y)	9950	4.16	146	Potential resin concentration is 7500 pCi/g.

Cobalt-60 (5 y)	124,000	3.61	79	Potential resin concentration is 5 million pCi/g.

From Table 1 of NSI-26002. units pCi/g are picocurie/gram. Potential resin concentrations are based on INL/EXT-06-11601 and assume 1 gram per cubic centimeter when conversion from Ci/m^3 was needed. The actual resin radioactivity concentrations released and reported in 2016 may be less.

"The Department of Energy Idaho Operations Summary for the event phrased the May 12 Occurrence report mildly: "Contaminated soil was discovered outside of a contamination area near the Advanced Test Reactor (ATR) evaporation ponds. Pre-work surveys were being performed in preparation for the ATR Complex Warm Waste Evaporation Pond liner replacement project. A radiological buffer area had been established to support surveys of the area surrounding the evaporation pond contamination area. A normally unoccupied area was surveyed and contamination was found in the soil. Following the discovery, the area was posted as a soil contamination area. Surveys of the road around the evaporation pond were conducted and no additional contamination was found."

"However, the full Occurrence Report (OR) stated **that soil contamination levels were as high as 250,000 disintegrations per minute per 100 square centimeters near the pond.** The contractor admitted that radionuclides were being sent to the open-air pond that the pond was not designed for. And the OR stated that snow fence was erected to limit the spread of radioactivity among other actions.[139]

"**This is not the first time radioactively laden resins, intended to capture radionuclides and clean up the waste water, have escaped the resin beds.** Resin beads were found near an underground piping leak in waste water lines headed for the evap pond. [140] Radiation monitors that should have detected the elevated radiation levels in the waste water going to the pond were either kept off or were otherwise ineffective in detecting the elevated radiation levels in the waste water. The damaged pipe and resins inside it were then left in the ground.

"But in the 2016 OR, it was admitted that the resins escaped to the open air evaporation pond and resulted in contaminating the pond and soil near the pond. The reality is that resins may have been sent to the pond since the evap pond was installed in 1993. The degree to which the release may have increased in recent years or months is not described.

"When resins were previously found as described in DOE/NE-ID-11139 in the 2001, federal cleanup CERCLA Track 1 documentation was prepared. But apparently this has not occurred for the 2016 OR despite the radioactivity involved being above ground rather than occurring underground where a pipe was leaking.

"The evap pond installed in 1993 was to accept only warm waste water that had been filtered through resin cleanup systems and the main radionuclide to be released was to be tritium. Based on DOE/NE-ID-11139, the normally accepted levels of radioactivity released to the evap pond are not trivial and the tritium released to the evaporation pond is in concentrations far exceeding drinking water standards, over 9 million picocuries/liter. [31] But the Battelle Energy Alliance does not estimate its releases of tritium from the ATR Complex to the skies. This requires others to make rough estimates when creating air emissions reports for the INL.

"Instead of just sending filtered waste water to the evap pond, the resin beads laden with the radionuclides that they are supposed to be removing from the waste water have been sent to the evap pond potentially greatly increasing the radioactivity. The levels of radioactive concentrations for a few of the many dozens of radionuclides they may contain are provided in Table 2 based on INL/EXT-06-11601.

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139 Department of Energy Occurrence Report NE-ID—BEA-ATR-2016-0014. "Contaminated Soil Outside Warm Waste Evaporation Pond at the ATR Complex." a copy made available on our website www.environmental- defense-institute.org/publications/ATR-2016-0014.htm

140 DOE/NE-ID-11139, "Track 1 Decision Documentation Package for TRA-605 Warm Waste Line," January 2005. http://ar.inel.gov/images/pdf/200503/2005030300231KAH.pdf

"**Table 2.** Maximum resin concentrations for a few selected radionuclides based on INL/EXT-06- 11601.

Radionuclide (Half Life)	Potential Used Resin Concentration (pCi/g)	CERCLA Unrestricted access level (pCi/g)	Average (mean) soil background levels at INL (pCi/g) [a]	Note
Americium-241 (432.2 y)	7000	187	0.005	Am-241 decays to Np-237.
Neptunium-237 (2.1 million y)	(would increase over time due to Am-241 decay)	13	not compiled	Np-237 contamination concentrations are restrictive than Am- 241.
Plutonium-239 (24,065 y)	6000	259	0.024	
Plutonium-238 (87.7 y)	5000	297	0.0014	Ci/m3 coverted to Ci/g assuming 1 g per cubic centimeter.
Cesium-137 (30.2 year)	2,000,000	6	0.44	
Europium-152 (13 y)	7500	4.16	not compiled	
Cobalt-60 (5 y)	5,000,000	3.61	not compiled	

Units pCi/g are picocurie/gram. Potential resin concentrations are based on INL/EXT-06-11601 and assume 1 gram per cubic centimeter when conversion from Ci/m^3 was needed. The actual resin radioactivity concentrations released and reported in 2016 may be less. Note a: Soil background concentrations based on S. M. Rood et al., Idaho National Engineering Laboratory, "Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory," INEL-94-0250, August 1996. Table 23.

"The 2006 INL report (INL/EXT-06-11601) characterized potential ATR resins from experiment loops and the main primary coolant system in order to investigate waste disposal options. [141] The ATR resins require remote handling and are too radioactive to be accepted by most commercial low-level radioactive waste disposal facilities. Basically, Texas will only accept the federal waste if DOE agrees to take possession of the dump. [142] There are federal disposal facilities in Washington and Nevada but those states don't want to accept the waste. The resins likely include cesium-137, strontium-90, and may include long-lived radionuclides significant for migration to the aquifer including americium-241, neptunium-239, plutonium-239, iodine-129, technetium-99 and others.

"For that reason, these radioactive resins with long-lived radioisotopes are shallowly buried over the Snake River Plain aquifer at the Radioactive Waste Management Complex and soon to be buried over the aquifer at the Remote-handled Low-level Waste facility outside the fence at the ATR Complex. And for now, some unknown quantity of the radionuclides from the resins have apparently been flushed to the open air evaporation pond and may be blowing in the wind. Don't worry. The DOE occurrence report says they put up snow fence to reduce the blowing.

141 Timothy Carlson et al., Idaho National Laboratory for the Department of Energy Office of Nuclear Energy, "Low- level Waste Disposal Alternative Analysis Report," INL/EXT-06-11601 rev. 1, September 2006. Table B-2-4. https://inldigitallibrary.inl.gov/sites/sti/sti/3661678.pdf

142 INL/EXT-06-11601 rev. 1, p. 3-2, from 2006 states that "Texas has a state law that requires DOE to take possession of the site after closure, if a 'federal waste' site is opened. DOE has not made a policy decision to accept future liability for the site after closure."

"In addition to the radiological contamination posed by the release of used resins to the evap pond that can have a long term environmental effect, workers conducting work near the pond at any time since the release may have received both external and internal exposures. The alpha and beta radioactivity would not be measured by a workers radiation badge although the badge, if worn outside the fence, would detect increased gamma radiation. The inhaled radionuclides would be undetected. Subsequent illness compensation claims may never factor in their possible unrecorded inhalation internal radiation doses.

The INL Battelle Energy Alliance public affairs folks, quite predictably, refused to answer any questions about their significant radiological release, including whether or not the release was intentional. And so far, there is no indication that the Idaho Department of Environmental Quality has done anything but facilitate INL's radiological release coverup." [143]

Section IV.E. Test Area North Cleanup Plans

Ground Water Contamination at TAN

The self-serving language in DOE's Test Area North (TAN) Fact Sheets persists as with all previous publications on INL. A consistent effort to minimalize the risks and hazards is pervasive. "The DOE believes the current risk of exposure to groundwater contaminants is minimal. At this time, only contaminated wells are located within a few miles of the TAN and all the drinking water at the facility is treated before use, so no human health exposures exist." [TAN Fact @ 3] EDI considers this an incredulous statement when DOE later states that: "none of the [treatment] alternatives [in the interim actions] would meet drinking water standards for the groundwater under TAN." [TAN Plan @ 8] Either the TAN potable water is not safe; or, DOE can treat the ground water for TAN production facilities but not for the cleanup of the TAN ground water contaminated by TAN facilities.

DOE's solicitous statement that the plume has only migrated a few miles challenges any public confidence that it is capable of objective characterization of its own mess. The following list of contaminates was not on DOE's Community Relations Plan (CRP) Fact Sheets: [TAN Fact]

List of Contaminates of Concern in the TAN Ground Water 1987-1998

Contaminate	Concentration	Drinking Water Standard
TCE	35,000 ug/L	5.0 ug/L
PCE	170 ug/L	5.0 ug/L
DCE	9,300 ug/L	5.0 ug/L
Strontium-90	1,930 Ci/L	8.0 pCi/L
Tritium	43,200 pCi/L	20,000.0 pCi/L
Cesium-137	7,500 pCi/L	119.0 pCi/L
Plutonium-238	1.22 pCi/L	7.02 pCi/L
Plutonium-239-240	5.0 pCi/L	62.0 pCi/L
Cobalt-60	890 pCi/L	100.0 pCi/L
Uranium-234	17 pCi/L	13.9 pCi/L
Europium-154	6.62 pCi/L	200.0 pCi/L
Americium-241	23.6 pCi/L	6.34 pCi/L

[TAN ROD @ 17][EGG-10802][EGG-10643]

Of particular concern is the high tritium contamination at TAN and the public and worker risks from

[143] Tami Thatcher, Environmental Defense Institute newsletter article *Radiological Release to ATR Complex Evap Pond* August 2017. http://www.environmental-defense-institute.org/publications/News.17.August.pdf

tritium exposure. For instance, huge tritium releases from INL facilities have been largely ignored despite the known risks. A cursory review of the literature by EDI reveled a significant body of research challenging DOE and the nuclear industry's public contentions that tritium is of little public health concern. Two studies by DOE's Battelle NW Labs in 1972 and 1982 found that rainbow trout exposed to tritium only 0.4 rad above background levels resulted in permanent immune suppression in all the fish.[Strand] Numerous other studies on animals have proven significant genetic damage and other biological dysfunction as a result of tritium exposure. Also see references on tritium studies.

Maximum contaminant in TAN TSF-05 injection well sludge

[OU 1-07B TAN groundwater RI/FS work plan, Appendix B and G]

Substance	Concentration	EPA Standard
1,1 trichloroethylene	24 ug/gm	7 ug/L
methylene chloride	290 ug/l	?
trans-1,2-dichloroethylene	410 ug/gm	5 ug/gm
Trichloroethylene	30,000 ug/gm	5 ug/gm
Tetrachloroethylene	2,800 ug/gm	5 ug/gm
2-butanone(methyl ethylketone)	180 ug/gm	?
Barium	326 ug/gm	1,000 ug/gm
Lead	180 ug/gm	50 ug/gm
Chromium	91 ug/gm	50 ug/gm
Mercury	101 ug/gm	2 ug/gm
Gross Beta	4,900,000 pCi/l	8 pCi/l
Gross Alpha	6,000 pCi/l	15 pCi/l
cobalt-60	812 pCi/gm	
cesium-137	2,340 pCi/gm	
emporium-154	6.62 pCi/gm	
americium-241	23.6 pCi/l	6.34 pCi/l
Tritium	1,000,000 pCi/l	20,000 pCi/l
plutonium-241	123.6 pCi/l	62.6 pCi/l
plutonium-239	12.2 pCi/gm	

[TAN Sludge] [TAN ROD @18][EGG-ER-10643][INL-95/0056@5-25]

Groundwater Pump and Treat Action at Test Area North (TAN)

DOE only identifies trichloroethylene, tetrachloroethylene, lead and strontium as contaminates at TAN. [TAN Fact @ 3] The State INL Oversight list additionally identifies cesium, cobalt, plutonium, americium and tritium also have been detected at high activity levels in the [TAN] injection well. [Oversight(b)] Though the State's list which is more complete, neither agency is telling the whole story in their public literature. The State cites migration of tritium and strontium-90 (Sr-90) in the ground water. [Oversight (b) @ 29] Sr-90 levels of 10 pCi/L in TAN-1 well, 12 pCi/L in TAN-2 well, and 27 pCi/L in APN-9 are also acknowledged by the State. [Ibid] The maximum Sr-90 contaminate level for drinking water standard is 8 pCi/L. DOE has an obligation to state the data presented in the previous tables in their fact-sheets, and the other agencies clearly are remiss by not ensuring that appropriate data reaches the public. Additionally, Test Area North 616 Tank area, trench soil has readings of 54,120 pico curies/gram in the soil which indicates additional contaminate sources than currently acknowledged.

[RE-P-80-090, p.6]

DOE's contention that the contaminate plume has not migrated more than 1/4 mile [TAN Plan @ 4] is in direct contradiction to its own fact-sheet stating contaminated wells located within a few miles of TAN [TAN Fact@ 3] and the State's report. [Oversight(b)@ 29] Additionally, DOE's claim that "trichloroethylene plume is not expected to reach existing supply or drinking water wells in areas outside of TAN for over 100 years" [TAN Fact@ 4] is currently being challenged. Knowledgeable hydrologists not related to DOE argue with justification that the aquifer is not homogenous and indeed, the existence of lava tubes can provide for speedy dispersion of contaminates. Even if the public were to accept the questionable 100-year migration time, the identified TAN contaminates have a half-life of thousands of years, a fact which dominates the discussion. This claim also contrasts to DOE's recent admission that Iodine-129 migrated eight miles south of the site and that "Our computer modeling has predicted for years that these contaminates would be detected off-site." [AP 2/13/93]

The groundwater pump and treat action will discharge partially treated water into the old leach pit. Any continued use of the existing TAN percolation pond (leach pit) - whether divided or not - is unacceptable. DOE's contention that "contaminates already in the pond would not be pushed deeper into the soil by water coming from the interim action" [TAN Plan @ 6] is totally unfounded. Sample data of the percolation pond show gross alpha at 53 pCi/g, and gross beta at 28 pCi/g. [TAN--5171 @ 17] EDI proposes that a new fully- lined evaporation pond, meeting Subtitle C requirements, must be built some distance from the present one to receive the processed TAN ground water. Even if the new lined pond had some minimal leakage, the water would not be flushing subsurface contamination downward as would be the case in the existing TAN percolation pond.

DOE acknowledges that: "The treatment facility built under these alternatives would be expected to remove a minimum of 90% of the contaminates in the groundwater before the treated water is discharged to the TAN disposal pond." And that: "none of the [treatment] alternatives [in the interim actions] would meet drinking water standards for the groundwater under TAN." [TAN Plan @ 8] The June 9, 1994 Moscow hearing presentation by EG&G project spokespersons acknowledged that the treated water discharged to the percolation pond contains greater than 300 pCi/l strontium-90. [Also see TAN ROD] This violates the Clean Water Act, Idaho Hazardous Waste Management Act and therefore does not meet the Applicable or Relevant and Appropriate Requirements (ARAR) rule. Discharging Sr-90 three hundred times the EPA's maximum concentration level of 8 pCi/l so that it can migrate back into the aquifer is unconscionable.

Environmental Defense Institute (EDI) suggests that technologies do exist to treat the groundwater to drinking water standards. No public acceptance should be expected for reintroducing contaminates back into the aquifer because DOE does not want to spend the money on appropriate resin filter technologies. If the agencies proceed with the identified treatment processes, the bottom line is: do not use the existing TAN percolation pond. Therefore, the "treated" groundwater must be categorized as a hazardous waste; and the new EDI proposed lined evaporation pond must be permitted by the State as a RCRA waste site. Because EDI raised this issue of re-dumping contaminated water, the agencies agreed to conduct more extensive treatability studies using commercially available resin filter columns. Despite success with these studies it is uncertain whether DOE will agree to pay the additional costs for the resins and appropriately dispose of the filters.

DOE's claim is unfounded that; "The only acceptable disposal option for this mixed waste [filter] carbon would be complete destruction in a special incinerator that also could capture the radionuclides." [TAN Plan @ 10] DOE previously used the Waste Experimental Reduction Facility for decades before EDI filed a Notice of Intent to Sue forcing the closure. See Section I.G for details on INL radioactive waste incinerators. EDI supports the Hanford approach recently negotiated with the State of Washington, EPA, and the stakeholders. The technology chosen is vitrification of all low-level, mixed, and high-level (except for spent fuel) into a stable glass/ceramic form. This approach will meet RCRA requirements and also put the waste in a stable form that can be safely stored until a permanent repository is developed. An important issue yet to be resolved is DOE's insistence on pre-treatment which the stakeholders justifiably consider a waste of money.

Additionally, delisting TAN waste treatment residuals from the hazardous waste classification subject to RCRA Subtitle C hazardous waste disposal and closure requirements; and classifying the waste in the same category (Subtitle D) as municipal garbage, is illegal. This arbitrary switch in waste classification by the stroke of DOE's pen must not go unchallenged by the State or EPA. Little public confidence exists for EPA's Best Demonstrated Available Technology (BDAT) requirements. For a detailed discussion on these inadequate and controversial regulations see the Natural Resources Defense Council's comments on "Land Disposal Restrictions for Newly Listed Wastes and Contaminated Debris." "Although EPA acknowledges that technology is available, has been demonstrated and meets all of the relevant standards for NWW constituents, the agency improperly based its BDAT determination on less effective incineration and solvent extraction technologies." Moreover, "incineration technologies often cause an irreconcilable conflict due to the need to operate at a high enough combustion temperatures to destroy organic wastes without also volatilizing the radionuclide constituents." [NRDC(c), 2/24/92 @ 4]

Another monumental problem faced at INL is the strangle hold contractors have on the site. What cleanup money does finally make it to Idaho, is eaten up by these site contractors who charge excessive overhead for doing the work. Cleanup contracts at other DOE sites allow only 30% overhead charges, and consequently get three times the work accomplished. DOE Headquarters is now attempting to reign in these excesses by awarding the INL Maintenance and Operations contract to Lockheed Martin, however recent Inspector General Audit suggests that little has changed. See Section I(K).

Comprehensive TAN Cleanup Plan

DOE’s Proposed Comprehensive Plan for Waste Area Group 1 (Test Area North TAN) dated February 1998 fails to provide remedial solutions that meet Applicable or Relevant and Appropriate Requirements (ARAR). The Plan offers no substantive information about the maximum contamination levels related to individual Operational Units (OU). Consequently, the general public is effectively denied essential information upon which to make their own determination of whether the preferred alternatives were appropriate.

The Plan claims to be “the comprehensive” CERCLA investigation into TAN. This is not a “comprehensive” Plan because the ANP Cask Storage Pad, the Area 10 HTRE Reactor Vessel Burial Site, and the TAN Pool have been excluded. The disposition of the contaminated Tan Pool water into unlined pits and the dumping of the “hardware” and “reactor fuel support structures “in the Pool as low-level waste is particularly egregious. [DOE/EA-1050@ 17&a-4] If the hardware and fuel element parts were properly classified as greater than class C low-level waste (GCC), DOE would legally be blocked from dumping it at the RWMC although that never stopped the Department from dumping GCC there in the past.

The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that the Department was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law. The need for the INL equivalent to the ERDF is discussed in the INL Environmental Impact Statement and the INL Site Treatment Plan but DOE has yet to initiate construction because the regulators are allowing short cut ER proposals to go through. DOE’s own “off-aquifer siting analysis identified two areas off the Snake River Plain Aquifer (Spent Fuel Storage at the INEL Yet off the Aquifer). [DOE/EA-1050@B-5] Another option would be for DOE to purchase additional adjacent land at the northwest of the site for an ERDF type dump off the aquifer.

The contamination the TAN Plan addresses is mixed hazardous / radioactive low-level waste (MLLW) and is listed in DOE’s own Site Treatment Plan (STP) which the Department was required to generate to comply with the Federal Facilities Compliance Act. This MLLW designation is supported by the TAN Remedial Investigation/Feasibility Study (RI/FS) sample data that clearly shows Resource Conservation Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) extraction analysis results exceeding the regulatory limit in 40 CFR ss 261.23. Therefore RCRA Land Disposal Restrictions (LDR) in 40 Code of Federal Regulations (CFR) Parts 148 and Parts 268 for MLLW and Nuclear Regulatory Commission 10 CFR-Subpart D ss 61.50 must be applied. Unfortunately, the State of Idaho Division of Environmental Quality (DEQ) and the Environmental Protection Agency as regulators refuse to force DOE to comply with the legal requirements of the most basic of environmental laws. The Plan proposes disposal of this MLLW in a manner that would not even comply with municipal garbage landfill requirements let alone the more stringent MLLW regulations. For those TAN hazardous waste release sites, the LDR's in 40 CFR 148 & 268 still apply.

Adding to the list of lessons NOT learned we must add dumping radioactive and chemical waste in unlined shallow pits and trenches over top of the regions sole source Snake River Plain Aquifer. This misguided dumping practice at the INL Radioactive Waste Management Complex Subsurface Disposal Area has resulted in extensive contamination of the aquifer. The proposed TAN Plan intends to repeat this dumping practice despite undeniable examples of failure of this approach. DOE has already gotten away with this illegal dumping in the Test Reactor Area Warm Waste Pond Environmental Restoration project completed in 1997. The Department proposes to repeat this type of dumping at the Naval Reactor Facility, Argonne-West and again at Test Area North. Still another lesson NOT learned at INL is the public and regulators rejection of grouting of MLLW and shallow land burial at Hanford. DOE proposes grouting the TAN tank wastes and leaving it in place in the existing waste tank. Grouting did not meet treatment and disposal requirements of MLLW at Hanford or INL. The State of Idaho simply will not force INL to comply with the relevant laws.

Below Table A lists the Operable Units (contaminate release sites) and the proposed decisions remedial actions or no actions. Table B lists the Operable Units and selected sampling data and the source of the data. This information is the result of weeks of review of the voluminous Administrative Record. The Environmental Defense Institute believes that this information is essential to making an informed decision as to whether DOE preferred alternative is appropriate and therefore should have been included in the Plan that was mailed out to the general public.

DOE has never in any of its INL Environmental Restoration Record of Decisions (ROD) been forced by the regulators to specify what institutional control constitutes. Only through that legally binding document can DOE be held liable for specific actions. For instance, 100 years of institutional control (the amount DOE has committed to) could be interpreted as retaining ownership and annual flybys to monitor the site. In view of the toxicity of the waste being hazardous for hundreds of thousands of years, this is a crucial issue. The length of time the waste will pose a risk to any intruder must determine the duration of institutional control and barriers adequate to keep intruders out must be maintained for the duration. Monitoring must include soil and ground water sampling to ensure the waste is not migrating. A trust fund must also be established so that if the federal government again decides to ignore the law, that state or local government will have the resources to do the job.

Table A and B Ignored sites: ANP Cask Storage Pad Area 10 Reactor Vessel Burial Site
TAN Pool contaminated soil

Table B

TAN Site	Contaminate	Concentration	Reference *
ANP Cask Storage Pad	Gross Alpha	330 pCi/g	(a) Table A-5-5
	Gross Beta	25,600 pCi/g	"
	Cs-137	30,400 pCi/g	
TSF-3 Burn Pit	Lead	2,830 mg/kg (a)	(a) Table A-2-3
TSF-06 Contaminated Soil	Cs-137 Mercury Gross Beta	30,400 80,500 mg/kg 1,880 pCi/g	(a)4-24 (a) Table A-5-6 (a) Table A-5-7
TSF-07 TAN Disposal Pond	Aluminum	25,400 mg/kg	(a)4-29
	Barium	9,740 mg/kg	(b) 4-110
	Mercury	4,040 mg/kg	"
	Sulfide	4,270 mg/kg	"

	Cobalt-60	87.7 pCi/g	“
	Cesium-137	135 pCi/g	“
	Cesium-137	135 pCi/g	“
Drainage Pool TSF-10	Aluminum	30,400 mg/kg	(a)4-26
TSF-09/18 V-1 Tank Liquid	Cobalt-60	101,000 pCi/l	(a) Table A-6-10
	Cs-134	16,900 pCi/l	(a) Table A-6-10
	Cs-137	12,500,000 pCi/l	(a) Table A-6-10
	Europium-152	83,800 pCi/l	(a) Table A-6-10
	Europium-154	93,800 pCi/l	(a) Table A-6-10
	Plutonium-238	7,010 pCi/l	(a) Table A-6-10
	Plutonium-239	3,220 pCi/l	(a) Table A-6-10
	Gross Beta	16,100,000 pCi/l	(c) 59
	Gross Gamma	24,300,000 pCi/l	(c)59
TSF-09/18 (continued)	Gross Alpha	19,800 pCi/l	(c) 59
	Tritium	11,800,000 pCi/l	(a) Table A-6-10
	Total Strontium	1,840,000 pCi/l	(a) Table A-6-10
	Lead	842 ug/l	(a) Table A-6-10
	Tetrachloroethene	1,800,000 ug/kg	(a) Table A-6-11
	Trichloroethene Tetrachloroethene Vinyl Chloride	All three chemicals/metals Exceed TCLP	(c) 8 through 12
Tank V-2	Gross Beta	6,340,000 pCi/l	(c) 59
	Gross Gamma	38,500,000 pCi/l	(c)59
	Gross Alpha	84.9 pCi/l	(c) 59
Tank V-2 (continued)	Trichloroethene Tetrachloroethene Cadmium Vinyl Chloride	All four chemicals/metals Exceed TCLP	(c) 8 through 12
V-3 Tank	Uranium-233/234	13,300 pCi/l	(b) A-83
	Strontium-90	12,300,000 pCi/l	“
	Cobalt-60	14,800 pCi/l	“
	Cesium-137	4,230,000 pCi/l	“
	Ruthenium-103	13,600 pCi/l	“
	Tritium	6,090,000 pCi/l	“

	Nickel-63	205,000 pCi/l	"
	Gross Beta	28,300,000 pCi/l	(c) 59
	Gross Gamma	2,230,000 pCi/l	(c) 59
	Trichloroethene Tetrachloroethene Vinyl Chloride	All three chemicals/metals Exceed TCLP	(c) 8 through 12
V-1, 2, 3 & 9 Tanks	STP lists waste as	MLLW	
V-9 Tank	Americium-241	40,200 pCi/l	(b) A-91
	Plutonium-238	170,000 pCi/l	(b) A-91
	Plutonium-239/240	45,300 pCi/l	(b) A-91
	Uranium-233	12,400 pCi/l	(b) A-91
	Uranium-234	211,000 pCi/l	(b) A-91
	Uranium-235	6,900 pCi/l	(b) A-91
	Uranium-236	3,260 pCi/l	(b) A-91
	Uranium-238	972 pCi/l	(b) A-91
	Cesium-137	6,370,000 pC/g	(b) A-91
	Tritium	353,000,000 pCi/l	(b) A-91
	Total Strontium	250,000,000 pCi/l	(b) A-91
	37 hazardous chemicals/metals		(b) 10-44
PMA-2M TSF-26 V-13 Tank	Cobalt-60	45,900,000 pCi/l	(c) 31
	Europium-154	93,000,000 pCi/l	(C)31
	Cesium-137	2,900,000,000 pCi/l	(c) 31
	Strontium-90	2,850,000,000 pCi/l	(c) 31
	Cesium-134	18,100,000 pCi/l	(c) 31
PMA-2M TSF-26 V-14 Tank	Cobalt-60	191,000,000 pCi/l	(c) 31
	Cesium-134	2,000,000 pCi/l	(C) 31
	Cesium-137	9,420,000,000 pCi/l	(c) 31
	Europium-154	17,200,000 pCi/l	(c) 31
	Strontium-90	9,260,000,000 pCi/l	(c) 31
	32 hazardous chemicals/metals		(b) 10-28
V Tank soil	STP lists as MLLW	54,120 pCi/g	RE-P-80-090 @6
V-13 & V-14 Tanks	STP lists liquid/sludge	MLLW	STP @ 6-3

IET Valve Pit TSF-21	Cs-137	602,000 pCi/l	(a)Table A-9-2
	Lead	9,350 ug/l	(a) Table A-9-2
	Trichloroethene	22,000 ug/l	“
Loft-02 Disposal Pond	Aluminum	23,900 mg/kg	(b) 7-43
	Manganese	1,080 mg/kg	“
	gross alpha	8,400 pCi/kg 8.4 pCi/g	“
	gross beta	6,500 pCi/kg 6.5 pCi/g	“
WRRTF-01 Burn Pit	Xylene	6,600 ug/kg	(a) Table A-3-3
	Acetone	4,200 ug/kg	(a) Table A-3-5
	Naphthalene	7,800 ug/kg	(a) Table A-3-5
	2-methylnapthalene	10,300 ug/kg	(a) Table A-3-5
	Lead	2,350 ug/kg	(a) Table A-3-6
Diesel Fuel Tank WRRTF-13	TPH	35,700 mg/kg	(b) 4-140

*See Reference Section for the following table references: (a) DOE-ID-10527; (b) DOE-ID-10557; (c) TAN(d)

TAN SNAPTRAN Tests by Tami Thatcher

Tami Thatcher writes; “There were three SNAPTRAN tests at INL in the 1960s all conducted at TAN. The INL was given three SNAPTRAN reactors to play with. These were designed as an experimental reactor to launch into space. A SNAPTRAN reactor was actually launched in 1965. It operated just 43 days before an electrical failure caused it (to be shut down?) (Google wiki SNAPTRAN)

“These were U-235 cores, 15.6 in. long by 8.8 inches in diameter. (Contrast this to ATR’s 4 ft. long, 4 ft. diameter core?) These were thermal power of 30 kW contrast to the Advanced Test Reactor is 250 MW thermal but usually operated at only about 100 MW thermal.

But what matters is the total amount of fissionable material in the core, not the rate at which it was designed to produce power. These had beryllium reflectors and were sodium-potassium Nak cooled.

“ One of the three did not dismantle or disassemble the reactor core so there’s no plume of it mentioned in the ERDA-1536 document or INEL HDE. But apparently it did go critical, become radioactive, and I found somewhere it said “it was only slightly damaged.” I can’t find where I read that. The thing is that all three would have also been a worker exposure source for TAN workers in the 1960s. And John Horan’s report of external radiation exposures in the 1990s, he claims he thinks it was an error that so many workers got over 5 rem but then on closer examination can’t find an error. He was in charge of safety in the 60s, including keeping tabs on worker radiation doses. So his claimed surprise at the high recorded doses is “incredible.” So one issue is the worker exposure from the SNAPTRAN tests which NIOSH tries to approach from looking at the INEL HDE created for offsite dose evaluation.

"J. R. Horan, "Occupational Radiation Exposure History of the Idaho Field Office Operations at INEL," EGG-CS-11143, October 1993. [144] [145] Thatcher wrote:

> "Following one SNAPTRAN test, the plume was tracked 21 miles by plane. Subsequent monitoring in Monteview, a farming community near TAN at the near end of the INL included cow's milk and alfalfa concluded that the release wasn't above allowable standards but never told residents. The DOE's 1966 report [1] concluded that the release was 20 percent of the total inventory, but it doesn't say what the total inventory was. The INEL Historical Dose Evaluation listed the release on January 11, 1966 as 2000 curies but the DOE's waste document said 600,000 curies. [2] They proceed to say "The SNAPTRAN-2 Reactor Dolly was dismantled and the reactor structure and components were removed to the burial ground. Forty-seven truck-loads of contaminated soil were removed from around the IET area to the CFA burial ground." If you understand how DOE is really not that particular about soil contamination, you know that the soil had to be hotter than hell. Around the BORAX I reactor debris from intentionally blowing it up, later, a few rocks were scattered over the top of it. Decade's later CERCLA reviews found unacceptably high soil contamination problems at TAN where the SNAPTRAN and initial engine tests took place, among others. Coincidentally, the US Geological Survey stopped well water monitoring for the entire north end of the INL from NRF to TAN after 1963 for about a decade." [146]

"The discrepancy between the 2000 curies and the 600,000 curies is said to be because the 2000 curies is the long-lived curies that blew offsite. They are saying that the short-lived curies stayed on-site. And p. A-64 SNAPTRAN, they say released 75 percent of the noble gases, 70 percent of the iodine, 45 percent of the tellurium, 4 percent of the "solids" this being alpha emitters like uranium and plutonium that they would not have monitored for, likely, and only 21 percent of the fission product inventory." Yes, a large fraction of the curies are short-lived. But the longer lived fission product inventory – how reliable is the 21 percent estimate? How reliable is the solid's 4 percent estimate? Well, these questions take more research and are harder to answer, especially without the environmental monitoring data.

ERDA-1536 p. II-248 says "only slight ground contamination" plume followed 21 miles but no iodine, only noble gases. 10 mrem 6 miles at boundary of INL. If the ground contamination was only "slight" then why the multiple truckloads of soil hauled away? And excessive soil contamination found years later?

4/1/1964 SNAPTRAN-3 Underwater, but steam ejected. 45 MW-sec of nuclear fission. Said to be a fireball. Prompt critical. "Blew up."

1/11/1966 SNAPTRAN-2 54 MW-sec of nuclear fission. Open air test, so no chance of iodine scrubbing from water. But DOE says "once again, the total integrated rad exposure at the nearest boundary was less than 10 mrem."

"So I think there is an issue about what was actually released by the two destructive SNAPTRAN tests. There's the mystery milk in SE Idaho in the 1965 and 1966 documented in Table E-5 of the INEL HDE. [147]

"There is an unsigned press release that is part of the DOE's Human Radiation Experiments collection dated July 20, 1965 of a destructive SNAPTRAN test. Why was this press release part of the Human Radiation Experiments collection, since acknowledged tests were not on this date? [148]

"There is reporting of fuel processing at the "chem. plant" for two SNAPTRAN tests, but we know there were three. This report below has Table V that lists all the fuel processed at ICPP.

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144 http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/26/050/26050117.pdf#search=%22doe%2Fid-12119%22

145 ERDA-1536; Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research & Development Administration, September 1977. p. II-249.

146 EDI's website here: http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf

147 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. See Table E-5 on p. E-36 for mystery milk and see Table C-21 for the public annual dose summary. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html

148 See the Department of Energy Human Radiation Experiments documents collection (of the small subset publically accessible) including J. R. Horan, "Annual Progress Report 1963, Idaho Operations Office of the US Atomic Energy Commission," 1964, and INEL-HRE-TO70228 and the SNAPTRAN collection at http://www4vip.inl.gov/library/searchreadingroom2.shtml

"In addition to MTR fuel, Hanford fuel, "Zirconium" which is naval propulsion fuel I think, it lists Borax, EBR-I, EBR-II, ATR, ETR, Borax IV, SL-1 scrap, SL-1 (fuel not in the reactor at the time of the accident, I suppose) SPERT, SNAPTRAN 2/10A-3 core debris, SNAPTRAN 2/10-2, and many others. [149]

"But nothing about the where-abouts of SNAPTRAN 2/10-1, which operated in the 1964 to 1966 timeframe but was supposedly only slightly damaged but radioactive. It makes sense for them to have reprocessed it. In an interesting but unreliable book "Atomic Accidents" by James Mahaffey, he says he could not find any record of the whereabouts of the 2/10-1 reactor. But it is not impossible for them to have shipped it in a shielded cask to another NASA research facility. But unless that facility had a hot cell or spent fuel pool, its seems very unlikely. Confirming its whereabouts would be somewhat helpful but may not help know the extent of understatement of worker and public exposures.

" There was an ans.org dinner meeting presentation about SNAP 10A by Schmidt. He says "test shutdown at 10,000 hours in 1966." Was he talking about SNAPTRAN 10A-1, the reactor not blown to smithereens?

Susan Stacey's "Proving the Principle" describes the fact the Idaho tested three SNAP reactors. So there are multiple issues:

- "There's the likely underestimation of the amount of fission products actually released from the two SNAPTRAN destructive tests that exposed the public. I say this because of the mystery milk high iodine levels in Idaho Falls in 1965 and 1966 and because of the likely underestimation of the fraction of inventory released from the fuel by the tests. The 2000 curie vs 600,000 curies is explained by DOE's using only the long-lived fission products they say blew offsite. But the assumed release fractions are subject to question.
- "The worker external as well as internal exposures, especially alpha and beta exposures were likely to have not been adequately monitored and likely not well represented by NIOSH feeble attempts to argue, as they have in person in Idaho Falls, that all radioactivity was timed to blow offsite, so that workers were not exposed.
- "The amount of soil contamination that had to be trucked away for disposal points to the mess and overall monitoring problems. I say this because later CERCLA investigations required hauling more contaminated soil away from TAN. Where was the soil trucked to? DOE's 1960s report says to a CFA landfill. But was it actually trucked to CFA or to RWMC? Some later soil cleanup was hauled to TRA. The soil mess points to lousy overall monitoring especially in those early years which is a public and a worker issue.
- "Where did the third SNAPTRAN reactor (INL had three of these reactors to play with), where did it end up? My conjecture is that at least one of the destructive tests resulted in no core to reprocess. So it is only conjecture on my part to wonder if the missing SNAPTRAN-10A-1 was actually reprocessed even though the official records say that -2 and -3 were reprocessed."

Section IV.F. Radioactive Waste Management Complex Cleanup Plan

Site Description

The Radioactive Waste Management Complex (RWMC) is the largest of the numerous INL radioactive waste burial grounds. This site's first trench was opened on July 8, 1952 for on-site mixed fission product waste, but soon started accepting waste from around the country. "During the 1950's, the rate of radioactive waste generated by private industry [Atomic Energy Commission] AEC licensees was increasing. Since no commercially operated burial ground existed for these wastes, most of the licensees used commercial sea disposal

[149] INEEL Site Report on the Production and Use of Recycled Uranium, L.C. Lewis, D.C. Barg C.L. Bendixsen J.P. Henscheid D.R. Wenzel B.L. Denning, INEEL/EXT-2000-00959, September 2000 http://www.osti.gov/scitech/servlets/purl/768760

services provided by seven firms that disposed of packaged solid waste in AEC approved areas off the US Coast." "In late 1959, the AEC decided that land burial had definite advantages, particularly economic, over sea disposal." [PR-W-79-038 @27]

Between 1946 and 1970, the AEC supervised the disposal of about 107,000 drums of low-level radioactive wastes at sites off the Atlantic and Pacific coasts, according to the history of the commission and a report by Daniel P. Finn for the Senate Intelligence Committee. Ocean dumping of low-level radioactive wastes by the USA ended about 1970 with the passage of the Marine Protection, Research and Sanctuaries Act, referred to as the ocean dumping act.

The RWMC is divided into primarily two areas, the Subsurface Disposal Area (SDA), and the Transuranic Storage Area (TSA). The SDA was expanded from the original 13 acres to its current 96.8 acres, and as of 1992 contained 20 pits, an acid pit, 58 trenches, and after 1977 more than 20 rows of soil "vaults" for small volume highly radioactive waste requiring remote handling and shielding. Soil vault is a euphemism for a plain old hole in the ground. Prior to 1977, remote handled waste was dumped in pits and trenches with other waste. The MFC Hot Fuel Examination Facility, ICPP, and the Navy's ECF remote handled hot waste is buried here in these 600+ holes. [INEL-94/0241] A thermal analysis of MFC waste notes 1,150 soil vaults at the SDA and container temperatures of 392 degrees (F). [RE-A-80-062 @2] See Section I(E) Navy waste characterization. A 1992 plot plan [RWMC # 416511] shows the 20 rows of soil vaults between the pits and trenches. Additionally, a more recent large concrete lined soil vault array has been added to the SW corner of Pit 20.

The SDA also contains the Transuranic Disposal Area (TDA) that originally was designed for two large pads (A & B) where the waste was stacked and later covered with ground to act as shielding, however only Pad A was used. Current DOE documentation acknowledges Pad-A with dimensions of 73.2 x 102.1 meters (240 x 335 feet) by 5.6 to 6.1 meters (20 feet) high and with a total volume of 10,200 cubic meters. [Pad-A ROD] However, if these dimensions are multiplied (minus soil cover) the volume would be 45,514 cubic meters. The discrepancy may in part be due to the Pad being somewhat larger than the waste stack but not likely to be four times larger. This volume discrepancy is not just an academic question but an important issue related to characterizing the actual volume of mixed alpha low-level waste dumped at this site.

The Transuranic Storage Area (TSA) covers 57.5 acres, and is divided into four areas. TSA Pad-1 opened in 1970 and has Cells 1 through 9, TSA-R Pad immediately south of Pad-1 has 3 cells. These two above ground pads are covered with plastic wood and soil. Pad-1 and Pad-R measure 150 x 1,100 x 15 feet. Pad-2 measures about 150 x 730 x 15 feet high. A containment building is currently being built over both pads for the planned exhumation of the waste. Pad-2 opened in 1975 contains an Air Support Building that stores barrels of TRU waste and has 3 earth covered cells behind it. TSA Pad 3 has the SWEEP building that assesses the contents of incoming waste barrels, and has another large air support storage building attached to it on the east. The fourth TSA section is the Intermediate Level Transuranic Storage Facility (ILTSF) that is divided up into two pads (Pads 1 & 2). The ILTSF contained 57 "concrete lined soil vaults" in 1979 and is used for remote handled waste in excess of 4,500 R/h three feet from the container surface.

Responding to warnings by the US Geologic Survey, the National Academy of Sciences Committee on Geologic Aspects of Radioactive Waste Disposal visited (June-July 1960) both Hanford and National Reactor Testing Station (NRTS) (now called INL) and submitted a report to the Atomic Energy Commission in which they stated:

"The protection afforded by aridity can lead to overconfidence: at both sites it seemed to be assumed that no water from surface precipitation percolates downward to the water table, whereas there appears to be as yet no conclusive evidence that this is the case, especially during periods of low evapotranspiration and heavier-than-average precipitation, as when winter snows are melted. At the NRTS pipes were laid underground without ordinary safeguards against corrosion on the assumption that the pipes would not corrode in the dry soil, but they did. At NRTS plutonium wastes (plutonium half-life 24,000 years) are given shallow burial in ordinary steel (not stainless) drums on the same assumption. Corrosion of the drums and ultimate leakage is inevitable .... The movement of fluids through the vadose (aeration) zone and the consequent movement of the radioisotopes are not sufficiently understood to ensure safety."[IDO-22056 @ 3]

Five years later (1965) the National Academy of Sciences revisited NRTS and concluded that "1.) considerations of long-range safety are in some instances subordinated to regard for economy or operation, and

2.) that some disposal practices are conditioned on over-confidence in the capacity of the local environment to contain vast quantities of radionuclides for indefinite periods without danger to the biosphere."[IDO-22056 @ 3]

These scientific observations by the National Academy of Sciences were made over forty five years ago and were ignored by the Atomic Energy Commission, Energy Research Development Agency (ERDA), and finally by DOE. Even in 1960, the scientists recognized what the consequences would be and offered specific criticism for subordinating safety to economic expediency. No claim to ignorance can be made by the federal agencies. This is outright gross negligence on the part of the federal government.

The cleanup proposal for the Radioactive Waste Management Complex (RWMC) unfortunately is characteristic of DOE's shell game with its nuclear waste. Observers also call DOE's process "radioactive relocation" - scoffing at the term "cleanup". Despite the fact that the RWMC is a Superfund cleanup site due to contamination from previous radioactive dumping, INL continues to bury radioactive waste at RWMC. The waste is dumped in unlined pits that would not even pass municipal garbage landfill regulations under Subtitle D. Neither the State nor EPA has demanded permitting of the RWMC under the Resource Conservation Recovery Act (RCRA). DOE claims that RCRA does not apply because radioactive waste is not covered by the law. Court decisions in 1987 over-threw that argument whenever radioactive and hazardous chemical wastes are mixed (mixed waste). The RWMC has mixed waste and therefore must be held in compliance with RCRA. EPA's inability to promulgate radioactive waste disposal standards has further exacerbated the enforcement problem. The Nuclear Regulatory Commission and DOE have effectively kept previous administration pressures on EPA to shelve the standards.

DOE's public literature (fact sheets) on cleanup actions inaccurately identifies only Rocky Flats transuranic (TRU) as the only off-site waste dumped at the Radioactive Waste Management Complex (RWMC). [RWMC Fact @ 2] Also on page 3 the fact sheet states that " The Subsurface Disposal Area which is dedicated to permanent disposal of low-level waste generated at the INL", [RWMC Fact @ 3] is not supported by the literature. A 1976 USGS document that has an RWMC plot plan of the location of the pits and trenches notes that "Trench 55 is still available for high-level waste." [IDO-22056 @9]

"In May 1960, the INL was designated as one of two national burial grounds for disposal of waste from any ERDA [predecessor of DOE] source. Consequently, a great deal of beta-gamma contaminated waste was received from various experimental operations around the country, and was buried together with the transuranic waste from Rocky Flats. This waste material included: reactor shielding weighing 16,329 Kg (36,000 lbs) from Kelly Air Force base, San Antonio, Texas, contaminated with Co-60; an aluminum heat exchanger 8.2 meters long and 1.5 meters in diameter weighing 20,000 lbs from Nuclear Engineering Company, Pleasanton, CA, contaminated with radionuclides of Co, Fe, and Al; drums containing old compasses, metascopes[sic], switchboards, electron tubes, contaminated with Ra-226, Po-210, Sr-90, Co-60 from US Army Chemical Center, Dugway, UT; drums containing animal carcasses from US Nuclear Co., Burbank, CA; concrete blocks 1.5 x 1.5 x 2 meters contaminated with mixed fission products from Lawrence Livermore, CA." [WMP 77-3 @ 8-9]

Also US Nuclear Corp., General Atomics Corp., dumped at INL. [WMP 77-3 @ 14] In later years, DOE facilities at Mound, Battelle-Columbus, Argonne-east, and Bettis also dumped at INL. "Soon general 'low-level' and 'high-level' wastes were buried here. High level wastes in shielded containers continued to be buried there at least until 1957. Some readings were as high as 12,000 rads per hour. 'Low-level' waste was buried in everything from cardboard boxes to steel drums and wooden crates. [Deadly Defense @ 50] Attempts were made to bury the most radioactive materials at the bottom of the trenches "to reduce the radiation level at the top of the trench to <25 R/hr. " [IDO-12085 @4]

Reactors and/or cores from the on-site Aircraft Nuclear Propulsion, SNAPTRAN, SL-1, Low-Power Reactor (ML-1), Portable Medium Nuclear Power Plant (PM-2A), and LOFT tests were also buried at the RWMC. Spent reactor fuel from the INL Aircraft Nuclear Propulsion (ANP) and other projects went to the burial grounds. "Information about the disposal of the insert material is uncertain based on discussions with personnel previously employed with the ANP Program. A check with personnel at ICPP indicated that no records available at ICPP existed to show that ceramic fuels had been received or were being stored at ICPP. In addition, the only fuel to be processed at ICPP, other than metallic fuel, was the graphite ROVER (nuclear rocket propulsion program) fuel. To date, no ceramic fuel has been processed at ICPP."[EGG-WM-10903 @2-14 & 2-21] Basically, there were three options, reprocess, storage, or dumping. If the spent reactor fuel was neither reprocessed or stored, then it was likely dumped at the RWMC.

Modifications to the EBR-II reactor at MFC in 1981 generated considerable radioactive waste that was buried at the RWMC. The large waste items included the old reactor vessel (16 tons), large reactor rotating plug (65 tons), and small reactor rotating plug (50 tons). The reactor-vessel cover contained about 270,000 curies of cobalt-60. This activity level results from activation of Stellite sleeves required for rod-drive shafts and gripper mechanisms. The reactor-vessel cover is filled with 263 individual graphite-filled cans. [ERDA-1552 @IV-16]

Considerable confusion exists in the public and DOE literature regarding waste classifications. The public cannot be faulted by combining all highly radioactive waste in the high-level category, as opposed to the arbitrary DOE definition of high-level being reactor fuel and fuel process waste. The term Transuranic is a relatively new term which earlier was called mixed fission products (MFP). High-level, Transuranic (TRU), and low-level are the currently used technical classifications.

Additionally, the public is not served by the DOE's deficient and inaccurate public literature that characterizes the waste at the RWMC. No mention is made of radionuclides in the aquifer, only "organic compounds are present in groundwater monitoring wells at RWMC." [RWMC Fact@ 3] DOE’s internal documents reviewed by independent analysis show that, "Core sampling into the 88 acre [RWMC] burial ground site has disclosed plutonium contamination 110 feet and 230 feet below the Waste Management Complex. Floods in 1962 and 1969 are believed to have caused the plutonium migration. Another possible cause is transport by organic chemicals. One test well emitted organic gas levels 30 times safe worker exposure limit and had to be sealed." [Deadly Defense @ 51] More recent water sample data show radionuclides at a depth of 580 feet below the RWMC. [IDO-22056] Disposal trenches average about 6 feet wide, 12 feet deep and 900 feet long. Pits are large deep rectangular holes dug down to basalt, filled with waste and then covered over with soil.

Subsurface Disposal Area Pits and Trenches

Pit / Trench Number	Waste Type	Year Used	Number of drums	Number of Cartons/Boxes
Trenches 1-16	Non-TRU	1954-57	?	?
Trenches 17,19, 20, 26, 32, 34, 39, 45, 47-49, 51, 52, 55, and 56	TRU	1958-74	?	?
Trenches 18, 21-25, 27-31, 33, 35-38, 40,44, 46, 50, 53, 54, 57, and 58	Non-TRU			
Pit 1	Non-TRU	1957-61	7,551	2,526
Pit 2	TRU	1959-63	22,435	2,367
Pit 3	TRU	1961-63	5,511	100
Pit 4	TRU	1963-67	31,411	2,368
Pit 5	TRU	1965-66	18,486	1,350
Pit 6	TRU	1967-68	14,396	3,423
Pit 7	MFP	1966-68	?	?
Pit 8	MFP	1967-67	?	?
Pit 9	TRU	1968-69	3,921	2,029
Pit 10	TRU	1968-71	26,645	2,849
Pit 11 (later emptied)	TRU	1970-70	13,542	90
Pit 12 (part emptied)	TRU	1970-72	4,838	26
Pit 13 through 15	TRU	1971-	?	?
Pit 16	Non-TRU			

20 Rows Soil Vaults >600 w/2 drums each hole	>Class-C LLW shielding /remote handling		1,200	SW corner Pit-20 array concrete vaults >Class-C LLW
Pad - A	Mixed Alpha LLW	1972-78	18,232	2,020
Acid Pit	Rad/chemical Liquids	1954-61	?	160,000 gallons

Acronyms:
[WMP-77-3 @2][IDO-22056 @9][Oversight(c), 1/6/96][INEL-94/0241][EGG-WM-10903@2-7]
MPF = Mixed Fission Products; TRU = Transuranic Waste (elements heavier than uranium >100 nCi/g);
Alpha Low-level = >10 nCi/g but <100 nCi/g TRU

Sub-soil sampling of the SDA burial ground showed Americium-241 at 66,000 pCi/gm, Plutonium-239 at 1,600,000 pCi/gm of soil, Cesium-137 at 2 pCi/gm, and Krypton-40 at 16 pCi/gm. [RE-P-81-016@2] Radiation being given off at 3 feet above Pit 13 and trench 55 were as high as 200 mR/ hr.[Tree-1013@8] SDA perimeter monitoring also at 3 foot height reached 7,261 mR/hr in 1975. [Ibid @ 11]

"High radiation level waste that would cause excess personnel exposure was handled and disposed by using special transfer vehicles and containers. A long tongue trailer, pulled behind a pickup truck, was used to haul material contained in 2x2x3 foot boxes or in 30 gal garbage cans. A shielded cask and a lead open-top box container were used to shield high-level waste."... "At least until 1957, no upper limit had been set on the level of radiation that could be handled; units of up to 12,000 R/hr were disposed." [PR-W-79-038 @19]

Limits of up to 400 grams of U-235, or 267 grams of Pu-239 that could be disposed in the same container were exceeded. [PR-W-79-038 @30] Two fires in Trench 42 occurred on September 8 and 9, 1966, and were caused by alkali metals being mixed with low-level waste. This was coupled with a 34% increase in "hot" waste in the trench. [Ibid] A third fire occurred on June 1, 1970 when sunlight on an exposed drum of uranium turnings ignited. The fire spread to other drums and "attempts failed to extinguish the fire in the waste stack." [Ibid @44] The fire was finally contained by a bulldozer operator who covered the stack with ground.

Pad-A within the SDA was the first attempt to comply with new regulations that required segregation of Mixed TRU waste from low-level. This crude storage approach consisted of a thin above ground asphalt pad (240 x 335 feet) upon which waste drums and boxes were stacked and later covered with soil to provide radiation shielding. Pad-A received over 87,500 kg of Uranium-234, 235, and 238 along with 4,600,000 kg of evaporator nitrates that the Code of Federal Regulations classifies as an ignitable oxide contaminated with plutonium, americium, thorium, uranium, and potassium-40. [Pad-A ROD@10]

EPA and State regulators went along with DOE on a no-action (no cleanup) Record of Decision even though the risk assessment showed Pad-A would be contaminating ground water in excess of drinking water standards within 100 years. [EGG-WM-9967 @ 7-2] Corrosion /disintegration of waste containers with the resulting release of contaminates and the long term erosion (wind and rain) of the 3-4 feet of cover soil from the top of the 25-30 foot Pad-A mound does not appear to be considered. EG&G's Remedial Investigation Feasibility Study for Pad A found that erosion rates of 36 inches per hundred years can be expected. [EGG-WM-9967 @ 7-2] This means that the Pad-A waste will be exposed in a hundred years.

Understanding the extent of the waste problem at INL is necessary for putting any remedial cleanup actions into context. Additionally, the nature and radioactive content of these wastes must be understood in order to quantify the risks these wastes pose. Early waste burial practices were particularly egregious. The issue of contaminated soil, estimated at 60,000 cm under-burden and an additional 112,000 cm overburden, at the burial ground is very serious because environmental restoration efforts must include this contamination because it too will leach into the aquifer below if not removed with the waste. [IEER(g)@85] Soil samples five feet below Pit 2 in the Subsurface Disposal Area contained the following concentrations: [TREE-1171 @29]

RWMC Pit 2 Sub-surface Soil Samples [TREE-1171 @29]

Nuclide	Concentration
Strontium-90	41.0 pCi/gram
Plutonium-238	220.0 pCi/gram
Plutonium-239/240	11,000.0 pCi/gram
Cesium-137	10.9 pCi/gram
Americium-241	1,550.0 pCi/gram

See Section I Part E Onsite Waste Hazard for summaries of disposed and stored waste. Samples were taken of deer mice tissues that had access through burrowing to the waste in the SDA. "Much of the activity [on the mice] in this one set of samples was associated with the hides and GI tracts, total concentrations of 2,026 and 415 pCi/g respectively while the lungs and remainder of the carcasses had total concentrations of 86 and 145 pCi/g respectively."[IDO-12085 @ 9] This sample data brings up numerous questions as to the extent these animals were consumed up the food chain by other predators which in turn may have been consumed by humans. "Harvester ants (Pogonomyrmex salinus) are complicating waste disposal efforts by doing what ants do best: digging below and moving dirt above."... "The rigorous digging of the ants disturbs radioactive contaminates and paves vertical tunnels that can channel water into disposal areas." [Programs and People @ 10] Six-month exposures measured at the RWMC perimeter from November 1973 to November 1984 found 16,800 mrem at station 33. [EGG-2386 @ 35]

At a 11/2/92 briefing, Idaho Division of Environmental Quality representative Dean Nygard emphatically denied that radionuclides had migrated lower than the 150 foot level below the SDA. Again, this position by the State is not supported by the literature. Cesium-137, Plutonium-238,-239,-240 were all found at the 240 foot interbeds. [IDO-22056@74] Forty-one % of the samples from the 240 foot inter-beds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, and Sr-90) have been detected in soils and in sedimentary inter-beds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot interbed in bore hole DO2."[DOE/ID-10183@134-145][DOE/ID/12082(88) @14-16]

Radionuclides are also confirmed in the aquifer under the RWMC. [EG&G-WTD-9438@25] USGS water sampling data at the 600 foot levels, expressed in pico curies per liter (pCi/l) show:

Groundwater Sampling Data at 600 Feet Under RWMC

Nuclide	Concentration pCi/L	Drinking Water Std. pCi/L
Tritium	10,000.00	20,000.00
Cobalt-57	48.00	1,000.00
Cobalt-60	100.00	100.00
Cesium-137	400.00	119.00
Plutonium-238	9.00	7.02
Plutonium-239-240	0.14	62.10
Americium-241	15.00	6.34
Strontium-90	10.00	8.00

[IDO-22056 @66] * The drinking water standard for gross alpha (total of all alpha emitters) is 15 pCi/l.

USGS report titled Hydrology of the Solid Waste Burial Ground as Related to the Potential Migration of Radionuclides Idaho National Engineering Laboratory, describes in detail the monitoring well drilling methodology. USGS hydrologists that drilled the wells went to considerable lengths to ensure surface or near-surface contamination did not compromise their 600 foot deep well samples listed in the table above. Analysis of the circumstances of the RWMC generated the following principal evidence supporting migration of radionuclides to the aquifer below.

> "Sufficient water has come in contact with buried waste to cause initial leaching and mobilization. Sufficient quantities of wastes have been available for leaching to account for observed subsurface radionuclide concentrations. The lithologic column beneath the burial ground has sufficient permeability and appears to be at field moisture capacity; this would allow infiltrated water to have migrated downward. Sufficient water has percolated downward through the burial ground to have reached depths were significant concentrations of radionuclides were found. Most of the higher subsurface radionuclide concentrations tended to lie beneath the oldest buried waste or beneath the areas through which the most water has percolated. A greater percentage of samples analyzed from the 110 foot sedimentary layer contained waste isotopes than from the 240 foot or deeper layers in the six interior wells. Samples from wells 93 and 96 indicate greater concentrations of nuclides in the 110 layer than in the 240 foot layer. Many of the observed subsurface concentrations of radionuclides were greater than could be attributed to artificial sample contamination from any known ground-surface or other overlying sources." [IDO-22056@83]

DOE's own sampling of the USGS 600 foot wells at the RWMC between 1987 and 1997 show americium-241 contamination at levels shown in the following table. Americium-241 is a decay product (daughter) of plutonium-241. The maximum concentration level allowed in drinking water is 6.34 pCi/l. Though the DOE sample concentration levels for Am-241 are lower than those of USGS, the data contradicts DOE public statements for the past several decades that actinides (isotopes heavier than uranium) had migrated to the aquifer which is 580 feet below the RWMC.

Americium-241 at 600 foot level at RWMC

Well Number	Date of Sample	Concentration (pC/l)
88	1992	0.40 +/- 0.02
89	1990	0.04 +/- 0.02
90	1988	0.06 +/- 0.03
90	1991	0.40 +/- 0.02
117	1987	0.06 +/- 0.03
119	1991	0.06 +/- 0.03
M-1F	1997	1.03 +/- 0.27
M-10-S	1993	0.3 +/- 0.1
M-3F	1997	0.045 +/- 0.017

[Hain(a)]

Radioactivity of Waste Dumped at the Radioactive Waste Management Complex Subsurface Disposal Area 1952-2003

Major Generator	**1952-1983**	**1984-1993**	**1994-2003**	**Total 1952-2003**
TAN	**63,000**	**2,200**	**?**	**65,200**
ATRC/TRA	**460,000**	**320,000**	**2,800,000**	**3,580,000**
INTEC/ICPP	**690,000**	**670**	**160**	**690,830**
NRF	**4,200,000**	**970,000**	**140,000**	**5,310,000**
MFC/ANLW	**1,100,000**	**150,000**	**810,000**	**2,060,000**
Rocky Flats Plant				
Non-plutonium	**57,000**	**-?-**	**- ?-**	**57,000**
Plutonium * (all species)	**576,967**			**576,967**
Other	**55,000**	**3,200**	**510**	**58,710**
Total	**7,261,967**	**1,446,070**	**3,750,670**	**12,458,700**

Notes for above table: [EGG-WM-10903 @ 6-25] [INEL-95/0310 (Formerly EGG-WM-10903) Rev.1; Volume 1 to 3; August 1995]
[* Plutonium totals are significantly understated because EDI only added rollup entries > 9 curies in the total]

ATRC/TRA/RTC; Advanced Test Reactor Complex/Test Reactor Area/ Reactor Technology Center
ICPP/INTEC; Idaho Chemical Processing Plant, aka Idaho Nuclear Technology & Engineering Center
NRF; Naval Reactors Facility
MFC/ANLW; Materials &Fuels Complex /Argonne National Laboratory – West
RFP/RFO; Rocky Flats Plant
Other; On-site D&D Environmental Cleanup and Non-Idaho National Laboratory Generators

The above summary of radioactive content of waste dumped is considered understated. The Environmental Defense Institute analysis of the curie content of Navy shipments to the burial ground, for instance, adds up to 8,140,668 curies. However, the above DOE data using annual summaries attributes the Navy to only 4.2 million curies or only half as much. DOE admits that the annual summaries are understated. [EGG-WM-10903 @ 6-26] EDI's analysis of the Rocky Flats plutonium (all species) dumped at the RWMC during the years 1952 – 1983 has a curie content of 576,967 Ci, and is also understated because only individual listings of >9 curies were counted. [INEL-95/0310 (Formerly EGG-WM-10903) Rev.1; Volume 3; August 1995]

Section IV.F.2 Flooding Issues at the RWMC

US Geological Survey (USGS) hydrologist Barraclough estimates that 100 acre-feet (32,492,910 gallons) of direct precipitation landed on the RWMC between 1952 and 1970. Additionally, due to the low depression of the RWMC local run off has entered the burial ground adding to direct surface water introduction. The 1962 flood which inundated the SDA allowed 30 acre feet (10,000,000 gallons) into the SDA. The 1969 flood put 20 acre feet (6.4 million gallons) into the SDA. [IDO-22056@46] It is no wonder radionuclides are found in the Snake River Aquifer. "Adams and Fowler measured solubility's of plutonium in tap water and found a range of 46,000 to 130,000 pCi/l."... "These findings are also consistent with Hagan and Miners (1970)." [Ibid.@70] According to DOE sponsored studies, the presence of gamma radiation increases the permeability/leach-ability of contaminates in basalt by ten-fold. [EG&G-J-02083] Water samples taken in the flooded SDA pits during the 1969 flood contained 13,000 pCi/l gross beta and 2,700 pCi/l gross alpha. [IDO-22056@69-70] This data verifies the solubility of radionuclides and the water sample data from the deep monitoring wells verify the mobility of these contaminates. Additionally, USGS soil samples under Pit 10 showed plutonium at 400,000 pCi/g and under Pit 2 the Pu was at 320,000 pCi/g which confirms contaminate mobility.[IDO-22056@77]

Flooding of the RWMC and its Subsurface Disposal Area (SDA) from the Big Lost River has occurred at least three times (1962, 1969, and 1982) since 1950. In 1962, Trenches 24 and 25 plus Pits 2 and 3 were flooded. In 1969, Trenches 48 and 49 plus Pits 8, 9, and 10 were flooded. In 1982, Trenches 42 and 49 plus Pit 16 were flooded. [EG&G-WM-10090@3] According to topographical map (INC-B-15368) of the burial ground area and a part of the Big Lost River ponding areas, the burial ground lies 40 feet below the Big Lost River 2 miles north. [IDO-22056@8] A flood-control diversion dam was been built to mitigate flooding. A USGS 1976 "Analysis of historical stream-flow information indicate that floods in the Big Lost River would overtop the flood-control diversion dam about once in every 55 years on average; if the culverts in the dam are completely plugged, overtopping of the dam would occur about once every 16 years." [IDO-22052@iii] The 1982 flooding of the SDA was in fact caused by plugging of the culverts. [EG&G-WM-10090] Since the RWMC is the lowest point in the region, there is nowhere else for the water to go. Currently, sump pumps are required to remove water out of the RWMC due to its lack of drainage. [IDO-22056 @10] This drainage problem begs the question of long-term institutional control to prevent flooding after DOE is gone.

In 1984, the Big Lost River Diversion Dam height was raised several feet to prevent additional flooding of the RWMC and other INL facilities. These improvements are expected to divert a maximum of 9,300 cubic feet per second flow of the Big Lost River with the accuracy limits of the computational procedures in the order of plus or minus 10-15%. The theoretical capacity then could be as low as 7,905 (9,300 - 15%) cubic feet per second. “A sustained flow at or above this [9,300] discharge could damage or destroy the dike”. [DOE/ID-22071 @ 24] According to Larry Mann, former USGS Supervisory Hydrologist, “There is a USGS publication that is undergoing technical review which will update the 100-year flood for the Big Lost River and provide an estimate for the 500-year flood. Peak flows for the 100 and 500-year floods are estimated to be 7,260 and 9,680 cubic feet per second, respectively”. [Mann 12/12/95]

Winter of 1996-97 brought record (188%) snow pack that feeds the Big Lost River coupled with record high Spring temperatures that again raise the flooding risks. Brandon Lommis, Idaho Falls Post Register reporter, found that in addition to the RWMC flooding hazard, the ICPP high-level waste tanks are also at risk. Lommis reports that, “Mike Bennett, INL’s water resources coordinator, said ‘it would be foolish not to have some concerns,’ and that dike failure could allow water to seep into the underground storage tanks under a chemical processing plant and possibly contaminate the Snake River Plain Aquifer, according to a recent study. INL officials this year asked the Army Corps of Engineers to help inspect the dam and dikes before the water peaks. Bennett said dirt graders and trucks are standing by to shore up any unexpected weak spots.” [Post Register 5/7/97] The May 20, 1997 LMICO Star noted that:

“Under normal conditions, the diversion dam is adequate to control water flow. The dam is weakest above the diversion gate, and may need reinforcement if water flows become heavier than anticipated (flood waters could flow over the diversion dam and back into the Big Lost river bed). Dixon has identified a source of rip rap (large rocks) and gravel for reinforcement. Along with the rip rap and gravel, 9,000 sandbags are strategically stockpiled to expedite any reinforcement that becomes necessary. The sandbags include 4,000 in existing inventory with another 5,000 bags ordered and available if needed.” [Star (d)]

Geologic investigations are needed on the ground up stream of the INL diversion dam to see if there is evidence of flooding and related heights/volumes. This type of information may minimize the uncertainty of long-term maximum flood projections (i.e.. validate flow-rate assumptions). The life expectancy evaluations are also needed of the Big Lost River diversion dam and related channels, dams etc., after the 100 year institutional control and maintenance of the flood control infrastructure ends. Absent maintenance, could debris collect and block the interconnecting channels to the spreading areas facilitating the failure of the dams, and thus flood the RWMC? The USGS believes this is a credible scenario in their 1976 report:

> “It would appear that a rare major flood of the [Big Lost] river could over-flow into the burial ground basin through the narrow wind-gaps in the basalt. Although this has not occurred in the INL history, evidence indicates it has occurred in the past 2,000 years and possibly within the past 200 years.” “At regional scale, horizontal hydraulic conductivities of the Snake River Plain Aquifer generally range from 100 to 10,000 feet per day as determined from well pumping tests or flow net analysis. The high number is among the highest for any know aquifer.”... “Although vertical hydraulic conductivity is generally much less than horizontal conductivity in basalt, significant vertical conductivity does exist, primarily through vertical fractures. This is demonstrated by the fact that surface water from the Big Lost River infiltrates from the channel and the INEL diversion area and produces measurable recharge to the aquifer. In addition, waste water recharged to the Test Reactor Area (TRA) disposal ponds eventually reaches the Snake River Aquifer, 450 feet below. There is no reason

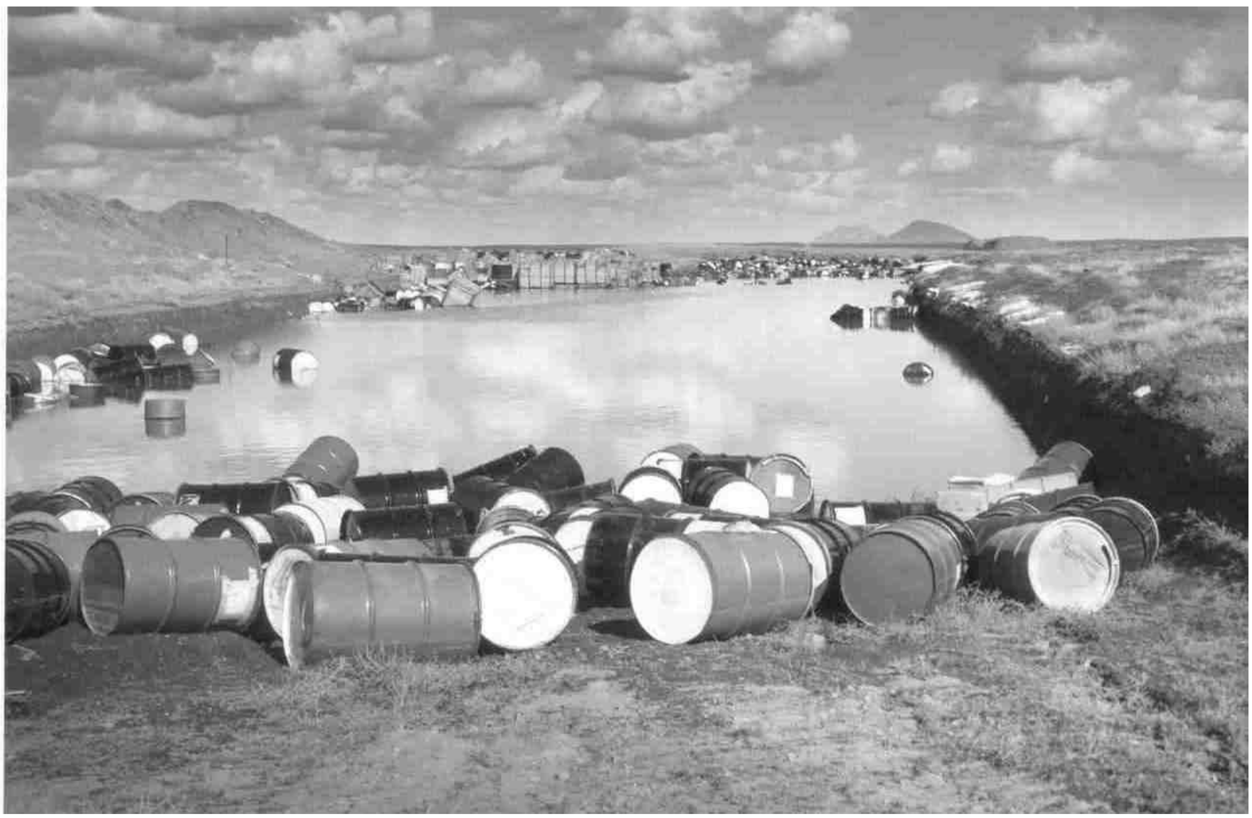
to believe that basalt beneath the burial ground have significantly less hydraulic conductivity than those beneath TRA or the diversion area." "Specified field tests...at Test Area North vicinity of the INL indicated an average horizontal permeability of about 55 feet per day and vertical permeability of about 15 feet per day." [IDO-22056@48]

A hypothesis is needed of Mackey Dam being overtopped and failing due to floods of not much greater recurrence interval than that of the maximum floods considered in the literature. The results of a failure of Mackey Dam have not been investigated in this paper. The INL EIS acknowledges that Mackey Dam "was built without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [DEIS @ B-17] is significant. One need only recall the catastrophic failure of the Teton Dam a few years ago northeast of Idaho Falls. The Teton Dam, also constructed by the Army Corps of Engineers, failed because of inadequate design and construction. A 1996 DOE Environmental Assessment (EA) for TAN Pool Stabilization noted that the maximum probable flood is considered conservative as the last flood (12,000 years ago) with the magnitude of 35,000 cubic feet per second.[DOE/EA-1050 @B-4] This flood would easily overflow the diversion dam capacity of 9,300 cubic feet per second.

USGS Photo of RWMC
Area North-East of Big South Butte

USGS report titled Hydrology of the Solid Waste Burial Ground as Related to the Potential Migration of Radionuclides Idaho National Engineering Laboratory, describes in detail the monitoring well drilling methodology. USGS hydrologists that drilled the wells went to considerable lengths to ensure surface or near-surface contamination did not compromise their 600 foot deep well samples listed in the table above. Analysis of the circumstances of the RWMC generated the following principal evidence supporting migration of radionuclides to the aquifer below.

"Sufficient water has come in contact with buried waste to cause initial leaching and mobilization. Sufficient quantities of wastes have been available for leaching to account for observed subsurface radionuclide concentrations. The lithologic column beneath the burial ground has sufficient permeability and appears to be at field moisture capacity; this would allow infiltrated water to have migrated downward. Sufficient water has percolated downward through the burial ground to have reached depths were significant concentrations of radionuclides were found. Most of the higher subsurface radionuclide concentrations tended to lie beneath the oldest buried waste or beneath the areas through which the most water has percolated. A greater percentage of samples analyzed from the 110 foot sedimentary layer contained waste isotopes than from the 240 foot or deeper layers in the six interior wells. Samples from wells 93 and 96 indicate greater concentrations of nuclides in the 110 layer than in the 240 foot layer. Many of the observed subsurface concentrations of radionuclides were greater than could be attributed to artificial sample contamination from any known ground-surface or other overlying sources." [150]



[150] IDO-22056@83; Also see Phase I RWMC Remedial Action for OU-7-13/14 Targeted Waste DOE/ID-11396.

Taken in January 1969, this photo of SDA Pit 9 shows material that "surfaced" when the area was flooded. (69-881) Some of the waste in Pit 9 was retrieved in 2004.

Geologic investigations are needed on the ground up stream of the INL diversion dam to see if there is evidence of historical flooding and related heights/volumes. This type of information may minimize the uncertainty of long-term maximum flood projections (i.e. validate flow-rate assumptions). The life expectancy evaluations are also needed of the Big Lost River diversion dam and related channels, dams etc., after the 100 year institutional control and maintenance of the flood control infrastructure ends. Absent maintenance, debris could collect and block the interconnecting channels to the spreading areas facilitating the failure of the dams, and thus flood the RWMC. The USGS believes this is a credible scenario in their 1976 report.

"It would appear that a rare major flood of the [Big Lost] river could over-flow into the burial ground basin through the narrow wind-gaps in the basalt. Although this has not occurred in the INL history, evidence

indicates it has occurred in the past 2,000 years and possibly within the past 200 years." "At regional scale, horizontal hydraulic conductivities of the Snake River Plain Aquifer generally range from 100 to 10,000 feet per day as determined from well pumping tests or flow net analysis. The high number is among the highest for any know aquifer." "Although vertical hydraulic conductivity is generally much less than horizontal conductivity in basalt, significant vertical conductivity does exist, primarily through vertical fractures. This is demonstrated by the fact that surface water from the Big Lost River infiltrates from the channel and the INL diversion area and produces measurable recharge to the aquifer. In addition, waste water recharged to the Test Reactor Area (TRA) disposal ponds eventually reaches the Snake River Aquifer, 450 feet below. There is no reason to believe that basalt beneath the burial ground have significantly less hydraulic conductivity than those beneath TRA or the diversion area." "Specified field tests...at Test Area North vicinity of the INL indicated an average horizontal permeability of about 55 feet per day and vertical permeability of about 15 feet per day." [IDO-22056@48]

A hypothesis is needed of the upstream Mackey Dam being overtopped and failing due to floods of not much greater recurrence interval than that of the maximum floods considered in the literature. The results of a failure of Mackey Dam have not been investigated in this paper. The INL EIS acknowledges that Mackey Dam "was built without seismic design criteria" and "additionally, it is not clear how resistant the dam structure is to seismic events" and the fact that "a fault segment runs within 6 kilometers of the Mackay Dam" [DEIS @ B-17] is significant.

One need only recall the catastrophic failure of the Idaho Teton Dam a few years ago northeast of Idaho Falls. The Teton Dam, also constructed by the Army Corps of Engineers, failed because of inadequate design and construction.

A 1996 DOE Environmental Assessment (EA) for TAN Pool Stabilization noted that the maximum probable flood is considered conservative as the last flood (12,000 years ago) with the magnitude of 35,000 cubic feet per second. [DOE/EA-1050 @B-4] This flood would easily overflow the INL diversion dam capacity of 9,300 cubic feet per second.

DOE's risk evaluation assumes non-conservative precipitation rates when calculating the leachate factors through the reinterred waste into Pit 9. "Heavy rainfall and melting snow within burial ground have also introduced water into the trenches and pits, especially where the soil cover has slumped or cracked." [IDO-22056@8]

"Between 1950 to 1963 the yearly precipitation at INL varied from 5.25 to 14.4 inches." "Between 1950 and 1965 the greatest daily precipitation rate was 1.73 inches in June 1954." "The greatest monthly precipitation rate was 4.4 inches in May 1957." [Ibid.@45] This means that considerably more water can, and has, aided the migration of contaminates than DOE is saying.

Additional Flooding Issues at RWMC

Since the radioactive waste will be extremely hazardous for tens of thousands of years and flooding will flush contaminates down into the aquifer, a conservative risk assessment would model the upper 95-percent confidence limits for the estimated Big Lost River 100-year peak flow of 11,600 cubic feet/second (cf/s). USGS has proposed this additional research to DOE, but the Department thus far is not willing to provide the funding. A USGS hydrologist notes, "The flow of 11,600 cfs represents the upper 95 percent confidence limit flow for the estimated 100-year peak flow (Kjelstrom and Berenbrock, 1996, p6). Future modeling needs are to model the area with this flow. We've expressed this to the INL and also have expressed that the WSPRO model used has limitations and that an application of more stringent models (two dimensional) is needed to refine and better delineate the extent of possible flooding of the Big Lost River." [6]

[6] Charles E. Berenbrock, U.S. Geological Survey Hydrologist, March 25, 1999 email to Chuck Broscious

USGS estimates the mean 500-year Big Lost River flood rates at 9,680 cf/s (34% greater flow rate than the mean 100 year flood).[7] This 500-year flood would inundate the ICPP and surrounding area. These potential hazards must be taken into consideration when making hazardous mixed radioactive waste decisions in these vulnerable areas because of the long-term consequences and the potential for additional aquifer contamination.

Cascading events should also be considered. This is known as a worst case scenario where one event triggers another event. For instance a 500-Year flood plus failure of Mackay Dam (built in 1917) resulting in estimated flows of 9,700 + 54,000 cubic feet per second respectively would be an example of a cascading event. Failure of Mackey Dam is non-speculative in view of the 1976 failure of the Teton Dam of similar construction and the fact that Mackey Dam lies within 11 miles of a major earthquake fault line that produced the 1983 Borah Peak 7.3 magnitude quake. An internal 1986 DOE report that analyzed the impact of Mackey Dam failure scenarios notes that, "Mackay Dam was not built to confirm to seismic or hydrologic design criteria," and "the dam has experienced significant under seepage since its construction." [8] This EG&G study acknowledged that the ICPP, Navel Reactors Facility, and the Test Area North (LOFT) facilities would be flooded with at least four feet of water moving at three feet per second.

USGS did not consider cascading events but noted previous studies showing that failure of Mackay Dam alone would result in 6 feet of water at the INL Radioactive Waste Management Complex (RWMC). Other studies recognized by USGS note that, "Rathburn (1989, 1991) estimated that the depth of water at the RWMC, resulting from a paleo-flood [early] of 2
to 4 million cf/s in the Big Lost River in Box Canyon and overflow areas, was 50-60 feet." "If Mackey Dam failed, Niccum estimated that peak flow at the ICPP would be at 30,000 cfs." [9] Comparing these flow rates with the USGS estimate 100-year mean flow of 6,220 cfs that would flood the north end of the ICPP with four feet of water, and a Mackey Dam failure becomes a real disaster potential with respect to the existing underground waste at the ICPP.

DOE is relying extensively on the Big Lost River Diversion Dam (located at the western INL boundary) to shunt major flood waters away from INL facilities. The last comprehensive analysis of this diversion dike system (below the diversion dam) was conducted by USGS in 1986 in a report titled *Capacity of the Diversion Channel below the Flood Control Dam on the Big Lost River at the INL*. In this study USGS estimated a mean flow rate of 9,300 cf/s, 7,200 of which went into the diversion channel and "2,100 cf/s will pass through two low swells west of the main channel for a combined maximum diversion capacity of 9,300 cf/s." "A sustained flow at or above 9,300 cf/s could damage or destroy the dike banks by erosion.

Overflow will first top the containment dike at cross section 1, located near the downstream control structure on the diversion dam." [10] This USGS study did not analyze the construction of the diversion dikes but they would likely fail as did the upstream diversion dam, built at the same time that the Army Corps of Engineers found deficient. "On the basis of a structural analysis of the INL diversion dam (U.S. Army Corps of Engineers, written comments, 1997), the dam was assumed incapable of retaining high flows. The Corps indicated that the diversion dam could fail if flows were to exceed 6,000 cf/s. Possible failure mechanisms are: (1) erosion of the upstream face of the dam that results from high-flow velocities and loss of slope protections (rip-rap), (2) overtopping of the diversion dam by flows exceeding the capacity of the diversion channel and culverts, (3) piping and breaching of the diversion dam because of seepage around the culverts, and (4) instability of the dam and its foundation because of seepage."[11]

Failure of the diversion dam and/or the diversion channel dikes would directly impact the Radioactive Waste Management Complex (RWMC) burial grounds. A 1976 USGS report notes, "The burial ground is within

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[7] Estimated 100 Year Peak Flows and Flow Volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory, U.S. Geological Survey, Water Resources Investigations Report 96-4163, page 11 shows flow rates for 5-year, 10-year, 100-year, and 500-year floods

[8] Flood Routing Analysis for a Failure of Mackey Dam, K. Koslow, D. Van Hafften, prepared by EG&G Idaho for U.S. Department of Energy, June 1986, EGG-EP-7184, page 15.

[9] USGS 98-4065, page 6

[10] Capacity of the Diversion Channel Below the Flood Control Dam on the Big Lost River at the Idaho National Engineering Laboratory, US. Geological Survey Water Resources Investigations Report 86-4204, C. M. Bennet, page 1 and 25

[11] USGS 98-4065, page 9

2 miles (3.2 km) of the Big Lost River and the surface is approximately 40 feet (12 m) **lower than the present river channel**. Sediments in the burial ground contain grains and pebbles of limestone and quartzite, suggesting that in recent geologic past, flood waters of the Big Lost River flowed through the burial ground basin. Two eroded notches or 'wind-gaps' in the basalt ridge bordering the west of the burial ground also suggest past Big Lost River floods." "A large diversion system on the Big Lost River was constructed by the AEC to control flood waters by diverting water into ponding Areas A, B, C, and D. The nearest of these, Area B is less than a mile [south] from and about 30 feet (9m) **higher** in elevation than the burial ground." [12]

USGS *Arco Hills SE* and *Big Southern Butte* quadrangle topographic maps clearly show the RWMC flooding vulnerability as do other USGS reports that note, "If [diversion] dike 2 [at ponding Area B] fails, large flows will drain directly toward the solid radioactive waste burial grounds." [13] These vulnerabilities must be taken into consideration when DOE attempts to leave the buried transuranic waste at the RWMC and not exhume and relocate it to a safe permanent repository.

Building dams around the proposed INL CERCLA Disposal Facility (ICDF) as was done at the RWMC is not an acceptable flood protection answer because lateral water migration will go under the dams and local precipitation will be held - thus exacerbating the leachate conditions. The liner of the ICDF will not be capable of maintaining integrity with the increased hydraulic pressure during a flood because they are only capable of blocking what minimal surface water may leak past the cap and infiltrate the waste. There are good legitimate reasons why dumps (even municipal garbage dumps) are not allowed by statute in flood zones. Dams by definition are only functional if there is regular maintenance which cannot be assumed once DOE ends institutional control of INL in a hundred years. Dumping the waste on top of the ground and mounding the cover over it will result in the cap eroding over the long-term which again is unacceptable.

Nuclear Regulatory Commission restrictions prohibiting citing radioactive waste disposal dumps on 100 year flood plains must be observed. [NRC 10 CFR ss 61.50] The reason for these restrictions is because the flood water will leach the contaminates out of the waste and flush the pollution more rapidly into the aquifer. Since these wastes will remain toxic for tens of thousands of years, they must be disposed of responsibly in a safe permanent repository.

The legal requirements of the process are spelled out in the National Environmental Policy Act that requires Environmental Impact Statements and public hearings. Only un-containerized wastes that can be compacted during placement should be allowed so as to minimize subsidence caused by container decomposition. Biodegradable, VOC, collapsible, soluble, TRU, or Greater than Class C Low-level, and Alpha-low-level waste must also be excluded from the RWMC dump and sent off-site.

USGS reports identified factors favoring downward waste migration. "In order for waste isotopes to be carried downward by water, four basic requirements are needed: 1.) availability of water, 2.) contact of the water with the waste, 3.) solubility or suspend ability of the waste in water, 4.) permeability in the geologic media to allow water flow downward." [15] This USGS report describes in detail how all four conditions are met at INL including the solubility factor where they note "Hagan and Miner (1970) leached five different categories of solid waste from Rocky Flats [the main source of plutonium in the RWMC] with ground water from the INL and Rocky Flats and measured the plutonium concentrations and pH of the leachate. They found the highest Pu-239 concentration in leachates from the acidic-graphite wastes, 62,000 to 80,000 ug/l plutonium or (3.8×10^9 to 4.9×10^9 pCi/L)." [Ibid]

The most reliable indicators of contaminate migration are onsite sampling data. Cesium-137, plutonium-238,-239,-240 were all found at the 240 foot inter-beds under the RWMC. [IDO-22056@74] Forty-one % of the samples from the 240 foot inter-beds contained radionuclides. [Ibid.@87] Other literature confirmation of plutonium at 240 feet includes: "Radionuclides (including Pu-238.-239.-240, Am-241, Cs-137, and Sr-90) have been detected in soils and in sedimentary inter-beds to a depth of 240 feet beneath the RWMC, (Hodge et al, 1989)." "Positive values for Pu-238,-239,-240 were detected in samples obtained from the 240 foot interbed in

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[12] Hydrology of the Solid Waste Burial Ground, as Related to the Potential Migration of Radionuclides, Idaho National Engineering Laboratory, U.S. Geological Survey, Open File Report 76-471, J. Barraclough, August 1976, page 8

[15] USGS 76-471 page 68-69

bore hole DO2."[DOE/ID-10183@134-145][DOE/ID/12082(88) @14-16] Radionuclides are also confirmed in the aquifer under the RWMC. [EG&G-WTD-9438@25]

A 1993 USGS report titled *Speciation of Plutonium and Americium in Ground Waters from the Radioactive Waste Management Complex* notes: “The solubility of plutonium, when added in the low-oxidation-state form [Pu (III) and (VI)], did not exceed 50 percent (of the amount added) in any of the waters from wells that penetrate the Snake River Plain Aquifer.” “In water from well 92, however, which is completed in a perched aquifer at a much shallower depth than the water table, 83 percent of the Pu (III) and (VI) remained in solution 30 days after it was added.” “In experiments using the high oxidation states Pu (V) and (VI), virtually all the added plutonium remained in solution in the water from all wells, and remained in the relatively soluble high oxidation states.” “The results indicate that although low-oxidation-state plutonium is generally insoluble in water [50%] from the Snake River Plain Aquifer, it is more soluble in water from the perched aquifer and could, in time, are leached from the waste and ultimately reach the Snake River Plain Aquifer.” The report goes on to note that the reason for the increased solubility of plutonium in the perched water is due to the 222,000 gallons of hazardous wastes including acids and solvents were also dumped in the RWMC.[16] The solubility of actinides and there mobility is a big issue with the ICPP high-level waste tanks contaminated soils because this resulted from raffinate (nuclear fuel processing waste) leaks which transuranic are already dissolved in an acid/solvent solution and therefore highly mobile. Flooding of the ICPP would therefore result in extensive migration of contaminates to the underlying aquifer.

Most of the [solid] wastes at INL were dumped at the RWMC in cardboard boxes [IDO-14532,p.25] and pose such a significant threat to workers during excavation that DOE considers it "impracticable" to clean up. "Burial of high level waste [at INL] continued until 1957 with no upper limit for the level of radiation. Items of up to 12,000 rems per hour were buried [at INL]."[Deadly Defense@50] Standard operating practice throughout INL's history was to cut off the metal ends of all spent nuclear reactor fuel that was shipped to the site or generated at the site. These highly radioactive fuel element parts were then sent to the RWMC for burial as "low-level" waste.

DOE's early public documents acknowledge that there are at least 800 pounds of plutonium dispersed throughout the buried waste at the Radioactive Waste Management Complex (RWMC). [DOE\ID-10253(FY91),@33] Other independent analysts cite "nearly 1000 pounds of plutonium, more than 200 tons of uranium, and 90,000 gallons of contaminated organic solvents were dumped into shallow trenches at the RWMC. [Facing Reality @ 6]

N.S. Nokkentved cites 431,700 pounds (216 tons) of uranium including 250 pounds of U-235, and 808 pounds of plutonium including 757 pounds of Pu-235, and 33 pounds of americium. [Times News, 7/29/89] More recent DOE revelations acknowledge 3,208 pounds (1,455 kg) of plutonium were dumped at the RWMC or enough for over 70 Nagasaki-type bombs. [ER-BWP-82] The reason for these varying numbers is because plutonium inventories have been secret, and early numbers were based on DOE's misinformation.

[16] Speciation of Plutonium and Americium in Ground Waters from the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey, Water Resources Investigations Report 93-4035, J. Cleveland, A. Mullin, 1993, page 1.
Chemical Contaminates in the Dissolved and Suspended Fractions of Ground Water from Selected Sites, Idaho National Engineering Laboratory and Vicinity, Idaho 1989, U.S. Geological Survey, Open File Report 92-51, pg. 33, shows organic solvents under RWMC
Plutonium in Groundwater at the NTS: Observations at ER-20-5, J.L.Thompson, A.B. Kersting, D. Finnegan, Chemical Technology Division, Los Alamos National Laboratory, Isotope Sciences Division Lawrence Livermore National Laboratory, December 1997 that shows extensive plutonium migration at the Nevada Test Site .

Selected Rocky Flats Waste Dumped at the Subsurface Disposal Area, 1954-1972

Radionuclide	Lower Bound Estimate	Upper Bound Estimate
Plutonium (all species)	1,102 kilo grams	1,455 kilo grams
Americium-241	44 kilo grams	58 kilo grams
Uranium-235	386 kilo grams	603 kilograms

[ER-BWP-82 @A-4]

RWMC Pit 9 Remedial Action

The EPA, State of Idaho and DOE released a Pit-9 cleanup Record of Decision in October 1993. Remediation of Pit-9 using alternative 4 would consist of exhuming the waste to include the following steps: (a) physical separation, (b) treatment, and © stabilization. The preferred alternative 4 remedial action presented in the "Revised Proposed Plan for a Cleanup of Pit 9 at the Radioactive Waste Management Complex" (RWMC) represents a flawed decision making process. A review of the available literature suggests that implementation of the preferred alternative 4 would not be protective of human health and the environment. Moreover, aspects of alternative 4 may be illegal under National Environmental Policy Act (NEPA) and Resource Conservation Recovery Act (RCRA).

DOE's statement that: "Because it is possible that some of the storage containers in Pit 9 have breached, the potential exists for subsurface soils to be contaminated with both radioactive and nonradioactive materials" is not supported by the literature. It is not just possible but a fact that contaminates have migrated. Additionally, DOE's Plan states: "The Pit 9 Interim Action will be used to expedite site cleanup and to potentially halt possible contamination of the vadose zone and groundwater." Plutonium has been found at 110 and 230 feet under RWMC and organic have contaminated the vadose zone. False and inaccurate statements like the above cited quotes challenge the very credibility of the document and indeed the whole cleanup process. Clearly, DOE, is not being honest with the public.

The Environmental Defense Institute (EDI) supports exhuming the buried waste from INL's Radioactive Waste Management Complex Pit 9 and the development and testing of waste treatment technologies at INL. Specifically, EDI endorses the Hanford approach, mandated by the State of Washington. Hanford is moving ahead with construction of a vitrification facility for all classes of waste except spent nuclear fuel which requires no treatment. Excavation and verification and storage actions are therefore supported. Waste treatment technologies are still in the developmental stage. As an interim action to mitigate additional contaminate migration from the buried waste, excavation is immediately necessary. The original treatment technology agreed to by the State of Washington, EPA, and DOE is to build a pre-treatment chemical separations process and one verification facility to stabilize low-level, mixed, TRU, and high-level waste into a glass/ceramic medium. Nitrification is the best approach and should be adopted at INL; however, the chemical pre-treatment is not supported. DOE's proposed Pit 9 technology is geared to listed RCRA organic contaminates and fails to provide a stable waste form for all contaminates. The goal is to get all waste forms into a stable medium as directly as possible.

The Pit-9 waste chemical separations (nitric acid leaching) process is now challenged by the State and EPA regulators as unworkable. Lockheed Martin finally in May 1996 admitted that the redesigned chemical treatment system did not work, and proposed replacing it with a physical soil separation process- abandoning the chemical leaching system. [IEER(g)@140] Even DOE has locked horns with its contractor. "The retrieval and treatment of the waste was originally estimated to cost $50 million in the 1993 Record of Decision; Lockheed Martin Advanced Environmental Systems, the contractor for the Pit-9 project, has estimated its costs through June 30, 1997 to be 57 million. This increase has occurred without retrieval and treatment system design having even been finalized, never mind built, tested and completed. Major components that have been designed or built are not in compliance with the terms of the contract. In March 1997, the contractor indicated that its final costs would be over $400 million." [IEER(g)@132] The public expects and the regulators must advocate for the entire waste volumes to be directly vitrified into a stable form that can be safely stored onsite until a permanent repository is permitted. To their credit the regulators have levied $940,000 in fines against DOE for missing Pit-9 cleanup milestones.

The Pit 9 issues of reburial of the residuals of chemical separations approach does not enjoy public acceptance for many reasons. First, the classification of low-level waste has no connection with environmental, health and safety hazards; [IEER(c)] it is merely a catchall category for all waste not classified as high-level or transuranic. Secondly, the public demands that the entire volume waste be processed directly into a stable form so that the inevitable interim storage does not continue the migration of contaminates into the environment. Finally, the Final Report Hanford Tank Waste Task Force got it right by recommending:

"The high cost and uncertainty of high-tech pretreatment and R&D threaten funding for higher performance low-level waste form, vitrification, and cleanup." "Put wastes in an environmentally- safe form, using retrievable waste forms when potential hazards from the waste may require future retrieval and when irretrievability does not cause inordinate delays in getting on with cleanup." "Let the ultimate best form for the waste drive decisions, not the size nor timing of a national repository." "Accept the fact that interim storage, at least, of the waste in an environmentally-safe form will occur for some time at Hanford. Select a waste form that will ensure safe interim storage of this waste." [Hanford]

The mantra repeated over and over again "get on with cleanup" in the Hanford Waste Tank Task Force is repeated in public interest group reports. [HEAL] DOE is wasting precious resources by refusing to recognize the public's demand for solutions to the radioactive waste problem. DOE must "get on with cleanup" and apply R&D to technologies that will put the whole volume of waste into a stable form for on-site storage for the near-term because there are no guarantees on any repositories coming on line soon. Additionally, the DOE is remiss in not investing in the essential R&D on emission control that will be key to health and safety in all waste processing that cannot be avoided in stabilizing and preparing for the waste acceptance criteria for the future repositories.

Under no circumstances would EDI support reinternment of processed waste back into Pit 9. Pit 9 simply must not be considered independent of the collective impacts of the site-wide environmental restoration and waste management activities. The final disposal of all processed wastes must be in a fully permitted and compliant RCRA/NRC radioactive waste site. The Agency for Toxic Substances and Disease Registry, a federal public health agency found that:

"The [Pit-9] clean-up level for Transuranic wastes of <10 nCi/g will not be protective of public health for a future agriculture or commercial use scenario." "The planned clean-up level for transuranic waste is 10 nCi/g. When compared to the proposed Annual Limits on Intake for Americium-241 by ingestion (40 nCi), an ingestion of only 4 grams of contaminated soil would exceed the proposed Annual Limit on Intake. Similarly, an inhalation of only 0.30 grams of contaminated soil within a one year period would exceed the proposed Annual Limits on Intake for Americium-241 by inhalation (0.25 nCi). In either an industrial or agricultural use scenario, the Annual Limits on Intake for Americium-241 by ingestion and inhalation would probably be exceeded." [ATSDR @ 10-11]

Former Governor Andrus, because of his long history of justified concerns over the mismanagement of INL's radioactive wastes, insisted that the State be the lead enforcement agency on the cleanup of the RWMC. Unfortunately, the ID Division of Environmental Quality and the INL Oversight Program have not provided a credible enforcement and oversight role in the process. EDI encourages current Governor Batt to reevaluate the positions his agencies have taken on INL cleanup.

Continued public pressure for the enforcement of environmental laws will be essential in coming years. Reauthorization of the Resource Conservation Recovery Act with stricter compliance standards that must also include radionuclides as a regulated hazardous material will also be key to environmental protection. The Clinton Administration, unfortunately, is not moving toward a new national environmental legislative priority.

A review of the DOE documents for Pit 9 reveals extremely disturbing assumptions made by J.J. King [EG&G-ERP-BWP-64] to determine the radiological inventory subsequently used in the risk evaluation. King acknowledges Rocky Flats radionuclide information on shipments to INL in 1968 contained the following:

Radionuclide	Quantity (grams)	Radionuclide	Quantity (grams)
U-238	33,373,000.00	U-235	1,210.00
Pu-238	4.18	Pu-239	43,543.44
Pu-240	2,720.83	Pu-241	210.11
Pu-242	7.44	Am-241	1,778.00

The above listed nuclides were contained in 345,377 cubic feet of waste shipped from Rocky Flats to INL in 1968. This represents an activity concentration of possibly 31,216 Curies. J.J. King cites Rhodes' determination that of the total 345,377 cubic feet shipped in 1968, 67,352 cubic feet (containing 203 g of Pu-239) went to Pit 10 and 102,103 cubic feet went to Pit 9. [EG&G-ERP-BWP-64] No accounting by King is offered as to what happened to the remaining 157,922 cubic feet of Rocky Flats waste shipped to INL during 1968. Generally, only one trench was open and received waste at any given time. In those early years, no attempt was made to segregate categories of waste. [EG&G-WTD-9438@23] It simply all was dumped in whatever trench or pit happened to be open at the time.

Another assumption King made in determining the radiological inventory was to assume that the Pu-239 was "distributed uniformly throughout the waste volume not associated with Pu-239 identified in Pit 10". [EG&G-ERP-BWP-64] There is no credible basis for these assumptions. The numbers King ended with are many orders of magnitude below the possible inventories available for deposition in Pit 9. Moreover, the use of Kings numbers in the risk evaluation are not conservative and greatly understates the probable hazard.

These issues of radionuclide inventory are extremely germane to determining the appropriate remediation for Pit 9. If DOE's presentation of inventories is extremely understated, and the Alternative 4 chemical separation design target for radionuclide removal is not met, a lot of radioactive waste could be returned to Pit 9. DOE's design treatment standards for "wastes and/or materials in Pit 9 containing [greater than] >10 nanocuries per gram transuranic would be treated to reduce the volume by >90% prior to returning to the Pit." [Plan@11] The returned 10% could still potentially have considerable radioactivity in the processed waste since no upper bounds are stated for this "stabilized" material.

The plan also calls for exhumed waste or soils that contain 10 nanocuries or less will be returned directly to Pit 9. This 10 nano-curie criteria is a DOE internally generated directive that has not been legally established as protective of the environment. No quality assurance mechanisms are offered to ensure that non-contaminated material is not mixed with contaminated waste to reach the 10 nanocurie/ gram criteria. The plan's criteria for residuals returned to Pit 9 uses industrial (1 in 10,000) carcinogenic risk performance criteria. Due to the long half-life of the radioactive contaminates and the probable inability to maintain institutional control over the sight, the residential performance criteria (1 in 1,000,000) should be used.

Another area of uncertainty is the radionuclide inventory of on-site waste in Pit 9. DOE acknowledges in the mailing that some Aircraft Nuclear Propulsion (ANP) wastes are in Pit 9. When asked at the Nov. 2 briefing if this may include ANP reactors, DOE emphatically denied that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the RWMC Subsurface Disposal Area (SDA). [EG&G-WM-10090@12] One of the ANP series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." [DOE/ID-12119@A-87] Though two ANP nuclear jet engine shells are on display at the ERB-I, the disposition of all of the other engines and reactor cores for these engines were to the RWMC. See Section I.C for HTRE details.

The HTRE-2 and 3 were disassembled in the IET hot shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350 ton transporter was moved under for shipment to the RWMC. Bridges between the IET and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. [PR-W-79-001 @4-3] 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 as well as considerable volumes of related radioactive parts were dumped at the RWMC.

Other reactor components including shielding weighing 36,000 pounds from Kelly Air Force Base, and a reactor heat exchanger 27 x 5 feet from Nuclear Engineering that were buried in Pit 2 in 1960 also may be part of the ANP program tests. The Hallam Nuclear Power Reactor from Lincoln Nebraska was also buried at the RWMC. [PG-WM-58-008 @2-3] Three SPERT experimental reactors tested at INL [ERDA-1536,@II-244] as where two SNAPTRAN reactors and, two Modular Cavity reactors from the ANP program were also dumped at the RWMC.

At the Pit 9 hearing in Moscow, (11/10/92) the State representative maintained his position that there was no radioactive contamination below the 150 foot level below the RWMC. One can only conclude that the State Division of Environmental Quality is grossly ill-informed. DOE's mailing only offers one waste volume number (110,000) cubic feet from Rocky Flats in Pit 9. [Plan@3] Why is the total volume to be exhumed not stated? DOE's Pit 9 estimated volumes are: [EG&G-WTD-9438@5]

Waste containers	150,690	cubic feet
Contaminated Soil	191,726	"
Total Volume	342,416	"

DOE's risk evaluation not stated in the public mailing states that the air pathway (respirable) exceeds the risk specific concentration for Am-241 and Pu-239 for both residential and occupational exposure. External pathway also exceeds risk specific concentrations for Am-241, Pu-239 and Cs-137 for both residential and occupational exposure. Soil ingestion exceeds residential exposure. [EG&G-WM-10090@10-11] This risk evaluation is based on understated (non-conservative) radionuclide inventories previously discussed. The risk evaluation also assumes 100-year institutional control over the site which is exceedingly presumptuous. Even if this control could be insured, the unlucky resident who tries to build a house with a basement over top of Pit 9, would be digging right into the buried wastes that will be toxic for 24,000 years. A future rancher who sinks a well through the burial ground also would be at extreme risk.

Another problem that the risk evaluation assumes is an underlying layer of soil to assist in filtering contaminates that may migrate. The underlying basalt at Pit 9 comes within 7.7 feet of the surface. [EG&G-ERP-BWP-67@6] "Some trenches and pits were excavated down to the basalt while others only have a thin layer of soil over the basalt. Therefore some older (pre 1970) buried waste has no soil between it and underlying basalt." [IDO-22056@8]

DOE's risk evaluation assumes non-conservative precipitation rates when calculating the leachate factors through the reinterred waste into Pit 9. "Heavy rainfall and melting snow within burial ground have also introduced water into the trenches and pits, especially where the soil cover has slumped or cracked." [IDO-22056@8] "Between 1950 to 1963 the yearly precipitation at INL varied from 5.25 to 14.4 inches." ... "Between 1950 and 1965 the greatest daily precipitation rate was 1.73 inches in June 1954." "The greatest monthly precipitation rate was 4.4 inches in May 1957." [Ibid.@45] This means that considerably more water can, and has, aided the migration of contaminates than DOE is acknowledging. According to a RWMC worker currently employed at the Pit 9 project, 18 tons of pyrophoric zirconium cuttings (also see IDO-14532 @50) and a reactor emitting one billion rads make the remediation process extremely dangerous.

The selected waste treatment processes and the criteria for material returned to the burial pits must receive the full EIS evaluation within the context of existing site-wide contamination and anticipated site-wide "processed" waste returned to the ground. It is conceivable that existing contamination below Pit 9 poses sufficient risk that would preclude adding additional risk from reburial of partially treated waste.

DOE has legally binding Environmental Restoration milestones that must be meet under the Federal Facility Agreement and Consent Order (FFACO). If the Department fails to meet a milestone the State of Idaho or the Environmental Protection Agency (EPA) can impose sizable fines on DOE or the contractor. Due to radical Congressional cuts in DOE’s cleanup funding the Department was forced to turn to large contractors who could attract Wall Street’s financial backing to provide the funding to build the waste treatment plants required by the FFACO. The sales pitch was that private industry could get the job done better, faster, and cheaper. Privatization is touted by its proponents as the wave of the future and fixed priced contracts would put an end to the proverbial cost overruns. Well, this simplistic approach is fine if the government wants to buy one thousand F-18 fighter planes. There are few uncertainties that the contractors face because of decades of experience manufacturing similar planes. The same cannot be said about cleaning up the Pit-9 radioactive waste dump at INL because no one knows for certain what is actually in the dump and the intensity of the radiation fields that may be encountered. This is the first time the government or anyone else has attempted cleaning up a highly radioactive dump site.

To further confound an already complicated situation, the DOE still has no permanent repositories for its nuclear waste. Even if the transuranic Waste Isolation Pilot Plant (WIPP) dump in New Mexico and the high-level waste dump at Yucca Mt. Nevada open, their capacity cannot handle the current volume in inventory. So there is this policy crunch to reduce the waste volume destined for the repositories. DOE puts unrealistic demands on its cleanup contractors to reduce waste volume and generate new treatment technologies that currently do not exist. The chemists are still struggling with the basic science and are not even close to developing an applied technology.

DOE gave the Pit-9 fixed price contract to Lockheed Martin Advanced Energy Systems for $179 million. Lockheed's cleanup record has been documented in a Public Broadcasting System program that featured the company's radioactive cleanup fiasco on Johnston Atoll in the Pacific. The technology was unable to meet criteria for discharge even after multiple recycling through the process. In a rerun, Lockheed Martin Pit-9 treatment technology failed forcing the contractor to delay facility construction for several years. This delay also resulted in a $750,000 fine imposed on Lockheed Martin by the State for missing a FFACO milestone. The fine was later negotiated in March 1997 where DOE/ID will pay $100,000 to EPA’s Superfund account, submit new deadlines for the projects and provide $870,000 for additional environmental projects in Idaho. Now Lockheed Martin wants to double the original $179 million contract. The total cost to the government for Pit-9 including management and waste storage is estimated at $264 million; but the delays and change in technology are expected to double the price. Tom Brokow’s NBC Nightly News (5/22/97) reported that Lockheed Martin is now asking DOE to raise the original $179 million “fixed” Pit-9 contract to $337 million.

Privatization is now seen by observers as something different than the faster, better, and cheaper alternative its proponents would like us to believe. Bill Weida, an economics professor at Colorado Collage and researcher for Economists Allied for Arms Reduction recently released a report on Privatization in DOE Cleanup Operations. This is a thorough analysis of the problem. Copies of the report are available by writing Bill Weida, c/o Department of Economics, Colorado College, Colorado Springs, CO 80903. The following is an excerpt from Weida’s executive summary:

> “Privatized nuclear cleanup operations will handle some of the world's most hazardous materials. Such high risk operations have many economic implications--most of them unfavorable. Because of this, and because of the general nature of nuclear waste cleanup, it is obvious that the cleanup of nuclear waste is a classic public good and that it is not an appropriate candidate for privatization. This fact has already been adequately demonstrated Department of Energy (DOE) cleanup privatization has only been possible when DOE assumed a majority of the risk in privatized operations. In fact, DOE has assumed so much risk in its current privatization contracts that there is no longer sufficient incentive for contractors to perform in an economically efficient manner. When these problems are added to the high capital costs created both by the use of private borrowers and by the appropriation of federal funds to the reserve account mandated by the Government Accounting Office (GAO), there remains no economic rationale for DOE privatization. Even DOE admits that privatization is fundamentally a budgeting ploy that trades short-term capital expenditures for delayed, and potentially higher, long-term reimbursements to a private contractor.”
>
> “DOE's privatization initiative could also be a very expensive experiment for those who live around sites where nuclear waste is stored or generated. As currently implemented, DOE privatization appears to be an attempt at union busting. If DOE cannot guarantee that members of the current local work force will be employed by privatized cleanup operations, the economic penalty levied on the regions that surround DOE sites will be substantial and the costs of privatization would need to be recalculated to include these negative economic impacts. Further, past experience with DOE contractors, and with the DOE itself, has shown that safety and health problems at DOE sites are only corrected when active citizen oversight is exercised. Privatization, as implemented by the DOE at the Portsmouth and Paducah gaseous diffusion plants, has been used to thwart citizen oversight by allowing the privatized operators to claim that most information about their operations is proprietary in nature and not subject to citizen oversight. At cleanup sites like Hanford and the INL, DOE has also limited public access to documents based on "procurement sensitive" document status. DOE's chosen successor as regulator of privatized operations, the Nuclear Regulatory Commission (NRC), has actively abetted this policy. These are the same short-sighted

approaches to site management that created many of the nuclear problems now facing DOE and they have the potential to significantly increase the costs of cleanup now facing the US." [Weida]

Another nuclear waste treatment plant called the Advanced Mixed Waste Treatment Project (AMWTP) was estimated by DOE in 1994 to cost $300 million. In January 1997, DOE awarded the AMWTF project, one of the largest privatization projects worth $1.18 billion, to British Nuclear Fuels Limited (BNFL) to treat mixed and transuranic waste at the INL. The team includes BNFL as the prime contractor with subcontracts with BNFL Engineering, CTS Duratek, Manufacturing Sciences, Morrison Knudsen, and Science Applications International. In the contract, BNFL has committed to treating at least 65,000 cm of waste at the INL, with the option to treat up to an additional 120,000 cm of waste generated by future INL cleanup and decontamination efforts, as well as some waste generated at other DOE sites. [Star 1/14/97] The AMWTP is another example of DOE's violation of the National Environmental Policy Act (NEPA) that requires the government to conduct an Environmental Impact Statement (EIS) of all major projects prior to commitment of resources. DOE did conduct a 1995 INL site wide EIS but only committed seven pages discussing the AMWTP which at that time was called the Idaho Waste Processing Facility. In those seven pages only the most cursory descriptions of the planned mixed transuranic treatment plant are offered. There is little characterization of waste throughput, emission control systems, or anticipated radioactive and chemical releases to the environment. [DOE/EIS-0203F@C-4.4.3-1] If BNFL wanted to build a municipal garbage incinerator in Boise, they could not get away with a seven page plan let alone a mixed transuranic waste incinerator. Only after public interest organizations filed a law suit did DOE agree to comply with the legal requirements of NEPA. Even more incredible is the fact that the AMWTP is to be built only few hundred feet from the Pit-9 treatment facility. An analysis of DOE's cleanup mess by the Institute for Energy and Environmental Research (IEER) found that duplication of comparable waste processing plants makes no sense.

"One of the remarkable indicators of a lack of coordination and disarray in DOE's Environmental Management program is its failure to coordinate extraction and treatment of buried waste in Pit-9 with the Advanced Mixed Waste Treatment Project [AMTWP] that is supposed to treat the 'retrievably stored' TRU waste at the Idaho Lab; treatment of the 'retrievably stored' wastes is estimated to cost $880 million dollars. The buried and stored wastes contain similar kinds of wastes and it is likely that a large percentage will require similar treatment technologies. Whether or not they are stored under a few feet of dirt is relevant only to extraction and not to treatment technologies. Yet DOE is proceeding with the Advanced Mixed Waste Treatment Facility as a privatized project without yet having absorbed the issues of the pit-9 failure." "Perhaps the only success of the Pit-9 has been the development of remote retrieval technologies that can reduce risk to workers from radionuclides, chemicals, and explosives. However, even this success has a major flaw in that Lockheed Martin AES did not build a double confined structure as required by the Record of Decision and as described in Lockheed Martin AES' own Best and Final Offer." [IEER(g)@145-146]

Privatization of waste treatment plants has produced an accountability barrier that state and EPA regulators find intolerable. Kathleen Trever, manager of the State of Idaho's INL Oversight program testified at a 1997 Congressional hearing stating: "The nature of Pit-9 subcontract allowed DOE subcontractor Lockheed Martin Advanced Environmental Systems (LMAES) to make design changes without consulting with the [regulatory] agencies, thus preventing the agencies from identifying and resolving concerns in a timely manner. In addition, EPA and Idaho were not even officially informed of the extent of cost overruns and schedule delays until October 1996, months after project deadlines had already been missed." [IEER(g)@146-147] As of this writing, LMAES's Pit-9 project is completely shut down because of contract disputes with DOE. LMAES contends that "subsequent inventories indicate that types and quantities of other radioactive and hazardous contents in Pit-9 are far greater than originally thought. Technology used on the project has been proven in laboratory testing, but never used before on a large scale to treat the types of materials now believed to be present in INL's Pit-9." [Star;7/15/97] [151]

[151] Chuck Broscious, Report: Review of the Mixed Hazardous Radioactive CERCLA Waste Cleanup Policy at the Radioactive Waste Management Complex Subsurface Disposal Area Department of Energy's Idaho National Laboratory, by Chuck Broscious, July 2018 and click here for Attachment http://www.environmental-defense-institute.org/publications/RWMCCERCLA4.pdf

Tami Thatcher's "Idaho To Miss Important Idaho Settlement Agreement Milestones" reports:

> "The currently missed milestones are the slowed pace of shipments of transuranic waste to the Waste Isolation Pilot Plant (WIPP) in New Mexico, which resumed a year ago, and the failure to get the Integrated Waste Treatment Unit (IWTU) treating liquid radioactive waste it was supposed to have completed in 2012. [152] DOE is paying fines to the state for not emptying the waste tanks and calcine treatment is delayed by continued problems at the IWTU.
>
> "Even with the progress of shipping of above-ground stored transuranic waste and some buried transuranic waste, the "cleanup" will still leave plenty of transuranic waste over Idaho's aquifer. The americium-241 buried at the RWMC not being exhumed would require six Snake River Plain aquifers to dilute to drinking water standards." [153]

Section IV. G. Power Burst Facility (PBF) Cleanup

The PBF (located at Auxiliary Reactor Area) cleanup Plan considers only two alternatives, no action, and hot spot removal. [PBF Plan] Consequently, there is no credible comparative analysis when the only other option is no action - to which no one subscribes. EDI requests a third alternative be evaluated. That option would involve exhuming all contaminated material on top of the PBF evaporation pond Hypalon liner with the stipulation that if contamination exists below the liner due to its failure, then all contaminated materials be exhumed.

The basis for this third alternative request rests on three factors. First, spot removal will inevitably compromise the liner, thereby providing migration route to the other contamination in the pond. Secondly, the concentration levels in the whole pond are more than high enough to warrant complete removal. Thirdly, simple efficiency would dictate considerable cost savings with one comprehensive operation as opposed to numerous operational set-ups and tear-downs.

Considerable discrepancy exists between information offered to the public in the "Dear Citizen" publication and DOE contractor documents. For instance, the "Dear Citizen" cites: "The highest concentrations of cesium-137 (325 pCi/g) were at the pond inlet"[PBF Plan; whereas DOE internal document (EG&G-WM-8804) cites: "Specific concentrations ranged from a high of 830 pCi/g for a surface sediment sample collected adjacent to the drip pan to a low of 15.2 pCi/g collected diagonally across the pond from the drip pan. Radiological Release Criteria specify a limit of 10 pCi/g for release of soils contaminated by cesium-137." [EG&G-WM-8804@ 5]

The "Dear Citizen" also does not offer important background on SPERT reactor tests. DOE internal documents have revealed that the 1954 SPERT-I reactor excursion released 240,000 curies of radiation including 500 curies of radioactive Iodine. The SPERT-II excursion in 1963 released 530 curies of radiation. SPERT-III released 1,900 curies. [ERDA-1536 @ II-244][IDO-12119@79]

Considerable public concern exists with this type of interim Plan. Specifically, if DOE is allowed to do only a spot removal to mitigate only the highest contaminate spot(s), there will more than likely be a later claim that the contaminate levels remaining do not warrant additional remedial action. The public may well be lulled into believing that the site was fully cleaned up during the earlier action. Public skepticism is further bolstered that this is not an interim but a permanent action by INL's statement that, "Both options [A&B] are permanent solutions and will reduce the risk for environmental and human exposure to the contaminants currently present in the pond." [PBF Plan @ 7] INL officials stated at a public briefing in Moscow 5/7/92 that once the hot-spots are

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152 Bryan Clark, *The Idaho Falls Post Register*, "IWTU might begin this year – DOE gives progress report to LINE Commission," February 1, 2018. The Post Register reported that as of last June, the IWTU was more than $200 million over budget. The DOE faces daily fines while it's not in operation because of missing the 2012 milestones and subsequently missed renegotiated schedules for hazardous waste tanks regulated by the State of Idaho.

153 Tami Thatcher, Idaho To Miss Important Idaho Settlement Agreement Milestones Environmental Defense Institute, News on Environmental Health and Safety Issues June 2018, Volume 29, Number 6.
Also: Public Comment Submittal to the Idaho Department of Environmental Quality for Class 2 Permit Modification Request and Request for Temporary Authorization for the Idaho Nuclear Technology and Engineering Center and Radioactive Waste Management Complex Located on the INL, by Tami Thatcher, November 2019
http://environmental-defense-institute.org/publications/CommentARP7PMR.pdf

removed, "the remaining concentrations of Chromium and Cesium will pose no risk." Again, these statements are not supported by data.

Public confidence levels in EPA, the lead agency on nine of the ten INL Waste Area Groups, are extremely low. This is particularly true after former President Bush's directive to all regulatory agencies to cease all new enforcement initiatives. As previously stated, OMB followed that up with a 1% cut to EPA's DOE/DOD oversight budget. Cuts in EPA budgets have continued into the Clinton administration which caused EPA to cut their Office of Federal Facility Enforcement. Moreover, the State has not protested these budget cuts to its enforcement partner in the INL cleanup process.

"EPA's FY 1993 budget requests identified 'Federal Facilities Enforcement' as a 'Material Weakness' requiring 'Corrective Actions'. According to EPA, 'the Agency does not have sufficient resources to perform an adequate level of oversight of other agencies' environmental compliance and restoration plans and activities.' Moreover, the Agency noted that '[t]he sheer magnitude, impact, and political realities of the [DOD] base closures program could easily consume the entire Federal Facilities resources base during this period.' [NRDC(f) 3/30/92] [Citing EPA, FMFY!, Attachment D@1]

"Oversight costs are typically estimated at approximately 2 to 4% of the costs of the cleanup. Hence, based on FY 1993 DOD and DOE environmental restoration and waste management budget of more than $7.3 billion, the budget for oversight of the Energy Departments' environmental restoration activities should be $150 to 300 million. Unfortunately, the EPA Federal Facilities Oversight Budget for FY93 is only $46.4 million - just 0.63 % of the DOE/DOD waste cleanup budgets. Moreover, while the DOE and DOD waste cleanup budgets increased from FY92 to FY93 by 26 and 44 percent, respectively, the EPA oversight budget declined by one percent." [NRDC (f)] "EPA is routinely reimbursed by private parties for the cost of overseeing the cleanup of commercial waste sites. During negotiations over some Interagency Agreements, the DOE has agreed to provide oversight funding to EPA and States. Unfortunately, the Office of Management and Budget (OMB) has opposed the transfer of DOE funds to EPA to cover oversight expenses." [NRDC(f) 3/30/92]

Public confidence is also extremely low with the State's enforcement role. In a recent meeting with the commenter, IDEQ's Dean Nygard stated that the State had adequate funding to fulfill its regulatory obligations. Indeed, he took issue with the Governor Andrus' attorney Jonathan Carter's testimony to the Senate Commerce and Labor Committee that characterized State funding as inadequate. In response to Mr. Nygard, EDI showed him numerous falsifications in INL primary cleanup documentation that the State had not challenged. These falsifications are prima facie evidence that either the State does not have the resources to enforce; or it has the resources but is simply rubber stamping INL proposals. State oversight requires between 2 to 4% of INL's $428,313,000 ER/WM. At 2%, the State should be getting $8,566,000. In 1992 the State only got $3,500,600 from DOE for oversight of INL. Clearly, this is inadequate funding.

PBF Applicable or Relevant and Appropriate Requirements (ARAR)

The Plan does not cite RCRA hazardous waste, corrective action, or closure requirements in the listed ARARs. The INL Federal Facility Agreement and Consent Order (FFA) exempts INL only "... from the procedural requirements to obtain federal, state, or local permits, when such response action is selected and carried out in compliance with Section 121 of CERCLA, 42 USC 9621. Nonetheless, these actions shall satisfy, to the extent authorized by law, all the applicable or relevant and appropriate federal and state standards, requirements, criteria, or limitations that would have been included in any such permit. Accordingly, when USDOE proposes that a response action be conducted entirely on the INL Site which, in the absence of Section 121(e)(10) of CERCLA and the NCP, which, would require a federal or state permit, USDOE shall include in the appropriate documents submitted to the Lead and Support Agencies: (a) Identification of each permit which would otherwise be required; (b) Identification of the standards, requirements, criteria, or limitations which would have had to have been met to obtain each permit; and Explanation of how the response action proposed will meet the standards, requirements, criteria, or limitations of this Part." [FFA/CO @ 18]

Additionally, the Plan does not certify that exhumed contaminated materials from the PBF evaporation pond will be deposed at a RCRA permitted site which is in full and complete compliance with RCRA standards. Engineering study summaries by EG&G on using contaminated soil in a grout and injecting this grout into existing partially filled plywood waste containers are not supported by the studies testing results. Considerable air voids, lack of structural integrity, and extensive cracking was documented throughout the tests that were conducted at Oak Ridge National Laboratory. Additionally, the study stated that unless the outside as well as the inside of the containers were grouted the subsidence problem would not be mitigated.

Clearly, the use of old or even new plywood boxes in addition to a relatively unstable grout will result in yet another cleanup of the same waste some years hence. To rebury these wastes in wood boxes again over the aquifer is ridiculous. The misguided culture in DOE for the past four decades has regrettably not changed. Those previous waste management practices are today's cleanups. Clearly, today's waste management practices are sure to be tomorrow’s cleanups as well, unless the DOE is brought under enforcement actions by the State.

The PBF evaporation pond is not a permitted RCRA land disposal site nor is it listed as an Idaho Hazardous Waste Management Act site. The big question is why? Why is the State not imposing federal and State enforcement regulations and closure requirements on this hazardous waste dump? The State claims that the PBF is not a permitted facility, because it is not does not generate wastes characteristically covered under RCRA. Yet there are clearly mixed hazardous chemical/radionuclide wastes that are covered under RCRA. Additionally, the State is not doing any split sampling of contaminates in the pond that means that they are taking DOE's word on the constituents and their concentrations. The Environmental Defense Institute (EDI) supports the construction of concrete surface bunkers similar to those used for munitions storage. This approach will accommodate regular monitoring of the contents of the facilities as well as ready retrieval for final shipping to the permanent repository. Current underground dumping in unlined pits or pads is a continuation of the failed waste management policies of the past, and therefore must end. Construction of vitrification waste treatment facilities is the best hope for putting these wastes into a stable form for interim storage until a permanent disposal site is built.

Section IV. H. Central Facilities Area

Motor Pool Percolation Pond

Agency plans to cleanup the Central Facilities (CFA) Motor Pool Pond fail to accurately acknowledge the source of, nor the quantities of significant radioactive contamination in the pond. DOE's plan states only that: "On several occasions, vehicles and equipment with small amounts of radioactive contamination were decontaminated at the station." In fact, washing vehicles is standard operating procedure to reduce the spread of on-site contamination picked up by vehicles - especially during the multitude of accidents the site experienced.

Internal DOE documents show concentrations of 8.41 pCi/l of cesium-137; americium-241 and plutonium-238 at 9.46 pCi/l; and plutonium-239 at 4.29 pCi/l that are not adequately accounted for in their public literature. Sampling data showed cadmium and lead concentrations were 25 times higher than background tolerance levels. Chromium levels were 3 times higher than background. [EGG-WM-9973 @4-1]

For those who are willing to read the administrative record, INL contractor (EG&G) documentation says that: "long-lived fission products such as cesium-137, cobalt-60, and strontium-90 may have been added to the waste stream during decontamination of vehicles." [EGG-WM-9973@13] Also potassium-40 concentrations of 8.73, lead-212, and radium-226 are not acknowledged. [EG&G 8792@36] Tritium contamination under CFA ranges as high as 24,800 pCi/l which means additional contamination loading from motor pool must not be allowed. [90 Oversight (a)] DOE's proposed plan also does not accurately state the volatile organic ranges. Oak Ridge Survey sampling found 2-butanone at 190 ug/kg; trichloroethane at 25 ug/kg; toluene at 23 ug/kg; methylene chloride at 460 ug/kg; acetone at 85 ug/kg; tetachloroethlene at 76 ug/kg; and 4-methyl 2-pentanone at greater than 8,300 ug/kg. [EGG-WM-9973.@4-6&11] EG&G sampling found organic such as bis (2 ethylhexyl) phthalate at 4,000 ug/kg. [EG&G-WM-9973 @1-7] The federal Primary Drinking Water Standards for most of these organic is 5 ug/L.

Over INL's history, many accidents and intentional releases made transport of contaminates off the site of significant concern. Washing all vehicles has always been standard operating procedure. Therefore, it is not surprising that those contaminates ended up in the Motor Pool Pond. Clearly, the instillation of motorized washing equipment made the process faster. The CFA Laundry washes 10 mrad/hr of contaminated clothing. [ERDA-1536 @II-161] Risk calculations for worker exposure only allow for inhalation at 5% and direct contact at 1%. This is grossly understated due to the close proximity of the pond to CFA. Both State and EPA review of the Plan challenge DOE statements that EPA risk assessment methodology guidance was followed and point out that heavy metals such as silver and selenium were not acknowledged. Additionally, EPA challenges DOE's dismissal of the soil to groundwater pathway for contaminates migration. EPA also challenges the use of average values that is inconsistent with EPA guidance requiring use of a 95% upper level confidence limit. Cesium is also not included in Exposure Assessment nor was alpha and beta emitters even tested for at the waste pit. [IDEQ]

The agency decision of "No Action" is not supportable, non-compliant with ARAR's, and therefore, unacceptable. The PCB aroclor-1260, in concentrations of 1,470 ug/kg, alone, would dictate enforceable remedial action of exhuming contaminates to prevent further migration to the aquifer.

Section IV. I. Auxiliary Reactor Area

Auxiliary Reactor Area II - Stationary Low-Power Reactor 1

Background on SL-1

The U.S. Department of Defense wanted the Atomic Energy Commission (AEC) to develop a simple reactor for military to generate electricity at remote military locations such as the Arctic or Antarctic. In the late 1950s, the Navy had dominance over reactor development for submarines and with Admiral Rickover's leadership, the Navy had applied stringent design/safety/operating policies for reactors.

In the case of the Stationary Low-Power Reactor Number One (SL-1), the Atomic Energy Commission assigned the development and design to the Argonne National Laboratory. The design and proposed operation of the SL-1, built at the National Reactor Testing Station (NRST), now the Idaho National Laboratory, was built and operational in 1958. The SL-1 design was reviewed in 1958 by the AEC's Division of Licensing and Regulation and also by the Advisory Committee on Reactor Safeguards. Argonne's initial role included design and initial operation of the SL-1, and then the AEC hired Combustion Engineering, Inc. on February 5, 1959 as its contractor to operate and also modify the SL-1 reactor. Combustion Engineering had a cost-plus-fixed-fee contract with the AEC to operate the SL-1 reactor and conduct research and development at CEI's office in Windsor, Connecticut. This contract was administered by the Idaho Operations Office of the AEC. Combustion Engineering had about nine personnel in Idaho assigned to the SL-1. [154]

The reactor served both as an experimental prototype and as a training facility for military personnel. Located at the INL's Auxiliary Reactor Area, SL-1 was a small compact Army nuclear power plant having only 3 megawatt thermal (MWt) and using highly enriched fuel, 93 percent enriched in uranium-235.

The SL-1 reactor had no containment. The reactor building consisted of a grain silo/like building around the reactor vessel; and gravel filled the space between the exterior silo and the reactor vessel that provided some radiation shielding. Access to the top of the reactor was up exterior stairs connected to an operations building connected to the silo building.

The SL-1 accident occurred on January 3, 1961, while the reactor was shut down and while a control rod drives was being reassembled. Withdrawal of a single control rod during shutdown inserted enough reactivity for a super-prompt-critical power excursion and subsequent steam explosion accident. On this bitterly cold afternoon of January 3, three Army technicians arrived at the facility for the four to midnight shift. The SL-1 reactor had been shut down for routine maintenance, and the task of the three Army crewmen that evening was to complete certain preparations for nuclear startup. There were only these three crewmen working at the SL-1 facility that night. During the process of attaching control rods to drive motors, one of the men apparently raised the central control rod too far.

In addition to many problems at the SL-1, there was an extensive history of control rod sticking, during rod drop tests and also when raising the control rods. When manually lifting the 80-lb rod assembly while shutdown and trying to free it, the rod may have suddenly become unstuck and withdrawn enough to cause the accident. The No. 9 control rod was later found to be bound in its shroud at the 20-inch withdrawal position. It would later be shown that the control rod could manually be lifted far enough and fast enough to cause the supercritical prompt power excursion in the reactor core. In a fraction of a second the power reached a magnitude of an estimated 19,000 MWt and vaporized part of the core. [IDO-19311] The water in the core region was vaporized, creating a

[154] Joint Committee on Atomic Energy, SL-1 Accident Atomic Energy Commission Investigation Board Report, U.S. Government Printing Office, Washington, 1961.

devastating steam explosion. The remaining water in the reactor vessel was hurled upward at high velocity, striking the underside of the reactor's pressure lid and lifting the whole nine-ton vessel upward 9-ft, shearing cooling pipes in the process.

The author interviewed Owen Gailar (now 93) by phone in July 2019. Gailar worked at Combustion Engineering Physics Division located in Windsor, CT where he was in charge of the Reactor Statics. The Combustion Engineering (CE) Windsor Engineering Division had control of the SL-1 modifications and operations. But the CE Windsor Reactor Statics Group that Gailar worked in had no part in the original SL-1 design and no control over ongoing SL-1 operations.

Gailar said he would "often get 'unofficial calls' from the CE SL-1 Physics Group reporting on loss of boron, critical rod positions and sticking control rods. In this capacity I could 'cross the aisle' and recommend to friends and supervisors in the Engineering Division that the SL-1 be shut down. They in turn did NOT push for SL-1 shutdown! 'You geeks worry about everything, nothing is going to happen,' was the response of mid-level supervisor in the Engineering Department. The supervisor was right…for a few months. Then four people [three SL-1 crewmen and a few years later a nurse that responded to the emergency who also received a high and unmonitored radiation exposure] were killed… and if not for bureaucratic money grabbing, a fifth [a night shift CEI supervisor requested but denied by the AEC] would have been killed in the first nuclear power related accident in the United States."

According to Owen Gailar's written comments to Broscious in 2019, There were significant problems with aluminum clad rods swelling and sticking produced a risk in controlling the reactor and implementing a controlled shutdown. Gailar and another person at Combustion Engineering at the Windsor office recommended the shut down of the SL-1 reactor, but they had no control over SL-1 operations. The part of Combustion Engineering that had control of the SL-1 wanted to continue reactor operations.

Combustion Engineering management wanted to continue operations and disregarded its CE Windsor Reactor Statics Group's warnings. These physicists became extremely concerned after they heard that the Army operators were conducting "bumping experiments" or "burp tests" to see how much "steam bubbles" were generated during shutdowns to evaluate the reactor's stability. These "bumping experiments" tests were dangerous because they were triggering the automatic scram system thus relying on the nuclear instrumentation and requiring the rapid insertion of control rods in a reactor with sticking control rods to limit the overpower condition.

Also, the Reactor Statics Group was concerned when they heard that Combustion Engineering/Army reactor operators were instructed to use a sledge hammer to drive the rods into the core. To no avail. Then later when operators tried to remove the rods, they could not manually lift the rods out because they had been hammered into place. The operators ask the Army for a jack to lift the rods out far enough (13") to reach the motorized rod lift; but were refused because "it might damage the reactor."

The Army SL-1 operators were concerned enough that "they wanted the night supervisor present but were turned down because there were no funds for a night supervisor." The AEC refused to provide funding for the additional staffing.

Other reactor facilities require monitoring control room instrumentation whenever fuel is in the reactor and during reactor core loading or unloading operations. With only three crewmen working at the SL-1 and no operator monitoring the control room instrumentation, there wasn't even anyone alive to call in the emergency. It was the activation of a fire alarm due to steam that activated the emergency response the night of the SL-1 accident.

As documented in the "SL-1 Accident Atomic Energy Commission Investigation Board Report" the Army provided no meaningful technical or safety oversight of the SL-1 reactor. The SL-1 reactor had been approved for operation at 3 MW thermal, but the AEC and Combustion Engineering were operating the reactor at higher power levels without licensing evaluation or approval. According to this board report, there was a lack of safety appraisals, lack of clear roles and responsibilities for safety, and "a number of deficiencies related to the SL-1 reactor." The board report stated: "…it is the judgement of the Board that, before the incident occurred, the condition of the reactor core and the reactor control system had deteriorated to such an extent that a prudent operator [the AEC and its contractor Combustion Engineering] would not have allowed operation of the reactor to continue without a thorough analysis and review, and subsequent appropriate corrective action, with respect to the possible consequences or hazards resulting from known deficiencies."

The AEC and Combustion Engineering would downplay the importance of control rod sticking because the problem of control rod sticking was far worse in late December 1960 after the high-power testing, above the approved 3 MWt, of the reactor.

Two crewmen died immediately and the third died about two hours after the accident. One of the men remained impaled on the ceiling by a piece of control rod rammed through his groin. "It all happened in a second or so." [155]

Twenty-two emergency responders, including the nurse, were acknowledged to have received external radiation exposures between 3 and 27 rem. The cancer deaths of these emergency responders several years after the SL-1 accident has been noted in several books about the accident. About 1200 workers participated in SL-1 cleanup.

According to Norton, "It [SL-1] was a terrible accident, made even more grisly because the intensely radioactive fission products scattered inside the building by the accident hampered the work of recovering the bodies. Staying in the building for mere seconds resulted in a year's allowable dose of radiation for rescue workers. And it took six days to remove the body that was impaled on the ceiling by use of a remotely operated crane and a closed-circuit television. The bodies were so badly contaminated, the heads and hands of the victims had to be severed and buried with other radioactive wastes at the Radioactive Waste Management Complex." [Norton] The Oil Chemical and Atomic Workers Union protested vigorously that the government refused to provide a proper Christian burial for the workers.

The SL-1 reactor accident would cause the radiation exposure of emergency responders including firemen, the nurse, health physics personnel, and then cleanup workers. The AEC acknowledged exposures of 0.1-0.5 roentgens [rem] to nearly 100 personnel are probably underestimated. Over 12 emergency responders received exposure greater than 10 roentgens [rem]. [IDO-19301@138] The maximum acknowledged radiation field was 1,000 R/hr. (Rad per hour) ERDA-1536, p.II-243], but this may understate the radiation fields especially the night of the accident. The exposed reactor was still emitting 22,000 R/hr. five months after the accident. Readings above the reactor one month after the accident were stated as 410 R/hr. [IDO-19301, p.109]

The AEC stated that 1,128 Ci including 80 Curies of radioactive Iodine were also released during the SL-1 accident. [ERDA-1536, p.II-243] [DOE/ID-12119@A-53] and this is likely to underestimate that actual radiological release. A temperature inversion kept the radiation plume close to the ground and at 25 miles the radioactive iodine levels were 10 times above background. At 100 miles the radiation levels were above background.

The author interviewed the widow of James Dennis who was a member of the SL-1 **in-**voluntary Army demolition crew brought in to dismantle the reactor after the accident. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia, which his medical documents confirm, was caused by exposure to 50 rem/hr. for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1, CAB] as grossly understated. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis, p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Dennis is only one of thousands of individuals who are victims of the health effects of radiation exposure caused by radioactive releases from DOE facilities.

Tami Thatcher's has written extensive published reviews of the available declassified reports on the SL-1 nuclear reactor accident. [156]

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[155] Norton; "Supercritical", Boyd Norton, Manager of SPERT Reactor tests during 1960s, Audubon Magazine May 1980, p. 89-105]

[156] Tami Thatcher, Environmental Defense Institute, The SL-1 Accident Consequences, September 2019. http://environmental-defense-institute.org/publications/SL-1Consequences.pdf

Tami Thatcher, Environmental Defense Institute, The Truth about the SL-1 Accident – Understanding the Reactor Excursion and Safety Problems at SL-1, Updated September 2019. http://environmental-defense-institute.org/publications/SL-1Accident.pdf

Tami Thatcher, Environmental Defense Institute, A Brief History of Radiation Exposures to Idaho National

"The Stationary Low-Power Reactor 1 (SL-1) was a small [3 megawatt] nuclear power plant designed for the military to generate electric power and heat for remote arctic installations [defense early warning - DEW line]. The reactor was operated from August 1958 until January 3, 1961 as a test, demonstration, and training facility. On the evening of January 3, 1961, the SL-1 reactor accidentally achieved a prompt critical nuclear reaction [melt-down] that resulted in a steam explosion that destroyed the reactor. The accident resulted in the deaths of the three operators on duty. The reactor vessel and building were severely damaged and highly contaminated, and a massive cleanup operation ensued to dismantle and dispose of the reactor and building." [SL-1 Plan] Also see Guide section I(B) on INL accident history.

"A burial ground was constructed approximately 1,600 feet northeast of the original site of the reactor. This was done to minimize radiation exposure to the public and site workers that would have resulted from transport of contaminated debris from SL-1 to the Radioactive Waste Management Complex (RWMC) over 16 miles of public highway. Original cleanup of the site took about 18 months. The entire reactor building and contaminated materials from nearby buildings were disposed in the burial ground. The majority of contaminated materials consisted of soils and gravel that were contaminated during cleanup operations." [SL-1 Plan] Reactor core minus the remaining fuel not blown out during the explosion were sent to the RWMC for shallow burial in the Subsurface Disposal Area. "The SL-1 Burial ground consists of three excavations, in which a total volume of 99,000 cubic feet of contaminated material was disposed. The excavations were dug as close to basalt as the equipment used would allow, and range from 8 to 14 feet in depth." ... "During a survey of surface soil in June 1994, hot spots areas of higher radioactivity were found within the burial ground, with activities ranging from 0.1 to 50 mR/hr." [SL-1 Plan] Surface soil samples showed Cs-137 at 1,854.8 p/Ci/g and Sr-90 at 2,806 p/Ci/g. [INL-95/0027 @6-15] Other soil samples at SL-1 burial ground showed cesium-137 at 70,000 and Sr-90 at 27,000 pCi/g. [IT Corp]

"The initial [SL-1] core loading consisted of 14,007.5 grams of uranium-235, and 1022 grams of uranium-238". SL-1 heavy metal and fission product full core isotopic inventory was 221,507.13 curies. [EGG, 3/22/94] It is assumed that approximately 7 percent of the initial fuel load or 15,505.499 curies are buried at the SL-1 site. As a result of the explosion, this fuel is dispersed among reactor and building debris and contaminated soil primarily in the form of fission byproducts cesium-137 and strontium-90. The total exposure risk to a future resident in thirty years of getting cancer is 5 in 10 chances; or a 50/50 chance. "The risk due to cesium-137 falls below the EPA one in 10,000 [industrial] threshold in about 400 years". [INL Facts(b)] This high risk means that if institutional control cannot be ensured for over 400 years, then people or animals coming in contact with the waste will face serious hazards. EPA's one in 10,000 threshold is an industrial standard; the residential standard is one in a million. Despite this hazard, DOE, the State, and EPA concluded that the SL-1 burial ground environmental restoration was only to consist of adding a thin earth and rock cap. For a compelling documentary of the SL-1 accident see Beacher Films, 6810 Chabet Rd, Oakland, CA 94618.

Laboratory Workers, Updated January 5, 2016. http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf

Tami Thatcher, Environmental Defense Institute January 2015 Newsletter article, America's only Nuclear Reactor Operator Deaths. http://www.environmental-defense-institute.org/publications/News.15.Jan.Final.pdf

Tami Thatcher, Environmental Defense Institute April 2018 Newsletter article, "An Editorial About the 1961 SL-1Accident History in Response to a February Guest Editorial in the Post Register." http://environmental-defense-institute.org/publications/News.18.April.pdf

Tami Thatcher's Understanding the Reactor Excursion and Safety Problems at SL-1 Jan 3, 2015 - On the night of January 3, 1961, the SL-1 nuclear reactor, a prototype for a military installation to be used in remote Arctic locations, exploded ...[PDF] http://www.environmental-defense-institute.org/publications/SL-1Article%20Rev5.pdf

Tami Thatcher, A Brief History of Radiation Exposures to Idaho National Laboratory Workers, January 5, 2016 Update. http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf

2. No Cleanup of ARA-1 Chemical Percolation Pond

Once again, DOE generates a "No Action" proposal without any substantive information to support the decision. The Auxiliary Reactor Area (ARA) Chemical Evaporation Pond is actually an unlined percolation waste pit for chemicals and radionuclides. Sampling did not include beta-emitting radionuclides. Alpha and gamma isotopes are listed without any quantitative contaminate values and drinking water standards upon which a reader could reasonably make an informed decision on the merits of the Agency decision.

This chemical percolation pit is located at ARA Area I, which is the site of the infamous SL-1 reactor explosion that spewed 1,100 Ci out and killed three operators (see next section on SL-1). The ARA has a long and sordid reactor destruct experimental history including Power Burst Reactor, Gas-Cooled Reactor Experiment, Mobil Power Plant #1, SPERT Reactors 1&2, Fast Spectrum Refractory Metals Reactor, Hot Critical Experiment, Fast Transient Reactor, and related support facilities.

In the Plan narrative, DOE commits nearly all discussion to trivializing the problem and offering little or no substantive information. The ARA facilities have extensively contaminated the ground in the area. DOE expects the public to accept background samples collected 100 feet from the pond. Given ARA released 361,632 curies over its history, this choice for background sampling is ludicrous. Adding insult to injury, DOE characterizes these background readings as "naturally occurring."

The ARA lies immediately up gradient of the Big Lost River. As previously cited, a six member ground water study team commissioned by EG&G, an INL contractor, was canceled after its preliminary results showed that contamination "could move from INL to the Magic Valley within months." [Aley, 1980] Their findings revealed the presence of lava tubes that move water rapidly through the aquifer and exit at Thousand Springs on the Snake River.

Other DOE studies of aquifer contamination plume movement from ICPP to CFA between 1953 to 1958 document a seven foot/day or one-half mile/yr. Contaminate travel time from surface disposal to the aquifer is approximately 4-6 weeks or 10 feet/day. [ERDA-5316@II-120&III-81] The fact is that the aquifer is not a homogenous geologic structure, but rather a very heterogeneous mix of different strata. Therefore no generalized characterization about water movement within the aquifer is valid. The entire volume of the Big Lost River literally disappears into the porous Snake River Plain. The Administrative Record lists the following contaminates in the ARA chemical "pond".

ARA Chemical Waste Pond Contaminates

Contaminate	Concentration	Contaminate	Concentration
Cesium-137*	297.00 pCi/gram	Barium	293.00 mg/kg
Cesium-134	11.40 pCi/gram	Methyl Chloride	26.00 ug/gram
Strontium-90	297.00 pCi/gram	Uranium-234	1.60 pCi/gram
Cobalt-60	8.14 pCi/gram	Gross Alpha	285.00 pCi/gram
Plutonium-239	2.60 pCi/gram		

* The Radiological Release Criteria for Cesium-137 is 10 pCi/gram. [EG&G-WM-8804]
[EGG-WM-10001@4-16 to 4-20][EGG-2612(90)][ARA Rod]

Section IV. J. BORAX-1 Remediation

“The [Boiling Water Reactor Experiment Number 1] BORAX-1 reactor was a small experimental reactor used in the summer months of 1953 and 1954 for testing boiling water reactor technology. In 1954, the design mission of BORAX-1 was completed, and the decision was made to make one final test, which resulted in the intentional destruction of the reactor. The destruction of the reactor contaminated approximately 84,000 square feet of the surrounding terrain. Immediately following the final test of the BORAX-1 reactor, much of the radioactive debris including some fuel residue, was collected and buried on site in the reactor shield tank.“ “However the cleanup did not sufficiently reduce the radioactivity at the site; therefore, the 84,000 square foot contaminated area was covered with approximately 6 inches of gravel to reduce radiation levels at the ground surface."..."Buried materials at the site consist of unrecovered uranium fuel residue, irradiated metal scrap, and contaminated soil and debris. Part of the waste was buried in the bottom half of the shield tank; the top half of the tank was collapsed into the bottom and the void space was filled with debris." [SL-Plan]

"After 25 years, exposure rates as high as 45 R/hr were measured above the gravel covering of the BORAX-1 site."..."Radiation surveys around anthills on the gravel covering detected radioactive fuel fragments which were presumably transported to the surface by ants."..."Vegetation sampling indicated that mean cesium-137 concentrations in rabbit brush from the former reactor site was statistically greater than the control area samples."..."Uranium-235 was detected in two surface soil samples 100 to 140 meters to the southeast of the former reactor in concentrations about 3 times greater than background." [Dickson] Forty seven ant hills were observed in the BORAX-1 gravel area and a survey of the hills showed radiation counts ranging from 2,000 and 15,000 counts per minute. Sixteen grams of U-235 fragments were found on the surface after the explosion.[Dickson] Recent surface soil samples show Cs-137 at 7,334 pCi/g and U-235 at 144 pCi/g. [INL-95/0027 @6-15] Other soil sample data showed Cs-137 at 67,000 and Sr-90 at 27,000 pCi/g. [IT Corp]

Only 12% of the BORAX-1 reactor fuel was recovered leaving the remaining 88% released to the surrounding area. The reactor core consisted of 30 uranium aluminum alloy assemblies containing a total of 4.2 kg of 90% enriched U-235. The reactor tank had 3,4000 gallons of waste during operation. [Dickson] According to DOE's internal documents BORAX-1 fuel remaining at the reactor site burial ground contained 22,800,000 curies. This number is significantly understated because, "The total value includes total activity at the dates indicated while individually radionuclide entries include activity only if the curie value was greater than 0 after 40 years of decay". [ERD-93-002] Also not included in the remaining soil contamination is 714 curies released to the atmosphere. Atomic Energy Commission video footage of the intentional BORAX-1 explosion can be seen in the movie Dark Circles.

DOE, State of Idaho, and EPA concluded that the BORAX-1 site could be covered over with an additional thin layer of soil and rock as the final environmental remediation action despite the extreme hazard the site presents to future generations. The deterministic exposure risk of contracting cancer by a future resident in thirty years is 3 in 100. EPA's standard for residential exposure is one in a million. This is an example of a nuclear sacrifice zone.

Section IV. K. Naval Reactor Facility Cleanup Plan

The Environmental Defense Institute (EDI) comments on the Department of Energy (DOE) Final Environmental Impact Statement DOE/EIS-0453-F, submitted previously for the record, are available on EDI's website. [157] EDI's comments have more background contamination and radioactive waste information needed to fully understand all the environmental impacts. EDI's comments on NRF CERCLA review is also available. [158] Tami Thatcher's DOE comments on DEIS that cover other crucial issues are available. [159] The comments below focus on the final FEIS issues that were not covered and therefore make it deficient for the following reasons:

* The FEIS fails to comply with all National Environmental Policy Act (NEPA) requirements;
* The FEIS fails to fully evaluate keeping the existing Expanded Core Facility (ECF) spent (used) nuclear fuel (SNF) cooling pool in operation for "over 33 years" as an integral part of NRF operation;
* The FEIS incorrectly says NNPP will not generate high-level-waste, greater-than-class waste or transuranic waste;
* The FEIS failed to adequately assess the ECF's seismic vulnerabilities.

"The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for all matters pertaining to

[157] http://www.environmental-defense-institute.org/publications/EDINRFcomments.pdf
2 http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdf
159 http://environmental-defense-institute.org/publications/CommentsECF.pdf

naval nuclear propulsion from design through disposal (cradle-to-grave).” [FEIS pg. Vol. I Abstract]

The Naval Reactors Facility (NRF) located on DOE’s Idaho National Laboratory (INL) is the waste end of the used reactor fuel (spent nuclear fuel or SNF) from the NNPP’s nuclear fleet. DOE’s role is designated to manage the Navy’s waste.

EDI finds this EIS a clever effort to slip in major expansion of the Navy’s SNF waste management without acknowledging 50+ years of massive radioactive contamination at INL by claiming previous NRF environmental studies. [160] DOE/NAVY claim these CERCLA reports are beyond the scope of this EIS. The Navy’s previous radioactive contamination will remain for manila putting Idahoans at risk. This is an unconscionable and avoidable assault on Idaho’s most valuable Snake River Aquifer that we depend on.

1**. NEPA Requirements Violated**

A. The FEIS fails to comply with all NEPA requirements.

The FEIS correctly states: “NEPA, Sec. 1502.1 Purpose Environmental Impact Statement. The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. **It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment… Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document.** It shall be used by Federal officials **in conjunction with other relevant material** to plan actions and make decisions.” [161] [emphasis added]

FEIS states: “Per NEPA requirements (10 C.F.R. § 1021 and 40 C.F.R. § 1500–1508), consideration must be given to whether actions performed under the alternatives could result in a violation of any federal, state, or local law or requirements, or require a federal permit, license, or other entitlements. Federal environmental laws that affect environmental protection, health, safety, and compliance were considered in the EIS scope development. In addition, environmental requirements that have been delegated to the state of Idaho and local requirements were considered to ensure compliance.” [FEIS pg. 1-13]

The Yale Law Journal Review notes: “To comply with existing law and achieve NEPA’s normative goals, agencies should expand EIS discussions of how applicable regulatory regimes will shape project impacts. Impact discussions are not ‘full and fair’ without this information because they fail to allow the public and other agencies to comment on—and more importantly, to challenge—this crucial aspect of project planning. Such an approach would further NEPA’s aim to ‘[r]igorously explore and objectively evaluate’ the full scope of project impacts that ‘significantly affect the quality of the human environment.’” [162]

Due to public and Federal court pressure, DOE has in the recent past conducted numerous “Programmatic” EISs that comprehensively analyze all relevant aspects of a project’s environmental impact. [163] DOE/NNPP must be pressured to fulfill NEPA requirements by reissuing this FEIS as a comprehensive “Programmatic EIS.”

The DOE/Navy is trying to avoid NEPA requirements to provide a comprehensive environmental impact statement of the proposed actions. Failure to provide NRF past-present-future waste characterization/disposition means the DEIS/FEIS are deficient. Absent this crucial waste data,

[160] Remedial Investigation/Feasibility Study (RI/FS) studies required by CERCLA to characterize the nature and extent of contamination because of past releases of hazardous and radioactive substances to the environment, to assess risks to human health and the environment from potential exposure to contaminates, and to evaluate cleanup actions.

[161] Authority: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977). Source: 43 FR 55994, Nov. 29, 1978, unless otherwise noted.

[162] *A ‘Full and Fair’ Discussion of Environmental Impacts in NEPA EISs: The Case for Addressing the Impact of Substantive Regulatory Regimes*, Sarah Langberg, foot notes 178 & 179 citing 40 C.F.R. § 1502.14(a) (2014). U.S.C. § 4332(C) (2012). http://www.yalelawjournal.org/note/nepa-eiss-and-substantive-regulatory-regimes.

[163] See, Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the U.S. Including the Role of the Fast Flux Test Facility, DOE/EIS-0310, December 2000.

Commenters' must rely on previous reports to ascertain how these operations effect the environment. [164] **The public cannot rely on this document to provide the information needed to make an informed decision.**

2. DOE/Navy fails to issue a Comprehensive Programmatic EIS

A. The FEIS inadequately evaluates keeping the Expanded Core Facility (ECF) in operation; for "over 33 years" as an integral part of NNPP operation.

FEIS states: "**Overhaul Alternative time period. The first 33 years of the 45 years (i.e., the [ECF] refurbishment period), refurbishment and operations activities would be conducted in parallel.**" [Pg. S-8] [emphasis added]

"[T]he NNPP will continue to operate ECF during new facility construction, during a transition period, and **after the new facility is operational for examination work**. **To keep the ECF infrastructure in safe working order during these time periods, some limited upgrades and refurbishments may be necessary. Details are not currently available regarding which specific actions will be taken; therefore, they are not explicitly analyzed as part of the New Facility Alternative.**" [165] [emphasis added]

The above FEIS statement: "Details are not currently available regarding which specific actions will be taken." **This documents the fundamental inadequacy of the FEIS.** DOE/Navy cannot legitimately claim compliance with NEPA when the most degraded part of this operation is not fully evaluated in explicit detail. More troubling is the Environmental Protection Agency (EPA) and Idaho Department of Environmental Quality's defining silence as regulators. This is a crucial issue given that the public's environmental defenders are politically compromised on enforcement of laws they have authority over.

The FEIS correctly states: "Per NEPA requirements (10 C.F.R. § 1021 and 40 C.F.R. § 1500–1508), consideration must be given to whether actions performed under the alternatives could result in a violation of any federal, state, or local law or requirements, or require a federal permit, license, or other entitlements. Federal environmental laws that affect environmental protection, health, safety, and compliance were considered in the EIS scope development." [FEIS Pg. 1-13]

Yes, environmental laws were considered but never acknowledged to be violated. In addition the FEIS fails to include soil and ground water contamination from ECF leaks and discharges that **do** violate environmental laws. [166] These issues will be discussed later.

3**. ECF Degraded Condition**

DOE/NRF's statements confirm the degraded condition of the ECF. Again documents the fundamental inadequacy of the FEIS to exclude specific actions required to mitigate continued significant ECF leaks. "Not a matter of urgency" discloses the Navy's previous decades of disregard for environmental degradation.

"Major portions of the ECF infrastructure have been in service for over 50 years. **The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards. Although water pool surfaces are covered with a fiberglass or epoxy coating, the water pool does not have a liner, creating the potential for water infiltration into the reinforced concrete structure and the potential for corrosion damage of the reinforcing bar within the structure. The capability to detect and collect small leaks, a common feature in modern water pools, is not present for the ECF water pool. Consequently, while the replacement or overhaul of the current water pool is not a matter of urgency that must be done in a very short period, it is something that needs to be planned and started soon."** [FEIS Pg. S-6][emphasis added]

A. ECF Leaks ?

"**Alternative methods would be to discharge the water from leak testing the pools (up to 18,927,000 liters**

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[164] See EDI's NRF CERCLA comments and for more detailed information on NRF's waste characterization not provided in this EIS. http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdf

[165] Final Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling, October 2016, DOE/EIS-0453-F, Pg. S-9, herein after referred to as FEIS.

[166] See EDI's NNPP Report that offers a Review of NRF CERCLA issues not addressed in this EIS. And Final NRF Comprehensive Feasibility Study Waste Group 8 Naval reactor Facility. And "Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999", J. Giles et.al., April 2005, ICP/EXT-05-00833, pg. 18.

(5 million gallons)) to the sewage lagoons or to the [Industrial Waste Ditch] IWD during the last year of construction. This discharge would occur over a short period of time (about 6 days) but is not expected to exceed the infiltration capacity or the maximum flow distance (2.9 kilometers (1.8 miles)) previously recorded for the IWD. **The permitted annual discharge rate for the IWD of 113,600,000 liters (30,000,000 gallons) would not be exceeded. Section 4.4.3 reflects this potential discharge of water for pool leak testing."** [FEIS Pg. 1-21]

Table 4.4-5: Discharge to the IWD for the Construction Period of the New Facility Alternative [FEIS Pg. 4-44]

Source	**Volume**[1]	
	liters per year	gallons per year
Construction Period Increase **(leak test water)**	18,927,000	5,000,000
NRF Baseline [including ECF] [2]	43,190,000	11,410,000
Total[3]	62,117,000	16,410,000
Wastewater Reuse Permit Discharge Limit[4]	113,600,000	30,000,000
Percent Increase Over the NRF Baseline[5]	**43.8**	
Percent of Discharge Limit[6]	**54.7**	

[1]Numbers have been rounded; therefore, unit conversions are not exact.
[2]Total volume of discharge to the IWD from all NRF sources **(including ECF) for 2009.**
[3]Total of Construction Period Increase and NRF Baseline.
[4]Based on the Industrial Reuse Permit Renewal Application for the Naval Reactors Facility pending approval, dated January 26, 2012.
[5]Percent increase from construction period over the NRF Baseline.
[6]Percentage of total discharges for NRF (62,115,000 liters) compared to the wastewater reuse permit discharge limit.

The NRF Industrial Waste Ditch (IWD) is just that; an open ditch where huge volumes of radioactive liquid process waste from the ECF is allowed to sink down into the aquifer below flushing previous contaminates down further into groundwater. DOE/Navy claims "CERCLA remedial action plan are outside the scope of this EIS" and thereby attempts to censure NRF groundwater and soil reports showing significant contamination above EPA/MCL limits. This FEIS facilitates continued contamination of Idaho's most precious resource that thousands of INL workers and all Idahoans rely on for drinking and crop irrigation.

Again, leak testing (in the above 4.4-5 table) is not defined, however the reader is left to assume that this represents the volume of water that continues to leak into concrete structure surrounding the ECF and that must be pumped out and discharged to the Industrial Waste Ditch (IWD) or other unlined percolation ponds at the NRF. These radioactive waste discharges eventually migrate to the aquifer and the Snake River via Thousand Springs near Hagerman, ID.

The above ECF "water tight" is not possible with planned epoxy/fiberglass coatings as previous use demonstrates, but only with the NRC required stainless liner which is not planned. FEIS fails to characterize/quantify what the above waste discharges will be and how these additional discharges will add to existing NRF soil/groundwater contamination described in CERCLA RI/FS. [167]

FEIS states: "The ECF water pool does not leak 16,000 gallons per day as alleged by the [EDI] commenter, and there is no known leak to the environment." "Appendix F, Section F.5.4.12 states that additions to the water pool are about 150 gallons of water per day to compensate for evaporation. The 150 gallons per day of make-up water is consistent with expected losses due to evaporation based on the surface area of the pool and facility humidity levels." [FEIS Pg. G-102]

[167] Remedial Investigation/Feasibility Study (RI/FS) studies required by CERCLA to characterize the nature and extent of contamination because of past releases of hazardous and radioactive substances to the environment, to assess risks to human health and the environment from potential exposure to contaminates, and to evaluate cleanup actions.

The above statement is misleading at best. The Navy's own earlier CERCLA report states: "The ECF water level is monitored frequently and recorded in water level logs. Water is routinely added to the pits to compensate for evaporation loss. **For the past four years, the average water loss has been 3500 gallons per month.** To determine if any leakage has occurred, the actual water loss per month is compared to theoretical and experimental evaporation data. **Between December 8, 1991 and February 6, 1992, significantly more water was added to the water pits than anticipated. The detailed investigation of this event identified that an unexplained water loss of 62,500 gallons occurred between December 8, 1991 and February 21, 1992.** A leak from one water pit was the expected cause of the water loss." [168]

The above documented ECF 62,500 gal.30 day leak = 2,083 gal. /day. Obviously, the DOE/Navy is not offering true or credible information in this FEIS. The above cited document was obtained through an EDI FOIA request and not radially available to public. Clearly, this is why the DOE/Navy does not include NRF CERCLA data in this FEIS. [169]

ECF leaks and discharges to the Industrial Waste Ditch (IWD) are not fully evaluated in the FEIS especially when ECF projects will be heavily regulated under substantive environmental law regimes such as the Clean Air Act (CAA) [170] or Clean Water Act (CWA). [171]

5**. The FEIS fails to include the Advanced Test Reactor as an integral part of NNPP operation**

Currently, the Advanced Test Reactor at INL that tests NRF fuel is a crucial part of NRF operations and itself produces SNF. This sleight of hand that the ATR is not an integral part of the NNPP/NRF is ridiculous and challenges the credibility of this FEIS.

The FEIS fails to include Idaho Nuclear Technology and Environmental Center (INTEC) as an integral part of NNPP operation

"In addition to DOE owned fuel INL/INTEC CPP-666 stores spent fuel from the Naval Reactors Program." [172] "The Idaho [CPP-666] inventory includes SNF from the Naval Nuclear Propulsion Program (i.e., submarines and aircraft carriers), which is different from commercial SNF in many ways, including enrichment level and design. From about 1952 to 1992 this Navy SNF was reprocessed in Idaho to extract high-enriched uranium for use in driver fuel rods at weapons material production reactors elsewhere." [173]

Chemical reprocessing at INL/INTEC generated millions of gallons of high-level waste – 900,000 gallons of which remains in underground tanks today. Leaks from this INTEC high-level waste tank farm and aquifer waste injection wells continue to contaminate the soil and groundwater. [174]

The FEIS states: "The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for **all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)."** [FEIS pg. Vol. I Abstract] [emphasis added]

Incomplete Environmental Impacts

The FEIS fails to include previous environmental contamination identified in CERCLA investigations in cumulative environmental impact;

DOE/Navy use a classical bait and switch ostensibly initially appearing to follow the legal requirements of NEPA, while later buried in the FEIS claim's the NRF has no obligation to include the full waste stream disposition and environmental contamination resulting from NRF/ECF operations. What is critical in any EIS is to review all

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[168] Final NRF Comprehensive Feasibility Study Report Waste Area group 8 Naval Reactors Facility, Idaho Falls Idaho, Pittsburgh Naval Reactors Office, and pg. 5-1.

[169] FEIS, Pg. G-102

[170] Clean Air Act (CAA)[10] Yale citing 42 U.S.C. ss 7401q(2012)

[171] Clean Water Act (CWA) Yale citing 33 U.S.C. ss 1251-1387 [11]

[172] Energy and Environment, Storage of DOE SNF at the Idaho National Laboratory, U.S. DOE.

[173] U.S. Spent Nuclear Fuel Storage, James Warner, Section Research Manager, Pg. 27, Citing T. Cochran, et.al., Nuclear Weapons Databook, Vol. II, May 24, 2012, Congressional Research Service, 7-5700, R42513, www.crs.gov

[174] Engineering Design File, Groundwater Pathway Risk Assessment for CPP-601, CPP-602, CPP-627, and CPP-640 Fuel Reprocessing Complex Non-Time-Critical Removal Action**,** Document ID: EDF-10195, Revision ID: 1, Effective Date: 02/08/12.

environmental the impacts of any subject operation. That literally means the past, present and anticipated impacts as NEPA requires. By ignoring history, we are bound to repeat it.

FEIS states: "Comments on the NRF Waste Area Group 8 CERCLA remedial action plan are outside the scope of this EIS." [175] [FEIS Pg.G-104]

Again, it is essential to review previous CERCLA analysis to get an accurate assessment of what current and future operations will be since the basic operations have not changed. Moreover, new waste discharges MUST be added to previous contamination to fully assess environmental impacts. An earlier NRF Environmental Report states: "Overall, less than an estimated 1500 curies of radioactivity have been released to the atmosphere during the period of 1953 through 1991, with the majority of the releases occurring in the 1950s. During the past 10 years, releases have been less than 10 curies per year…. In Addition to the annual releases, a single release occurred in 1955 during the performance of an engineering test to obtain information on the effects of boiling conditions in naval reactors. … A conservative estimate of the amount of radioactivity released from the site was 870 curies. [176]

Review of the historical deep well sampling data at NRF does not support the Navy's conclusion of no impact. NRF CERCLA report shows Table III Deep Well Sample Results for Wells # 1, # 2, and # 3 at 60, 69, and 44 pico curies per liter respectively for gross beta. [177] The federal drinking water standard for gross beta is 8 pico curies per liter. This deep well sample data confirm that contaminates in fact migrate, contrary to the Navy's claims that contaminates are bound up in the soil.

Vegetation at NRF CERCLA Unit 8-08-14 radioactivity (pCi/gm) Sampling Results (Pre-1971) Sample # 68-1 was 144,522; Sample 6-82 was 687,447 pCi/gm. [178] DOE/NRF understandability is blocking this shocking data. Like a used house salesman showing a prospective buyer a fancy color brochure that does not show the failing foundation, leaking heating oil tank and water leaks, DOE fits perfectly by vehemently objecting to independent environmental review.

The FEIS Inadequately Characterize Groundwater Contamination

FEIS states: "Groundwater monitoring has generally shown long-term trends of decreasing concentrations for radionuclides, and **current concentrations are <u>near</u> or below EPA MCLs for drinking water and the sites where there is historic contamination are <u>not used as sources for drinking water</u>.**" [Pg. G-99][emphasis added]

The above statement "**current concentrations are "<u>near"</u> EPA MCLs for drinking water and the sites where there is historic contamination are <u>not used as sources for drinking water</u>" completely disregards NRF staff, visitors and thousands of INL workers at other facilities who drink water drawn from facility wells.** What about adjacent Atomic City residents? What kind of credibility can the public put on the Navy's assurance that groundwater is "<u>NEAR"</u> regulatory EPA MCL limits? None! Every INL/NRF potable water source should have a notice DO NOT USE FOR DRINKING.

The FEIS states: "During the construction period of the New Facility Alternative, there would be **small impacts on the amount of water seeping into the perched water zone at the IWD outfall**." [4-44][emphasis added] "The increased water discharge volume at Location 3/4 or Location 6 during the transition period could result in **additional seepage of water to the perched water zone located beneath the IWD outfall. When the areal extent of this perched water zone was greatest, annual discharge volume to the IWD was 650,000,000 liters (172,000,000 gallons) and was not regulated by a permit**. [FEIS Pg. 5-40]

To characterize waste discharges as having "small impacts" to the ground water is ridiculous. Why? Because these huge contaminated waste water discharges will flush existing waste into the aquifer. Nuclear Regulatory Commission (NRC) would otherwise require leak-proof stainless steel liner in all commercial spent nuclear fuel

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[175] Proposed Plan Waste Area Group 8, and Removal Actions Considered for Naval Reactors Facility Idaho National Laboratory, issued by DOE, EPA, and Idaho Department of Environmental Quality.

[176] Naval Reactors Facility Environmental Summary Report NRF-EC-1046, Pg.18. And Naval Reactors Facility Environmental Summary Report NRF-EC-1007, Calendar Year 1991, Pg. 18.

[177] NRF October 1995 Remedial Investigation / Feasibility Study (RI/FS) Appendix K.

[178] Final NRF Comprehensive Feasibility Study Waste Group 8 Naval Reactor Facility Appendix H, October 1995, Pg. H6-13, Table H6—5.

(SNF) storage pools because leaks contaminate the groundwater. Epoxy/fiberglass coatings are not allowed at NRC regulated SNF facilities because they leak and the pool cannot be accurately leak tested. Moreover, applying more epoxy to acknowledged failing concrete pool walls adds to the absurdity. Below EDI discusses ECF significant leaks and what DOE/Navy euphemistically calls "Leak Testing" that is apparently when they measure the amount of ongoing ECF leaks into this pool substructure. Leaks to the soil cannot be measured except by water required to maintain pool water volume.

The FEIS states: "Water pool refurbishment would include correcting deteriorating conditions. These actions would be necessary to ensure that the water pools support long-term use by, to the extent practicable, **bringing the water pools up to current design and construction standards.** [Pg. S-8]

The "current design and construction standards" DOE/NRF refers to above are not the standards NRC requires of all regulated SNF storage pools. DOE/NRF makes no apparent reference what standards are being applied to this ECF. There is no intent to replace the degraded/leaking ECF SNF water storage pool. What will NRF do with the 400 SNF assemblies in the ECF while "The water pools [are] drained, decontaminated, and emptied of some equipment" with degraded pool gate seals? We discuss this major issue below in seismic vulnerabilities.

No Discharge of Radioactive Liquid?

The FEIS states: "Liquid LLW: Refurbishment Period: There would be **no impact from liquid** LLW since waste generation volumes would not change. Post-Refurbishment Operational Period: There would be **no impact from liquid LLW** since waste generation volumes would not change." [Pg. S-69] [emphasis added]

"Groundwater: There would be **negligible impacts to groundwater** under the No Action Alternative and the refurbishment period of Overhaul Alternative from radiological constituents **if** preventive and corrective maintenance is not sufficient to prevent a **minor** water pool leak. There could be **small impacts to groundwater** during the transition period and new facility operational period under the New Facility Alternative from potential increases in non-hazardous salts in wastewater discharge." [Pg. S-73] [emphasis added]

No reasonable person can read these repeated statements of "no impact" "negligible impacts to groundwater" knowing the huge leak volumes in question and knowing this operation has been doing this for 50 years, without cringing. Again, the Navy intends to keep this leaking ECF in operation for decades. The FEIS offers no accurate characterization of the ECF water discharged/leaked. See below NRF CERCLA report EDI gained through FOIA that documents this crucial data.

The FEIS states: "Radiological Effluent: There would be **no impact from radiological effluent since none** would be discharged to surface water or the Snake River Plain Aquifer (SRPA). "NRF does **not discharge radiological liquid effluent to the environment**." [FEIS Pg.S-16] [emphasis added]

However FEIS states: "Radiological Liquid Effluent Parameters for NRF [Industrial Waste Ditch] IWD maximum discharge for Co-60, Cs-137, Sr-90, and tritium (H3) at 20, 20, 1.9 and 0.7 pCi/l respectively. "Actual minimums and maximums over 5-yr. **or** 2 yr. period are reported." [FEIS Pg. 3-32] [179]

These two above FEIS statements are contradictory and challenge the veracity of the document. Additionally, why 5 yr. **OR** 2yr. periods recorded? Is there data in 5-yr. monitoring data showing higher numbers that DOE/Navy is withholding like 10 yr. monitoring data? See below CERCLA data showing significant radioactive contamination intentionally excluded.

The above FEIS table 4.4-5 showing tens of millions of gallons of water used for direct contact cooling of extremely radioactive used reactor fuel (SNF) and dumped in the open IWD ditch, belies DOE/NRF's statement: "**NRF does not discharge radiological liquid effluent to the environment." The coolant water is radioactive and hazardous due to corrosive activated material on extremely radioactive used fuel surfaces and must be treated as such.**

NRF CERCLA reports prove FEIS false by showing S1W Leaching Bed Area Radioactivity Soil Sampling for Cs-137 at 310,000 pCi/g; Co-60 at 1,300,000 pCi/g. [180] The NRF Retention Basin where highly radioactive process waste water is sent to allow short-lived isotopes to decay before discharging it to IWD showed sludge

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[179] FEIS Pg. 3-32

[180] Final NRF Comprehensive Feasibility Study Report Waste Area group 8 Naval Reactors Facility, Idaho Falls Idaho, Pittsburgh Naval Reactors Office, Appendix I, October 1995, Table 1-3a, Pg. I-59.

samples of Cs-137 at 192,700 pCi/gm; [181] Strontium-90 at 5,118 pCi/gm. NRF Vegetation sampling results at location 68-1 and 68-2 at 144,522 and 687,447 pCi/gm respectively. [182]

These FEIS statements of "no impact" are categorically false. Absence of recent CERCLA Remedial Investigations/Feasibility (RIFS) showing significant environmental contamination documents how this FEIS attempts to ignore fundamental NEPA policy. For instance, NRF CERCLA Unit 8-08-12 sample results show chromium at 2,090 mg/kg (MCL = 50 mg/kg); Cesium-137 at 149,759 pCi/gm (risk-based soil level = 0.003). [183]

Below Table H6-6 lists the radioactive isotopes found in the ECF process water Leaching Bed sediments. This CERCLA data contradicts FEIS statement: "NRF does not discharge radiological liquid effluent to the environment." These sample results show extremely high radioactive mud that will eventually percolate into the aquifer.

1971 Samples NRF Leaching Bed Mud [184]

Table H6-6- Unit 8-08-14 Radioactivity (pc/gm) Sample Results (pre-1971)

Sample Number	Soil				
	Cs-137	Cs-134	Co-60	Hf-181	Sb-124
1	310,000	42,000	450,000	4,900	190,000
2	190,000	42,000	42,000	6,200	37,000
3	210,000	7,600	1,300,000	8,700	43,000
4	80,000	14,000	640,000	9,100	ND
5	95,000	20,000	1,000,000	15,000	55,000
6	140,000	42,000	1,000,000	19,000	ND
7	150,000	40,000	1,100,000	20,000	ND
8	140,000	31,000	440,000	8,200	33,000

Source: NRF-RI/FS Table H6-6 Pg. H-6-14

NRF CERCLA report continues: "The release of 62,500 gallons is a conservative maximum estimate. Based on the results of periodic NRF Chemistry analyses of the low level of radio nuclides present in ECF water pool water, the estimated quantities of radionuclides released are as follows: 5.2 x 10-2 curies of tritium, 9.7 x 10-6 curies of carbon-14, 7.1 x 10-6 curies of manganese-54, 1.9 x 10-5 curies of cobalt-58, 4 x 10-4 curies of cobalt-60, 6.6 x 10-5 curies of nickel-63, 1.2 x 10-6 curies of strontium-90, 1.2 x 10-6 curies of yttrium, and 1.1 x 10-5 curies of cesium-137. Thus, a total of 5.25 X 10-2 curies of radioactivity were estimated to have been released. The estimate is considered to be conservative, because previous leaks from the water pit into observation rooms within the ECF building rarely indicated the presence of radioactive contamination. The release occurred about 30 feet below ground surface." [185] [5-1]

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[181] Ibid. Appendix H, Table H8-4, Unit 8-08-17, Pg. H8-8.
[182] Ibid. Appendix H, Table H8-5, Pg. H8-9.
[183] Ibid. Appendix H, Table H4-13, Unit 8-08-12, Pg. H4-22.
[184] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Prepared for the U.S. DOE Pittsburgh Naval Reactors Office, Pg.H-6-14.
[185] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-2

"Tritium is the only radionuclide expected to migrate with the water. The COPCs as identified in the Work Plan (WEC, 1995) were tritium, carbon-14, cobalt-60, manganese-54, nickel-63, strontium-90 and cesium-137.

Table 2-1 OU 8-08 COCs and Risk-based Soil Concentrations

COC	Exposure Route	Risk-based Soil Concentration(1) (pci/gm unless specified)	Max. Soil Concentration (pci/gm unless specified) Detected at OU 8-08
Lead	Direct Contact	400 ppm(2)	1,140 ppm
Americium-241	External Exposure	895	20
	Ingestion of Soil	283	--
	Food Crop Ingestion	301	--
Cesium-137	External Exposure	16.7	7,323
	Ingestion of Soil	24,860	--
	Food Crop Ingestion	164	--
Neptunium-237	Food Crop Ingestion	19.8	0.79
Nickel-63	Food Crop Ingestion	15,846	730
Plutonium-238	Ingestion of Soil	590	20
	Food Crop Ingestion	1,153	--
Plutonium-244	External Exposure	3.3	0.24
Strontium-90	Ingestion of Soil	15,418	750
	Food Crop Ingestion	45.6	--
Uranium-235	External Exposure	13.2	0.18

(1) Concentration which corresponds to a 1×10^{-4} carcinogenic risk.
(2) EPA recommended cleanup level (EPA, 1994)

The concentration terms for each radionuclide are given in Table 5-1 below. [186] [Pg. 5-2]

[186] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-2.

Table 5-1 COPCs and Concentration Terms for Unit 8-08-79

Constituent	Estimated Amount Released (Curies)	Concentration (pci/l) of pit water (1992)	Concentration Term (pci/l) - Decay-Corrected to 1996
Carbon-14	9.7×10^{-6}	41	41
Cesium-137	1.1×10^{-5}	46.5	42.3
Cobalt-60	4×10^{-4}	1691	930
Manganese-54	7.1×10^{-6}	30	0.8
Nickel-63	6.6×10^{-5}	279	270
Strontium-90	1.2×10^{-6}	5.1	4.6
Tritium	5.2×10^{-2}	219791	170761

Summary of NRF Drinking Water Radioactivity Results [187]

Table 4 Well Number	Gross Alpha (based on Am-241) pCi/l	Gross Beta (Based on 137-Cs pCi/l)
#1 Maximum	5.0	2.0
#2 Maximum	3.0	2.0
#3 Maximum	1.0	3.0
#4 Maximum	1.5	2.0
EPA MCL	15	8

EPA MCL for Drinking Water for Gross Alpha radioactivity is 15 pCi/L; Gross Beta MCL is 8 pCi/L

The below table 2-1 is found in a NRF CERCLA report and documents soil contamination. [188]

Maximum	Gross Alpha (based on Th-230) pCi/l	Gross Beta (Based on Sr-90 pCi/l)
Up Gradient	3.0	3.1
System	5.3	3.7
On site	3.1	3.9
Down Gradient	4.1	5.1
EPA MCL	15	8

NRF CERCLA report: "5.5.2 Risk Characterization: Table 5-2 summarizes the risks associated with Unit 8-08-79. The carcinogenic risk for the 30 year future residential scenario is with cesium-137 being the risk driver through the groundwater ingestion pathway. The carcinogenic risk factor the 100 year future residential scenario is 7E-6 with cesium-137 and nickel-63 being the risk drivers through the groundwater ingestion pathway." [189]

"The specific activities of the water released are known, the volume of water can be accurately calculated, and a conservative assumption is made that the specific activity of the water released remains the same until it reached

[187] Naval Reactors Facility, Environmental Monitoring Report, Calendar Year 1991, NRFRC-EC-1007, Table 4, Pg. 21.

[188] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Prepared for the U.S. DOE Pittsburgh Naval Reactors Office, Pg. 7.

[189] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-3.

the aquifer." [190]

Table 5-2 Summary of Risks Associated with Unit 8-08-79, Water Pit Release
Residential Groundwater Ingestion

	Concentration (pci/l)	30 Year Rad. Risk	100 Year Rad. Risk
Carbon-14	41	9E-07	9E-07
Cesium-137	42.3	1E-05	3E-06
Cobalt-60	930	7E-06	7E-10
Tritium	170761	5E-05	9E-07
Manganese-54	0.8	1E-18	3E-43
Nickel-63	270	3E-06	2E-06
Strontium-90	4.6	3E-06	5E-07
Total Risk		8E-05	8E-06

Source: Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-4

NRF CERCLA report: "The release is estimated to have occurred approximately 30 feet below ground surface. The COPCs were identified as carbon-14, cesium-137, cobalt-60, manganese-54, nickel-63, strontium-90, and tritium." [191]

Why are these earlier NRF CERCLA reports important? The basic NRF operations are expanding but there is no commitment to stop contamination to the environment or even be honest about it. By reviewing previous CERCLA reports, we get clearer picture of what the current/future will do to Idaho's environment.

FEIS fails to include Worker Exposures

NRF non-military employees are excluded from EEOICPA coverage with a faulty rationale and this egregious exclusion must be removed.

DEIS states: The Energy Employees Occupational Illness Compensation Program Act (EEOICPA) is outside the scope of this EIS. [DEIS Pg. G-117]

"The historically high allowable doses at NRF, the variety and complexity of operations at NRF, the problems of adequately monitoring internal dose and transient conditions, and the evolving science of radiation health and epidemiology of radiation workers showing elevated cancer risks at annual doses less than 2 rem per year point to the unsupportable rationale for excluding NRF workers from compensation. Although it would in many cases be decades late, and the compensation will never compensate for the early deaths of fine people, this exclusion must be removed. **By any measure of fairness and honest assessment, the exclusion of NRF workers from**

[190] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-3.
[191] Final NRF Comprehensive Feasibility Study Report Waste Area Group 8 Naval Reactors Facility, Pg. 5-4

EEOICPA act compensation must be removed." [192]

Incomplete Waste Disposition

FEIS Fails to Include NEPA Requirements of Cumulative Radioactive Waste Disposition.

"Comments on the history of disposal at the RWMC are outside the scope of this EIS." [FEIS Pg. G-99] Despite the above statutory statements the FEIS states: "Historic disposal at the RWMC including the subsurface disposal area of the RWMC were previously evaluated and addressed through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process which included opportunities for public comment.

The FEIS fails to acknowledge the NRF's waste stream to INL burial landfill that would not qualify as a municipal dump under EPA Subtitle D regulations. Since the NRF/ECF basic operations will increase but not change the process and the nature of waste generation, inclusion of waste is crucial. Thus, it is essential to review previous years to get an accurate assessment of what current and future operations will be. The DOE/NRF makes their position clear as the above statement shows – waste deposition is absolutely not part of this EIS thus violating basin NEPA rules.

EDI is obliged to offer the Summary of Naval Reactors Facility best-estimate radionuclide inventories in waste sent to the INL RWMC Subsurface Disposal Area from 1953 through 1999. When added the total curie content is 952,986.86. [193]

NRF plans to ship its highly radioactive remote handled waste to R-H LLW Facility yet FEIS claims: **"Comments on the location of the new Remote-Handled Low-Level Radioactive Waste disposal facility at the INL are outside the scope of this EIS."** [FEIS Pg. G-99]

DOE/Navy use a classical bait and switch ostensibly initially appearing to follow the legal requirements of NEPA, while later buried in the FEIS claim's the NRF has no obligation to include the full waste stream disposition and environmental contamination resulting from NRF/ECF operations. What is critical in any EIS is to review all environmental the impacts of any subject operation. That literally means the past, present and anticipated impacts as NEPA requires. By ignoring history, we are bound to repeat it.

FEIS says NNPP will not generate high-level-waste (HLW)

"High-Level Radioactive Waste: NRF **does not currently generate any high-level radioactive waste.** Transuranic Waste: NRF does **not currently generate any transuranic waste** from naval spent nuclear fuel handling operations." [Pg. S-19] [emphasis added]

Clearly NRF does not consider irradiated spent nuclear fuel (SNF) produced by NNPP as high-level waste as it is classified in statutes. In the recent past, the NRF had 5 propulsion prototype reactors several are defueled but operable. [194] **Currently, the Advanced Test Reactor at INL that tests NRF fuel is a crucial part of NRF operations and itself produces SNF. This sleight of hand that the ATR is not an integral part of the NNPP/NRF is ridiculous and challenges the credibility of this FEIS. See EDI comments on Draft EIS**

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[192] Tami Thatcher http://environmental-defense-institute.org/publications/CommentsECF.pdf Pg. 1. Citing:

[2] Naval Nuclear Propulsion Program, Office of Naval Reactors, "Occupational Radiation Exposure from Naval Reactors' Exposure from Naval Reactors' Department of Energy Facilities," Report NT-113, Mary 2011. http://nnsa.energy.gov/sites/default/files/nnsa/02-12-multiplefiles/NT-11-3%20FINAL.pdf

[3] Kohnlein,W, PhD., and Nussbaum, R. H., Ph.D., "False Alarm or Public Health Hazard?: Chronic Low-Dose External Radiation Exposure, Medicine & Global Survival, January 1998, Vol. 5, No. 1. http://www.ippnw.org/pdf/mgs/5-1-kohnlein-nussbaum.pdf

[4] "An Epidemiology Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U.S. Department of Energy Facility, January 2005. http://www.cdc.gov/niosh/docs/2005-131/pdfs/2005-131.pdf and http://www.cdc.gov/niosh/oerp/ineel.htm and Savannah River Site Mortality Study, 2007. http://www.cdc.gov/niosh/oerp/savannah-mortality/

[193] "Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999", J. Giles. et.al, April 2005, ICP/EXT-05-00833, table 5 pg. 18.

[194] NRF Reactors: Large Ship Reactor A, Large Ship Reactor B, Natural Circulation Reactor, Submarine Thermal Reactor, High-Temperature Propulsion Reactor.

for listing of NRF transuranic waste and GTCC waste dumped at RWMC. [195]

"In addition to DOE owned fuel INL/INTEC CPP-666 stores spent fuel from the Naval Reactors Program." [196] "The Idaho [CPP-666] inventory includes SNF from the Naval Nuclear Propulsion Program (i.e., submarines and aircraft carriers), which is different from commercial SNF in many ways, including enrichment level and design. From about 1952 to 1992 this Navy SNF was reprocessed in Idaho to extract high-enriched uranium for use in driver fuel rods at weapons material production reactors elsewhere." [197]

Chemical reprocessing at INL/INTEC generated millions of gallons of high-level waste – 900,000 gallons of which remains in underground tanks today. Leaks from this INTEC high-level waste tank farm and aquifer waste injection wells continue to contaminate the soil and groundwater. [198]

The FEIS states: "The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for **all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave)."** [FEIS pg. Vol. I Abstract] [emphasis added]

The FEIS inaccurately characterizes transuranic waste

EDI comments on the DEIS (Page 18): "Navy Waste Characterization Partial listing of isotopes found in Navy waste dumped at INL" table shows clearly how Navy waste dumped in the RWMC burial grounds contains Transuranic waste. [199] One of the reasons for this is the lack of precision in cutting off the structural parts of the fuel element in preparation for reprocessing or storage. Destructive tests of fuel assemblies additionally add to the fissile content of the waste stream. In recent DOE documents characterizing the Navy waste streams going to the RWMC they acknowledge presence of, "Irradiated fuel element end boxes that were cut off of the fuel plates in the hot cells. The end boxes may contain some fuel, but **generally** only activation products". [200] [emphasis added] Independent characterization of this waste must be made before more is dumped at the RWMC.

EDI's comments (Page 19) on DEIS table "Spent Reactor Fuel Dumped at INL's RWMC Subsurface Disposal Area Burial Grounds 1952 to 1980 [RWMIS] [201] shows:

Naval Reactors Facility (NRF)	27,707,700 Mass in grams or 27,707.7 kilograms

NRF Environmental Report states: "During 1991, approximately 776 cubic meters of solid radioactive waste containing 102, 706 curies of radioactivity were shipped to RWMC disposal facilities." [202]

DOE/NRF legitimately cannot deny its own waste data by claiming it is "beyond the scope of this FEIS. A legitimate assessment of any operation (absent FEIS disclosure or current publically available data) is to look at past waste streams. The above preliminary numbers, compiled by the Environmental Defense Institute, are drawn from Freedom of Information Act from DOE's Radioactive Waste Management Information System Database (P61SH090, and P61SH070, Run Date 10/24/89) and represent about 57 shipments specifically identified as "irradiated fuel". Not included in the above listing are even more numerous shipments called "un-irradiated fuel", "fuel rods", "control rods", and other reactor fuel not identified specifically as "irradiated". The curie content of these shipments identified as "fuel rods" (>7,000 curies) suggests that they are also irradiated reactor fuel. The

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195 http://www.environmental-defense-institute.org/publications/NNPP-Report7A.pdf Page 17 through 18

196 Energy and Environment, Storage of DOE SNF at the Idaho National Laboratory, U.S. DOE.

197 U.S. Spent Nuclear Fuel Storage, James Warner, Section Research Manager, Pg. 27, Citing T. Cochran, et.al., Nuclear Weapons Databook, Vol. II, May 24, 2012, Congressional Research Service, 7-5700, R42513, www.crs.gov

198 Engineering Design File, Groundwater Pathway Risk Assessment for CPP-601, CPP-602, CPP-627, and CPP-640 Fuel Reprocessing Complex Non-Time-Critical Removal Action, Document ID: EDF-10195, Revision ID: 1, Effective Date: 02/08/12.

199 Transuranic (TRU) waste is "radioactive waste that is not classified as high-level radioactive waste contains more than 100 nanocuries (3700 Becquerel's) per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years.

200 EG&G-WM-10903; A Comprehensive Inventory of Radiological and Non Radiological Contaminates in Waste Buried In the Subsurface Disposal Area of the INEL RWMC During the Years 1952-1983,June 1994, Lockheed, Pg. 2-30.

201 Radioactive Waste Management Information Data Base Solid Master Data Base (P61SH090), List for 1954 to 1970, Run Date 3/29/89, pages 517, 518, 519 and 520 (RWMIS).

202 Naval Reactors Facility, Environmental Monitoring Report, Calendar Year 1991, NRFRC-EC-1007, Pg. 37.

above listing also does not include 7 shipments of "irradiated fuel" during the same period to the RWMC Transuranic Storage Area amounting to 621.549 kilograms, and which also were not included in the Spent Nuclear Fuel EIS.

DOE/NAVY gets to call waste whatever they want – HLW should equal either SNF or chemically separated material from reactor fuel reprocessing. But the activated metals and the bits of SNF on the chopped off end caps of the fuel/ECF canal trash --- these are going to a "low level radiation waste facility --- specifically, RWMC and the remote handled LLW facility at INL that has no permit to accept HLW. They don't even like to admit when its greater-than-class C material, let alone that it should be considered HLW.

Proper comprehensive evaluation – required by NEPA- looks at all cumulative environmental impacts – past, present and future. DOE/NRF cannot legally exclude complete characterization of its entire waste stream.

The FEIS inaccurately characterizes greater-than-class C waste;

FEIS states: "Solid Low-Level Radioactive Waste (LLW): Operations at ECF result in generation of solid LLW primarily consisting of filters, resin, contaminated components, pieces of insulation, rags, sheet plastic, paper, and filter paper and towels resulting from radiochemistry and radiation monitoring operations. The annual average of LLW waste generated at NRF is 740 cubic meters (960 cubic yards) from routine activities and 1200 cubic meters (1600 cubic yards) from decontamination and decommissioning (D&D) activities. There are 38 shipments of LLW from NRF annually." [pg. S-20]

No complete characterization (isotope content/activity rate) of this highly radioactive remote handled waste is offered in this FEIS. Again a violation of NEPA.

EDI's comments on DEIS (Page 8) notes; "Since this NRF reactor core waste going to the RWMC burial grounds contains long-lived radioactive isotopes due to many years of exposure in the reactor core, it should be classified as high-level waste and treated according to Nuclear Regulatory Commission (NRC) disposal standards. At the very least this waste must be put in NRC Greater than Class C (GTCC) waste category. NRC disposal criteria require that "waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste." [10 CFR 61.7] Class C waste, must, for this reason, be disposed at a greater depth than other classes, or, if that is not possible, under an intruder barrier with an effective life of 500 years. "At the end of the 500 year period," according to NRC regulations, "remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety." [Ibid.] The adequacy of the EPA, NRC, IDEQ regulations is discussed more fully in the waste dumping in this paper, for instance there is considerable debate over these **regulators non-enforcement that allows greater than class-C waste to be dumped in shallow land burial at INL in a flood zone.**

FEIS states: "Mixed Low-Level Radioactive Waste (MLLW) and TSCA MLLW: NRF generates a **small** amount of MLLW and TSCA MLLW, primarily from D&D activities at ECF. The annual average of MLLW and TSCA MLLW generated at NRF is 20 cubic meters (26 cubic yards). There are 12 shipments of MLLW (including TSCA MLLW) from NRF annually." [Pg.S-20]

The above DOE/NRF statement is a grossly inadequate and inaccurate waste characterization that does not meet NEPA requirements.

Incomplete Seismic Vulnerabilities

The EIS failed to adequately assess the ECF's seismic vulnerabilities.

The FEIS states: "**The ECF water pools have never undergone a complete refurbishment and have not been upgraded to current seismic standards."** [Pg. S-6]

Despite this statement, NRF intends to continued use of the ECF for decades and does not specify exactly what modifications will be made and what independent seismic assessment will be made to demonstrate compliance.

FEIS states: "Seismic Hazards Refurbishment Period: There would be **moderate** impacts from seismic hazards until refurbishment activities are complete. Activities during the refurbishment period would improve the building's ability to withstand vibratory ground motions from seismic activity. Post-Refurbishment Operational Period: There would be small impacts from seismic hazards since the refurbishment actions would improve the building's ability to withstand vibratory ground motions from seismic activity." [Pg. S-33]

FEIS states: "Seismic Hazards: Differences in impacts from seismic hazards from the alternatives are related to the ability to withstand vibratory ground motions under each alternative. Since there would be no additional refurbishment or upgrades to ECF for the No Action Alternative, the facility and supporting infrastructure **would**

continue to degrade for a period of 45 years. During the refurbishment period of the Overhaul Alternative, **to the extent practicable,** infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions.

"During the **construction and transition periods** of the New Facility Alternative, **there may be upgrades or refurbishments to ECF,** to ensure operations continue in a safe and environmentally responsible manner**.** [Pg.S-72]

What do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously, this is slippery non-committal language that has no business in this FEIS and must raise RED flags to EPA/IDEQ regulators.

The above FEIS statement contradicts the fact that NRF intends to continue ECF operations for over 3 additional decades. Additionally, the FEIS fails to offer requisite detail on what exactly these ECF "upgrades" will be.

"During the **refurbishment period** of the Overhaul Alternative**, to the extent practicable**, infrastructure and equipment would be refurbished or designed to the appropriate natural phenomena hazard category to withstand vibratory ground motions."

Again, what do the above statements: "to the extent **practicable**" and "there **may be** upgrades or refurbishments to ECF" mean? Obviously, this is slippery non-committal language that has no business in this FEIS and must raise RED flags to regulators. Repeating a false statement over and over does not make it true.

FEIS states: "During the construction and transition periods of the New Facility Alternative, there may be upgrades or refurbishments to ECF, to ensure operations continue in a safe and environmentally responsible manner. During the transition and new facility operational periods, the structures, systems, and components in the new facility would be designed to the **appropriate natural phenomena hazard category to withstand vibratory ground motions."** [FEIS Pg. S-72]

Only careful reading reveals that only the NEW Facility portion covered in this EIS will be built to "appropriate natural phenomena hazard category to withstand vibratory ground motions" cleverly giving the impression that the ECF is included.

Seismic Vulnerability of Storing Highly Enriched SNF in ECF

The FEIS states: "Naval nuclear fuel is highly enriched (approximately 93 weight percent to 97 weight percent) in the isotope uranium-235 (235U). As a result of the high initial uranium enrichment, very small amounts of transuranic radionuclides are generated by end of life when compared to commercial spent nuclear fuel." [Pg.1-3]

This Navy high burnup SNF ECF is the most hazardous material in the world requiring deep geological disposal for hundreds of thousands of years due to the long-lived radio-isotopes produced in nuclear reactors. The current ECF inventory of ~400 assemblies constitutes a significant unregulated hazard in the event of accidental loss of canal coolant water.

"Since the 1990's, U.S. reactor operators are permitted by the U.S. Nuclear Regulatory Commission (NRC) to effectively double the amount of time nuclear fuel can be irradiated in a reactor, by approving an increase in the percentage of uranium-235, the key fissionable material that generates energy. In doing so, NRC has bowed to the wishes of nuclear reactor operators, motivated more by economics than spent nuclear fuel storage and disposal. Known as increased "burnup" this practice is described in terms of the amount of electricity in gigawatts (GW) produced per day with a ton of uranium." [203]

"Given these uncertainties the U.S. Department of Energy (DOE) and the NRC have provided general estimates of the radionuclide content of spent nuclear fuel based on current and previous burnup assumptions. According to DOE the estimated average long-lived radioactivity for a typical PWR and BWR assembly having lower burnup at the time of geological disposal are 88,173.69 curies and 30,181.63 curies respectively. 29 For current burnups the NRC estimates that the post discharge radioactive inventory of spent fuel for a typical PWR and BWR

[203] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, citing : Foot Note 29: U.S. Department of Energy, Final Environmental Impact Statement, for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, 2002, Appendix A, Tables A-7, A-8, A-9, A-10, (PWR/ Burn up = 41,200 MWd/MTHM, enrichment = 3.75 percent, decay time = 23 years. BWR/ Burn up = 36,600 MWd/MTHM, enrichment = 3.03 percent, decay time = 23 years.)

assemblies are 270,348.26 curies and 127,056.67 curies respectively.[204] **Approximately 40 percent of the total estimated radioactivity for lower and high burnup is Cs-137**.” [205] [emphasis added]

The FEIS ECF accident source terms do not list Cs-137.[206] This represents another significant deficiency in this FEIS. The Navy uses zirconium clad fuel that adds to storage hazards.

“Zirconium cladding of spent fuel is chemically very reactive in the presence of uncontrolled decay heat. According to the National Research Council of the National Academy of Sciences the buildup of decay heat in spent fuel in the presence of air and steam: “ is strongly exothermic – that is, the reaction releases large quantities of heat, which can further raise cladding temperatures… if a supply of oxygen and or steam is available to sustain the reactions.. The result could be a runaway oxidation – referred to as *a zirconium cladding fire* – that proceeds as a burn front (e.g., as seen in a forest fire or fireworks sparkler)...As fuel rod temperatures increase, the gas pressure inside the fuel rod increases and eventually can cause the cladding to balloon out and rupture.[original emphasis]” [207]

The FEIS states: “Naval spent nuclear fuel consists of solid metal and metallic components that are nonflammable, highly corrosion-resistant, and neither pyrophoric, explosive, combustible, chemically reactive, nor subject to gas generation by chemical reaction or off-gassing. Naval spent nuclear fuel is primarily from pressurized water reactors (PWRs).” [FEIS Pg. 1-3]

Seismic Vulnerabilities of ECF Degraded Concrete Basin

There are some crucial unknowns the FEIS failed to assess.

1. Is the ECF basin concrete already to degraded to allow continued operation?
2. What radiation cumulative level has the ECF basin been exposed to now and in 10 years? 10 x E 10 rad? More? Less?
3. Will the fuel in the ECF (or some fraction of fuel) melt/burn if water is removed and the fuel is uncovered?
4. Will the concrete or structural materials above the ECF actually fail if temperatures rise because of fuel heat up? Interesting that it has not been brought up as an issue before, but perhaps that is because the fuel melting temperature of fresher fuel assured fuel melt before such structural damage.

Defense Nuclear Facility Safety Board conducted a review of the newer INL/INTEC CPP-666 SNF Basin concrete foundation. This review is relevant because the Navy’s ECF “refurbishment” will entail draining portions of the basin so epoxy leak-proofing can be applied potentially putting similar stresses on the ECF concrete foundation.

“The [Fuel Storage Area] FSA Pool Structures is a passive design feature of the FAST facility. **Additional calculations performed to increase the allowable floor loading to support the FSA Reracking Project indicated that the original design objective to allow an empty pool to be adjacent to a water filled pool resulted in <u>overstresses</u> during the [Design Basis Earthquake] DBE.”** [208] [DFNSB Pg. A-4]

FEIS fails to fully analyze the ECF refurbishing part that includes empting sections so epoxy leak prevention remediation can proceed. Calculations of shifting ECF SNF on the degraded concrete basin foundations ability to withstand the “overstress” concurrently with a DBE are absent.

Radiation degradation of concrete ECF SNF basin

It is highly likely that the ECF concrete walls have received an aggregate gamma ray dosage far in excess of that necessary to severely degrade the concrete, thus increasing seismic vulnerabilities. Maintaining ECF water levels

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[204] Alvarez citing: U.S. Nuclear Regulatory Commission, Characteristics for the Representative Commercial Spent Fuel Assembly for Pre-closure Normal Operations, May 2007, Table 16, p.44-45. http://pbadupws.nrc.gov/docs/ML0907/ML090770390.pdf

[205] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, : December 17, 2013, Pg. 5

[206] FEIS Pg. F-35

[207] Robert Alvarez, Memorandum: High Burnup Spent Power Reactor Fuel, December 17, 2013, pg. 8.

[208] DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Pg. A-4.

should a significant seismic event (earthquake) occur are problematic. The FEIS fails to fully analyze these fundamental issues in the Hypothetical Accident 4.13.2.2.

For continuously wetted concrete (no stainless steel liner) an aggregate dose of 10 x E10 rad (10 x E8 gray) is the limit. For dry concrete the limit is not known. The few pieces of data available from the X10 reactor in Oak Ridge, Tennessee and the Temelin reactor in the Czech Republic suggest that the allowable dose to avoid structural degradation and failure is 500 to 2,000 times lower than for wetted concrete (i.e., 5 x 10E6 rad).

The catastrophe hazard from an ECF basin drain down event is more than extreme. Such an event must be prevented at any cost. Once a drain down begins it cannot be stopped. Once the fuel is exposed no human or robotic response is possible - of any kind. A current example is Japan's Fukushima reactor/SNF storage disaster.

The accident will then proceed to its ultimate termination independent of human intervention. Temperatures inside the ECF structure will likely rise to levels sufficient to cause the concrete to fail and the building to crumble in on itself. The human exclusion zone for direct radiation exposure will likely be 1-2 km in all directions. No access will be possible in this zone for decades. Once fuel fails and radioactive atmospheric releases that zone will be pushed farther out (likely much farther out). Access to respond to the event may not be possible in or through that zone for centuries.

FEIS must provide independent engineering assessments of ECF basin concrete. Alternatively, using civilian fuel (since Navy fuel details are classified) as a surrogate; what is the concrete heat profile and rad profile of used civilian fuel? How far is it from the walls and floors of the basin? Then do some estimates of shielding and you have estimates of dose. Doing that correctly requires details about the fuel, and a complex set of radiation calculations that have a lot in common with optics problems. Gamma rays are light after all. The fuel is opaque to it, as are the water and concrete. Some of it is absorbed and heats the fuel, water and concrete. Several different interactions occur that shift the energy spectrum and generate secondary radiation. The most accurate way to assess all of this is to actually measure it.

What the ECF review will likely find is the surface of the concrete probably exceeded 10 x E10 rad after 10-20 years. It is likely now that the concrete 6-10 inches in has exceeded that same dose. The concrete 'paste' likely has little to no strength in 6-10 inches from the surface.

The temperature issue is different. So long as there is some cooling and the fuel is over 20 years old, there is not much heat to remove. If the basin water is lost, during an earthquake or severe leak, the rad field can be extreme. That prevents human entry. Lacking human entry the systems fail. When ventilation is lost heat then builds up having only convective and radiative cooling to keep things under control. [209] With limited ventilation, the temperatures inside the structure will rise substantially. If newer fuel is present, this could get out of hand quite quickly creating a second barrier (after the lethal rad fields) to human entry. The potential then is that following a basin drain down that uncovers the fuel that the accident progresses of its own accord to complete loss of control of the basin and failure of the fuel. It is likely that no recovery will ever be possible at that point. The accident proceeds to final completion (whatever that is) entirely outside of human ability to influence it.

The concrete dose serves to heat the concrete failing it prematurely. This is well known. And it served to hide the insidious damage to the concrete, as that is waived away as being all thermal damage, and then assessing that the concrete in the basin hasn't seen high heat, so it will not fail. For instance, the rad dose damage gets ignored. There are also an equally large but still handful of data points for dry concrete exposed to radiation. That data was thrown out in developing the standards for what radiation dose concrete can withstand. The data was discarded on the presumption that the early weakening was attributable to heat. The experience at Temelin and X-10 show that to be wrong. The concrete wasn't heated.

At a microscopic scale, absorbed radiation heats the concrete at nearly the atomic level. The heat damage is then limited to a small volume. But continue doing this over 50 years in a large SNF ECF basin and the problem becomes a stochastic one of adding up all of the random little damages into one large failure. This can lead to a large uncontrollable leak and extended loss-of-coolant.

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[209] A DNFSB review of the newer INL/INTEC CPP-666 Fuel Storage Area (FAST) water basin found "[T]he Confinement Ventilation System is degrading due to facility aging. This degradation could result in future operational downtime, radiological contamination and personnel exposure." DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Executive Summary.

Yet another way to consider it is that the radiation serves to boil out the water from the cement paste that forms the backbone of concrete. When the concrete is moist there is water immediately available to cool the local heating and/or to replace the lost water. When the concrete is dry (< about 11% water) these effects are not enough and waters of hydration are lost from the paste to migrate out of the concrete. The paste then chemically changes and falls apart as damage accumulates.

One of the papers on this considered two different dose rates and times to accumulate the same aggregate dose or different doses. What they observed was very interesting. The time until the concrete was weakened remained the same despite the differing dose rates. In other words, the effect seemed to be caused by some critical radiation insult and then the passage of time. This is hugely concerning as it brings into question the entire safety basis and the possibility that the damage is essentially done in the first few days. It then just takes time for the basin concrete to fail. The FEIS acknowledges ECF basin concrete degradation.

Congress' Role

Exemptions from Environmental Laws

Consequent to over a half century of Congressional exemptions to the NNPP from nuclear operations and waste management, the largest contamination of the human environment has resulted.

The 1985 Low Level Waste amendments require DOE to take ownership of a NRC licensee of GTCC waste. But as DOE manages its own LLW it is not required to classify it according to the laws for NRC licensed facilities. DOE does not have to classify its waste as A, B, C or Greater-Than-Class C except when it wants to send this waste to a another state or NRC-licensed facility. Below are exemptions to the Low-level waste law for NRC licensees like commercial power reactors.

TITLE 42 United States Code Annotated 6.427.§ 28.021c

" Disposal of low level radioactive waste; (a) State responsibilities, (1) Each State shall be responsible for providing, either by itself or in cooperation with other States, for the disposal of (A) low-level radioactive waste generated within the State (other than by the Federal government) that consists of or contains class A, B, or C radioactive waste as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983;(B)low-level radioactive waste described in subparagraph (A) that is generated by the Federal Government **except** such waste that is (i) owned or generated by the Department of Energy; (ii) owned or generated by the United States Navy as a result of the decommissioning of vessels of the United States result of the decommissioning of vessels of the United States Navy; or (iii) owned or generated as a result of any research, development, testing, or production of any atomic weapons…." [210]

Exemptions from Regulatory Oversight

In the early 1990s Clinton Administration, Congress established the Defense Facility Nuclear Safety Board (DFNSB) to conduct safety assessments of DOE operations. Congress however did not grant the Board with enforcement authority similar to NRC.

Defense Facility Nuclear Safety Board enabling legislation states in pertinent part:

"SEC. 318. DEFINITION. [42 USC 2286g] "As used in this chapter, the term 'Department of Energy defense nuclear facility' means any of the following:

"(1) A production facility or utilization facility (as defined in section 11 of this Act) that is under the control or jurisdiction of the Secretary of Energy and that is operated for national security purposes, **but the term does not include__**

"(A) any facility or activity covered by Executive Order No. 12344, dated February 1, 1982, pertaining to the Naval nuclear propulsion program;"

The bottom line is NNPP is unregulated by any federal agency – even the Nuclear Regulatory Commission charged with regulating commercial nuclear operations or Defense Nuclear Facility Safety Board charged with monitoring DOE nuclear facilities.

Attorney Mark Sullivan representing EDI petitioned the Defense Nuclear Facility Safety Board (DFNSB) to conduct a safety analysis of DOE's 60 year old Advanced Test Reactor at the INL. DFNSB chairman Winokur's reply states: "It is the Board's understanding that currently the primary defense-related mission of ATR is

[210] 42 United States Code Annotated 6.427. § 28.021c.

research and testing of components in support of naval nuclear propulsion program. **Navy nuclear propulsion activities are excluded from the Board's jurisdiction by 42 U.S.C. ss 2286g(1)(A).**" [211]

EDI's *Unacceptable Risk at INL's Advanced Test Reactor* details significant safety problems that neither DOE, the Navy or DFNSB are willing to address. As a fundimental part (as stated above) the ATR must be included in this FEIS but it is not!

NRF CERCLA Cleanup Conclusion

EDI's comments are by no means a complete analysis of this lengthy 3 Volume document because the NRF operations are classified and there are no regulatory agency reports on it.
For instance, the NNPP SNF coolant time, fuel cladding needed to properly determine ECF basin loss-of-coolant source terms are classified.

This DOE/NRF/NNPP FEIS is deficient and EPA and IDEQ are complicitious if they do not also reject its findings that contain innumerable fundamental false statements. This EIS should be detailing how NRF is going to completely replace the ECF basin as a SNF wet storage facility. Many casual EIS readers mistakenly assumed ECF replacement. Instead, DOE/Navy intends to keep this high-hazard heavily degraded ECF operating for 3-4 decades far beyond its design life that has already expired. The Navy is only willing to spend money to expand capacity for new large ship reactor SNF assemblies.

The DNFSB noted, in Recommendation 2000-2, (now 14 years back) that "[I]t was concerned with the fact that many of the DOE's nuclear facilities were constructed years ago and are approaching end-of-life. The DNFSB expressed concern that some degradation of reliability and operability of systems designed to ensure safety can reasonably be expected and recommended specific actions to assess system condition and apply system expertise in managing the configuration of vital safety systems." [212] Lacking enforcement authority, DNFSB can only advise.

EDI finds this EIS a clever effort to slip in a deliberately narrow major expansion of the Navy's SNF waste management without acknowledging 50+ years of massive radioactive contamination at INL by claiming previous NRF environmental studies. DOE/NAVY claim these CERCLA reports are beyond the scope of this EIS. The Navy's previous radioactive contamination will remain for manila putting Idahoans at risk. This is an unconscionable and avoidable assault on Idaho's most valuable Snake River Aquifer that we depend on.

Congress bears the most responsibility for NRF's unregulated willful contamination of Idaho's environment via nuclear waste mismanagement and exposure to catastrophic accidents by granting exemptions to these rogue agencies compliance with the same regulations imposed on commercial nuclear operations.

Even when federal (EPA) and state (IDEQ) regulators can enforce NEPA regulations, or mixed-hazardous RCRA regulations, Clean Water Act regulations, they remain largely silent. We the public are left with little alternative than the Courts for redress. Even this process is blocked by the courts. [213] FOIA requests when approved are largely redacted and Appeals to DOE's office of Hearings and Appeals are denied. [214]

It is unconscionable that 3-4 additional decades of continued operation of the ECF represents a significant unregulated hazard of the most deadly radioactive material in the world and that high-level waste ultimately must be interred in a deep geologic repository yet to be established by Congress.

The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that it was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection

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[211] DNFSB Chair, Peter Winokur letter to Mark Sullivan, 9/23/10. Also see EDI's Unacceptable Risk at INL's Advanced Test Reactor.

[212] DNFSB Recommendation 2000-2 INEEL Priority Facility Phase I Safety Class, Ventilation and Fire Protection Systems Assessment Report, Pg.1.

[213] KYNF and EDI filed a complaint in U.S. Federal Court asking for DOE to conduct an EIS on the Advanced Test Reactor, but the judge ruled in favor of DOE. See U.S District Court for Wyoming (06-CV-205-WFD).

[214] KYNF and EDI filed a FOIA 6/23/2010 that was denied. It was appealed 9/30/2010 (10-032) (OM-PA-10-063) resulting only a few documents released with most redacted. Second appeal 2/28/13 (TFC-009) (OM-PA-13-012) denied.

and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law. DOE's own "off-aquifer siting analysis identified two areas off the Snake River Plain Aquifer (Spent Fuel Storage at the INEL Yet off the Aquifer). [DOE/EA-1050@B-5] Another option would be for DOE to purchase additional adjacent land at the northwest of the site for an ERDF type dump off the aquifer in Clark County.

The Plan (January 1998 publication) assumes that the DOE and the Naval Reactor Facility (NRF) enjoy credibility in the public's eye. This is an invalid assumption. These agencies have broken the law and are being forced via a Federal Facility Agreement and Consent Order to correct their illegal activities. As illegal polluters, no credibility can be assumed and therefore full and complete disclosure is demanded in all Plan publications. The Plan does not provide the reader with full disclosure or provide the essential information the reader needs in order to evaluate the appropriateness of the preferred remedial alternative. For instance, maximum contaminate levels for all contaminates of concern must be stated for each Operational Unit as well as the effective standard for that contaminate so that the reader can make up their own mind whether the cleanup actions or no actions are appropriate. Stating conclusions without providing definitive data to support the finding assumes credibility that the agencies do not have.

Another major assumption that is extensively evoked in the Plan is 100 years of DOE monitoring and institutional control of the contaminated sites. In real life, when entities brake the law, and are required to do major corrective actions in the future, they are generally required to establish a trust fund so that if they again decide to disregard their legal requirements, or are no longer in existence, the funding will be there for the state or local government to do the job. The state of Idaho should therefore, require DOE to establish a monitoring/institutional control trust fund to cover those costs at INL. An example of where this issue is important is the current designation that NRF is not in the Big Lost River (one mile away) 100 year flood plain. This current designation is due to Big Lost River dams that divert flood waters south into spreading areas. These dams and their related water channels require regular maintenance in order to provide that flood protection to NRF and other INL facilities. Spring 1997 runoff nearly topped the dams. Prior to construction of the diversion dam, NRF was in the Big Lost River 100 year flood plain. [RI/FS@5] Nuclear Regulatory Commission (NRC) radioactive waste disposal requirements state, "waste disposal shall not take place in a 100 year flood plain." [10 CFR ss 61.50] Institutional control must include diversion dam and water channel maintenance as well as monitoring and fencing of waste sites. The NRF Plan proposes consolidation of contaminated soil into one of the leach pits. The cesium alone will take over 420 years to decay to acceptable risk levels, or considerably longer than the planned 100 year institutional control.

The Environmental Protection Agency (EPA) and the Idaho Division of Environmental Quality (DEQ) also incorrectly assume credibility with the public. The presence of their logos on the Plan, their review of the document, and their endorsement of the preferred alternative make these agencies complicities in the Plan's inadequacies and flaws as well as a history of INL "cleanup" Plans that were more cover-up than cleanup.

The Plan states: "The Comprehensive RI/FS Waste Area Group 8 represents the last extensive Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) investigation for the Naval Reactors Facility." This Plan is not "comprehensive" because it excludes the Retention Basin (one of the most contaminated waste sites at NRF) from the CERCLA cleanup process. The Retention Basin (OU-8-08-17) is a large concrete tank that temporarily holds liquid radioactive and chemical wastes (presumably to allow short-lived isotopes to burn off) prior to discharge to the various leach pits. The Plan fails to state that the sludge in the basin contains cesium-137 at 192,700 pico curies per gram (pCi/g)(risk-based action level is 16.7 pCi/g) and Cobalt-60 at 20,410 pCi/g. [RI/FS@H8-8] A long history of Basin leaks assures significant soil contamination under the basin and therefore must be included in the Comprehensive Plan.

The Plan's exclusion of the NRF Expanded Core Facility (ECF) leaks additionally demonstrates the incompleteness of the so called "comprehensive" Plan. The ECF, built in 1958, does not meet current spent reactor fuel storage standards that require stainless steel liner, leak containment, and leak detection systems. The ECF should be shutdown for exactly the same reasons the Idaho Chemical Processing Plant (CPP-603) Underwater Fuel Storage Facility was shutdown - it was an unacceptable hazard and did not meet current standards. ECF has been leaking significantly >62,500 gallons of radioactive water over the past decade and the soil contamination around and underneath the basins must be included in the CERCLA cleanup process. [RI/FS@5-1] The Plan offers no soil sampling data to substantiate exclusion of the ECF from CERCLA action. A theoretical risk analysis assumed only one leak which does not reflect the actual ECF history and that is why the sampling data is essential.

The Plan's exclusion of the Sewage Lagoon (NRF-23) from its so called "comprehensive" CERCLA cleanup, again, demonstrates the incompleteness of the Plan. Contaminate levels of arsenic, mercury, and cesium-137 would normally require remedial action. In fact, the Track 1 investigations recommended inclusion of the lagoons into the comprehensive RI/FS primarily due to radionuclides and the risk assessment results showed increased cancer rate of 1 in 10,000 from exposure to the site. [Plan@25] The Plan offers no data to substantiate the "risk management decision" to exclude the lagoons. NRF intends to continue to use these unlined leach pits despite the fact that every gallon of waste water that flows into the pit, leaches more of the contaminates toward the aquifer below. NRF should be required to close the Sewage Lagoons, clean them up, and build new lined ponds that meet current regulations.

The preferred alternative 3 that DOE, the State, and EPA want the public to accept cannot be justifiably called a cleanup plan. A shell cover-up game, yes, but not a cleanup plan. Alternative 3 is a rerun of the misguided actions at the INL Test Reactor Area Warm Waste Pond. The NRF Plan calls for the consolidation of the contaminated soil from numerous sites into the bottom of one of the old leach pits (S1W Leach Pit), then cap it with rocks and gravel. It's quick, dirty and comparatively cheap; and that's why DOE likes it. With a slight of hand DOE wants to create a dump without calling it a dump because if they called it a dump then they would have to comply with hazardous and radioactive disposal regulations. If it looks like a duck, walks like a duck, and quacks like a duck then it is a duck. The very moment contaminated soil is moved from one site to another, a dump is created, and therefore the regulations apply regardless what DOE wants to call it.

The Plan offers inaccurate data to support the preferred alternative. The Plan states that the maximum soil concentration at all of the 8-08 Operable Units for cesium-137 is 7,323 pCi/g. [Plan@14] Appendix H of the RI/FS however credits the S1W Leach Pit with a maximum detected cesium-137 concentration of 149,759 pCi/g "decay corrected to obtain equivalent 1995 results." [RI/FS@H4-22] This contaminate concentration discrepancy is significant because the undisclosed higher amount qualifies under NRC radioactive waste Class B criteria in 10 CFR ss 61.55 and the "technical requirements for land disposal facilities" in ss 61.50. The preferred alternative does not meet NRC requirements. Actually, DOE's preferred alternative does not even meet municipal garbage landfill requirements under RCRA Subtitle D which require liner, leachate monitoring wells, impermeable cap, and location restrictions over sole source aquifers. The NRF Plan contains none of these essential features. This Plan effectively shifts the risks, hazards, and ultimate cleanup costs to future generations. The high levels of hazardous materials in the NRF waste qualify it as a mixed hazardous and radioactive waste under the 1992 Federal Facility Compliance and RCRA Land Disposal Restrictions. Hazardous contaminates in the soil include chromium at 2,090 mg/kg, lead at 1,140 mg/kg and mercury at 56.1 mg/kg. EPA's interim lead soil cleanup level is 400 mg/kg. The Plan offers no Toxic Concentration Leach Procedure (TCLP) data to support exclusion of this hazardous waste from regulatory disposal compliance. The transuranic contaminates (americium-241 and plutonium-238) at 20 pCi/g have half-lives of 432 and 87 years respectively guarantee the waste will be hazardous for a long time. Under the circumstances, it is difficult to see how the Plan's preferred alternative can claim to meet all the "Applicable or Relevant and Appropriate Requirements" (ARAR).

The INL Oversight Program's Kathleen Trever claims that the SIW data set containing the 149,759 pCi/g cesium-137 was not considered reliable by DOE and therefore it was not used in the Risk Assessment. When asked about this data-set discrepancy, EPA's Wayne Pierre said that DOE could not arbitrarily ignore data-set unless they had more than 10 data-sets, and then they could choose the most reliable 10 sets. Since DOE only had three data-sets, Pierre thought it unacceptable to rely completely on the 1991 and 1992 samples. It is possible that the earlier sampling grid identified hot spots that the later sampling grids could be planned to avoid.

1971 sampling data buried in the RI/FS show long-term waste mismanagement at the S1W Leach Pit with cesium-137 at 310,000 pCi/g, cesium-134 at 42,00 pCi/g, hafnium-181 at 20,000 pCi/g, and cobalt-60 at 1,300,000 pCi/g. [RI/FS@I-59] Algae (accessible to ducks using the pond) sampling show 667,447 pCi/g. [RI/FS@ pg H6-13] By comparison, the risk based soil concentration for cesium-137 applied to this Plan is 16.7 pCi/g. These high contamination levels were due primarily to once through reactor cooling water dumped in the leach pits which was discontinued by 1980. No explanation is offered why the remediation goal applied to Waste Area Group 3 of 0.02 pCi/g for cesium-137 was changed.

Alternative 4, Complete Excavation and "Off-site Disposal" is equally unacceptable because "Off-site" is defined as hauling the contaminated soil from NRF to another INL leach pit consolidation site at the Idaho Chemical Processing Plant, Test Reactor Area, or the Radioactive Waste Management Complex, none of which would qualify even as a garbage dump. Interestingly, DOE calls these "INL soil repositories." Therefore, alternative 4 also does not meet legal requirements in the ARAR's.

The cumulative risk assumptions that determine the exposures to future 100 year residential and occupational scenarios are not conservative (most protective of human health) and not supportable. The Plan states: "The ingestion of soil, the ingestion of food crop, and direct contact with soil through the dermal pathway is not included in the cumulative assessment because these involve exposures routes that are not likely to occur at more than one release site at a time." [Plan@11] A possible future scenario of a pasture over the leach pit, a well over the Retention Basin, and dermal exposure from digging around the ECF is reasonable. Therefore, all these pathways must be considered to be cumulative. The risk assessment must also be recalculated using the above cited maximum cesium-137 contaminate level of 149,759 pCi/g which will produce radically different results from the 7,323 pCi/g used by DOE as the maximum contaminate level at NRF.

NRF and DOE representatives stated at a public meeting in Moscow that the groundwater and aquifer are not at risk because contaminates are absorbed by the soil column. Review of the historical deep well sampling data at NRF does not support the Navy's conclusion. The NRF October 1995 Remedial Investigation / Feasibility Study (RI/FS) Appendix K shows Table III Deep Well Sample Results for Wells # 1, # 2, and # 3 at 60, 69, and 44 pico curies per liter respectively for gross beta. The federal drinking water standard for gross beta is 8 pico curies per liter. This deep well sample data confirm that the contaminates do migrate, contrary to the Navy's claims.

The Plan's "remediation goals" that set risk-based soil concentrations for contaminates of concern (cleanup goals) fail to include inhalation as an exposure pathway. This exclusion represents a major flaw in the Plan. Inhalation is the most biologically hazardous for alpha emitting contaminates of concern listed as americium-241, neptunium-237, plutonium-238, plutonium-244, and uranium-235, yet inhalation is not considered for these isotopes, nor for lead. The wide difference between ingestion of beta/gamma contaminated soil also appears out of balance. For instance, cleanup goals for cesium-137 external exposure is set at 16.7 pico curies per gram (pCi/g) while ingestion of soil is set at 24,860 pCi/g. Additionally, the beta emitter strontium-90 is not considered for external or inhalation exposure but is considered for soil ingestion at 15,416 pCi/g and food crop ingestion at 45 pCi/g.

An integral factor in the Plan's establishing a "remediation goal" is the maximum concentration of contaminates of concern. The Plan acknowledges (pg 14) that the maximum cesium-137 soil contamination detected at the NRF is 7,323 pCi/g which generated a risk based cleanup goal of 16.7 pCi/g. Again, as previously discussed, this must be recalculated using the above cited maximum detected cesium-137 at 149,759 pCi/g "decay corrected to obtain equivalent 1995 results." This significant discrepancy begs the question as to the quality of regulatory review the State and EPA are bringing to the process and whether the "remediation goals" are supportable.

Section IV. L. Materials and Fuels Complex (MFC)
(formerly Argonne National Laboratory – West (ANL-W))

The Materials and Fuels Complex (MFC) formerly called Argonne National Laboratory-West (ANL-W) below these site names are inter-changeable has a solid high-level waste site called the Radioactive Scrap and Waste Facility (RSWF) that is seldom acknowledged. It has 12-foot-deep steel walled underground repositories (27 rows on 12 ft centers and 40 rows on 6 ft. centers for a total of 1200). According to DOE, the existence of severely corroded storage wells coupled with the lack of a monitoring program for soil contamination was identified as a vulnerability. RSWF had as of 1981, 81 cubic meters containing 9,823,000 Ci of radioactive materials, including 40.73 grams of plutonium. [ID-10054-81@19] Responding to pressure, ANL-W upgraded

1,016 of the RSWF vaults in 1995 and plan on upgrading another 350 in the next three years.[RSWF] Even the new upgrades do not meet regulatory requirements for spent fuel storage because the contents cannot be inspected due to the welded cap on the top of the vault. However, the regulators granted ANL-W a variance.

MFC radioactive airborne releases for the 1952-81 period were 44,580 Ci. [ID-10054-81@19] The 1977 radioactive content of MFC's annual waste generation sent to the RSWF or RWMC is 1,300,126 curies. [ERDA-1552 @V-23] DOE claims that MFC dumped 1.1 million curies at the RWMC between 1952 and 1983. [EG&G-WM-10903] MFC's Zero Power Physics Reactor fuel is releasing fission product because the uranium has oxidized and hydrided on approximately 25% of the plates, causing stainless steel cladding to bulge. In a few isolated cases, the cladding is breached. A total of 83,276 spent fuel elements/assemblies are stored at MFC. [DOE Spent Fuel Working Group Report, p.25]

ERB-II Leach Pit Sediment Sampling Data

Detected Radiochemical	Maximum Detected Value (pCi/g)
Yttrium-90	2,247
Americium-241	0.65
Cobalt-60	196
Cesium-134	1.8
Cesium-137	29,110
Uranium-234	35.64
Uranium-235	2.18
Uranium-238	3.54
Neptunium-237	329
Strontium-90	2,247
Iodine-129	124

[ANL-5277]

The DOE/MFC Plan suffers from the same misguided approach to environmental restoration that the DOE has applied at other INL sites. The apparent absence of lessons learned between the Hanford Environmental Restoration (ER) process and the INL ER process is regrettable and a serious threat to Idaho. DOE is taking advantage of its position as the single largest employer in Idaho to float ER actions at INL that it was not allowed to do at Hanford because public and regulatory pressure blocked shortcuts. Specifically, at Hanford DOE was required to build the Environmental Restoration Disposal Facility (ERDF) which is a fully compliant Resource Conservation Recovery Act (RCRA)/ Nuclear Regulatory Commission (NRC) mixed hazardous/radioactive dump with double liner, leachate collection and monitoring wells and an impermeable cap. ERDF was completed in the Spring of 1996 at the farthest location on Hanford away from the Columbia River and will receive contaminated soil and decontamination/decommissioning (D&D) waste. At INL, DOE refuses to build such a repository because the Department is not being pressured by the state and EPA regulators to comply with the law.

This must not be called a “comprehensive” plan because it does not include ANL-W-W’s underground high-level waste site (Radioactive Scrap and Waste Facility) which as of 1981 has 81 cubic meters of waste containing 9,823,000 curies of radioactive materials including 40.73 grams of plutonium.[ID-10054-81@19] DOE must not continue to postpone treatment and disposition of this waste.

The polluters continue their criminal arrogance by thumbing their nose at the law and continuing to use leach pits that currently pose unacceptable hazards to environmental health and safety. Specifically, ANL-W intends to continue to use the contaminated Industrial Waste Pond (ANL-01) and the Sewage Lagoons (ANL-04) and the State and EPA regulators are silent. Continued waste water discharge perpetuates the leaching of contaminates into the soil column and eventually to the aquifer below. The Plan acknowledges that: “Human health risks from cesium-137 will be at acceptable levels within 130 years due to radiological decay.” [Plan@14] Yet in the next paragraph, the plan states: “Institutional controls are assumed to remain in effect for at least 100 years.” What about the remaining thirty years. Once the CERCLA process is wound up in a few years, there are uncertainties that DOE or any other federal agency is going to fulfill its questionably enforceable commitment to provide monitoring and institutional control to ensure no people gain access to the waste sites. Again, a trust fund is warranted and a requirement under the NRC 10 CFR ss 61.63 "Financial Assurances for Institutional Controls."

MFC's Plan, like the NRF deficient Plan, is to consolidate all the contaminated soil into the Industrial Waste Pit, and again, it does not meet Applicable or Relevant and Appropriate Requirements (ARAR's). The Plan offers no maximum contaminate levels of the waste planned for the Pit. This lack of full disclosure by the polluter and the regulators is unacceptable. The drawing offered in the Plan [Plan@15] of the Industrial Pit does not vaguely resemble the near 20 foot deep localized depression that the pit is in. The Plan drawing shows a flat terrain with the leach pit being the only depression. This is a major discrepancy. Continued pooling of surrounding precipitation runoff into the pit (covered or not) will provide water to leach contaminates toward the aquifer. Moreover, the cap does not include an impermeable seal to keep precipitation out. The Waste Pit currently receives drainage from a considerable area to the southeast in addition to storm water from the MFC site. A major flaw in the Plan is not providing drainage diversion away from the pit regardless of the alternative chosen. The fact that chromium, mercury, selenium, and zinc are in the pit sediments qualifies the waste as a mixed hazardous/radioactive and it must be disposed pursuant to RCRA land disposal restrictions.

The Plan states at page 8 that: "contaminates to the ground water show only arsenic and chromium exceeded the risk based screening levels." The MFC RI/FS well (M-13) 1993 sample data shows strontium-90 at 1,330 pCi/L at 642 feet. [RI/FS,Vol.III App. H pg. 3] EPA maximum concentration level for strontium-90 in drinking water is 8 pCi/L. The Plan does not acknowledge this strontium migration or propose remedies that will correct the problem.

Alternative 5 (phytoremediation) that would use plants, over five growing seasons, to absorb the contaminates in the leach pit, is so ludicrous in an arid environment that it does not deserve rebuttal. There are issues of plant density to prevent wind erosion (contaminate dispersion). What is ANL going to do after annual harvest and between growing seasons to prevent wind erosion? Bench scale tests in ANL's greenhouse will only reflect efficiencies in an artificial climate controlled environment, not the real desert thing.

The Sanitary Waste Lift Station (ANL-31) is listed as a no action site presumably because ANL wants to continue to use the pumps. The Plan offers no data to substantiate this no action decision. The Track 2 Investigation shows maximum concentrations of sludge collected from the Lift Station as follows: cesium-137 at 9,380 pCi/g, strontium-90 at 2,470 pCi/g, uranium at 4.8 pCi/g, neptunium-237 at 13 pCi/g, and cobalt-60 at 16.3 pCi/g.[Vol. III Track 2 App.-H pg.4] This contamination suggests that this Lift Station was inappropriately excluded from the cleanup. May 1995 Track 2 reflect continued high gross alpha and gross beta in the pump water and sludge. [Vol. III Appendix - E]

The EBR-II Leach Pit (ANL-08) underwent an interim "cleanup" action in 1993 when only "the majority of the sludge was removed "and the pit was backfilled. The Plan fails to acknowledge that the remaining sludge had the following pCi/g concentrations: cesium-137 at 29,110, iodine-129 at 124, neptunium-237 at 329, strontium-90 at 2,247, yttrium-90 at 2,247. [RI/FS Vol.II pg.59-60] Inadequate interim actions end up being permanent because of the additional volume of contaminated soil used as backfill is now part of the problem.

The public has demanded for many years that DOE treat its radioactive waste into a stable vitrified form so that it can be stored onsite until a safe permanent repository can be established. At the very legal minimum, all contaminated soil should be shipped off the INL site to a licensed and permitted RCRA hazardous/radioactive disposal site. A compromise would be if there is an area on the INL site that is not over the Snake River Plain Aquifer, use it to build a licensed and permitted RCRA hazardous/radioactive disposal site for INL low-level wastes only.

The MFC Plan makes it very clear that DOE and the regulators refuse to learn from past mistakes. So far three of the six U.S. commercial radioactive waste dumps are now closed and undergoing CERCLA cleanup. The Institute for Energy and Environmental Research's book High-Level Dollars Low-Level Sense notes the following about these dumps:

"At each of the three sites (located at West Valley, New York; Maxey Flats, Kentucky; Sheffield, Illinois), water has leaked into the burial trenches and in some cases caused extensive movement of radionuclides into the surrounding environment. Rather than being maintenance-free stabilized landfills, as was intended, these sites have ended up requiring active maintenance and remedial activities within ten years of closure. The problems at Maxey Flats which was first opened in 1962, provide an instructive example. A 1974 report by the state of Kentucky found that radioactive materials, including plutonium had moved hundreds of feet from where they had be buried. Although the operator of the site, U.S. Ecology had claimed that significant subsurface migration of plutonium was not possible, a 1975 report by the EPA found plutonium in core drilling samples, monitoring wells, and drainage streams. The EPA report noted that although Maxey Flats had been 'expected to retain the buried plutonium for its hazardous lifetime 'the plutonium had actually migrated from the site in less than ten years." [IEER(c)@69]

Even the fact that INL Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex is a CERCLA cleanup site seems to have been forgotten. Shallow burial of radioactive waste resulted in contaminate migration hundreds of feet below the SDA. See Section IV(D) Radioactive Waste Management Complex. DOE's continued use of Envirocare in Utah is unacceptable because it is being sued for permit violations by the Natural Resources Defense Council for RCRA non-compliance. According to Edwin Lyman:

> "The Idaho National Laboratory (INL) has 26 metric tons of sodium-bonded spent nuclear fuel left over from operating the Experimental Breeder Reactor II. It contains metallic sodium, which reacts violently with both air and water. DOE argues that the fuel can't be put in a geologic repository unless the sodium is removed. INL chose to remove the sodium through pyroprocessing, a technology that poses a proliferation threat because it can separate nuclear bomb ingredients out of spent fuel. Despite opposition from the Alliance, UCS, and other environmental and peace groups, INL started pyroprocessing in 2000. As a waste management effort, it has been a disaster right from the start." [215]

Section IV. M. Remote-Handled Low-Level Waste Disposal Facility (RHWDF)

The DOE's short-cut Environmental Assessment (EA) and attached Finding of No Significant Impact of the Remote-Handled Low-Level Waste Disposal Facility (RHWDF) is a violation of the National Environmental Policy Act (NEPA) that – if appropriately applied - would require a full Environmental Impact Statement (EIS) given the major potential environmental, health and safety impact of this proposal. Moreover, given DOE/INL gross mismanagement of existing nuclear waste disposal at the Idaho National Laboratory (INL) over six decades – resulting in extensive contamination of the underlying Snake River Aquifer, the public has no confidence that this new remote handled low-level landfill dump will not further impact their health and safety. [216] Thus, at the minimum, a full scale EIS must be conducted.

"DOE classifies some of the LL W generated at the INL as remote-handled LL W because its potential radiation dose is high enough to require additional protection of workers using distance and shielding. Remote-handled wastes are those with radiation levels exceeding **200 millirem** per hour at the surface of a container, and includes debris, used materials (i.e., gloves, tools, hardware, and other activated metal components), ion-exchange resins, and filters." [217]

The EA states: "The scope of the proposed action only addresses the need for **final disposal location** of remote-handled LLW waste generated by various operations at various facilities on the INL Site. The environmental impacts from operating facilities at the INL Site that will or may generate remote-handled LLW in the future are out of the scope of this EA." [218] [Emphasis added] The public is justifiably angry that DOE and the Navy is building yet another permanent nuclear waste dump over the sole-source aquifer that these agencies mismanagement – over 6 decades - have extensively contaminated.

Specific Deficiencies of this Environmental Assessment (EA)

* No detailed waste characterization (including curie content) of known waste streams slated for dump internment;

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[215] Edwin Lyman, on August 11, 2017, the Los Angeles Times revealed that, without significant reform, the Department of Energy (DOE) will miss its 2035 deadline for getting all its spent fuel out of Idaho. The LA Times article is based on a report by Edwin Lyman of the Union of Concerned Scientists (UCS), a longtime Alliance ally. DOE documents he got through the Freedom of Information Act show DOE is knowingly making the situation even worse while leaving the public and the State of Idaho in the dark.

[216] See EDI Snake River Plain Aquifer Report available at, www.environmental-defense-institute.org

[217] EA-1793, pg. 1

[218] EA-1793, pg. A-9.

1. Naval Reactor Facility (Naval Nuclear Propulsion Program) ;
2. Advanced Test Reactor;
3. Materials and Fuels Complex (MFC) (formally Argonne National Lab – West) to include the restart of the Transient Reactor Test Facility;
4. Idaho Nuclear Engineering and Technology Complex (INTEC) formerly called Idaho Chemical Processing Plant (ICCP);
5. Other specific INL operations to include RWMC non-compliant WIPP/ICDF waste;
6. Other Non-INL waste shipped to INL (past/future);

* No cumulative radioactive/curie content of annual/final estimate waste to be dumped;
* Inadequate flood plain documentation;
  The proposed candidate dump(s) are above the Snake River Plain Aquifer and right beside to the Big Lost River;
* No disclosure of Greater than Class-C Low-level waste slated for the dump. According to Nuclear Regulatory Commission regulations, GTCC waste is prohibited from shallow landfill dumps and must be interred in a deep geologic repository; [219]
* No disclosure of credible onsite interim "road-ready" storage currently operating;
* No cumulative doses from all INL operations to the aquifer – the public has a right-to-know how much this new dump will add to existing INL contamination to the aquifer and general environment;
* No discussion of "Consent Order" compliance that all high-level , transuranic and alpha-emitting waste is to be shipped out of state for permanent disposal. [220]

The Environmental Protection Agency and the Idaho Department of Environmental Quality are complacent in this six decade long mismanagement of INL waste disposal because they failed to exercise their regulatory/legal oversight. These regulatory agencies with jurisdiction must demand a full EIS of the INL new dump and make their comments available to the public. Neither the Environmental Protection Agency, Nuclear Regulatory Commission, nor the Idaho Department of Environmental Quality bothered to even comment on the Greater-than-Class-C (GTCC) Waste EIS despite DOE's disclosed intent to construct a new GTCC and Transuranic waste dump at INL. Where is the "due-diligence?"

The EA states: "No other federal or state agencies were formally consulted during preparation of this Environmental Assessment." [221] DOE's Notice of Intent states: "In addition, DOE proposes to include DOE LLW and **transuranic waste** having characteristics similar to GTCC LLW and which may not have an identified path to disposal (herein referred to as GTCC-like waste) in the scope of this EIS." [emphasis added] [222]

DOE fails to disclose if this new dump is permanent. "At the end of the operational life [50 years] of the disposal facility, an engineered cover would be placed over the disposal vaults." [223] This sounds permanent by any reading.

The EA states: "Before DOE authorizes disposal of LLW under DOE Order 435.1, it must be demonstrated that the disposal facility will do the following:

"Before sited, designed, operated, maintained, and closed such that the total all-pathways exposure to the public is less than 25 mrem/year effective dose equivalent (EDE) from the facility and to less than 30 mrem/yr EDE for all potential sources of radionuclides.

"Limit the radionuclide concentrations for near surface disposal so that the potential exposure received by an inadvertent intruder (more than 100 years post-closure) would be limited to **100 mrem/year for acute**

[219] Title 10 Code of Federal Regulations (CFR) Subsections 72.3 and 61.55

[220] U.S. District Court for the District of Idaho, Settlement Agreement and Consent Order, Cv. No. 91-0035-S-EJL and 91-0054-S-EJL, 8/17/95; and Agreement to Implement U.S. District Court Order Dated 5/25/06, signed 7/1/08.

[221] EA-1793 pg. 6-1

[222] Federal Register / Vol. 72, No. 140, DOE Notice of Intent, 7/23/07.

[223] EA-1793, pg. 2-5

exposure and 500 mrem total EDE for chronic exposure." [Emphasis added] [224]

"Dose to representative members of the public shall not exceed **25 mrem** (0.25 mSv) in a year total EDE from all exposure pathways, excluding the dose from radon and its progeny in air. Dose to representative members of the public via the air pathway shall not exceed **10 mrem** (0.10 mSv) in a year total EDE, excluding the dose from radon and its progeny." [225]

No mention in the EA that every 500 years, non-sorbing radionucides, which dominate the dose, by the way, are estimated to increase by a factor of 3.

The EA also states: "The Idaho Ground Water Quality Rule (IDAPA 58.01.11) establishes minimum requirements for protection of groundwater quality through standards and an aquifer categorization process. Primary constituent standards are based on protection of human health, and secondary constituent standards are generally based on aesthetic qualities. The primary constituent standards for radionuclides incorporate standards set by EPA (40 CFR 141.66). These limits are typically specified as a maximum contaminant level (MCL). MCLs found in 40 CFR 141 include values for beta-gamma-emitting radionuclides and alpha-emitting radionuclides. The MCL for beta-gamma-emitting radionuclides is the concentration that, assuming an ingestion rate of about one-half gallon of water per day for 365 days per year, the dose equivalent to the whole body or critical organ does not exceed **4.0 mrem/year**. Other specific limits include a maximum gross alpha activity of 15 pCi/L (excluding radon and uranium isotopes), a maximum combined Ra-226 and Ra-228 concentration of 5 pCi/L, a maximum uranium mass concentration of 30 μg/L, and maximum H-3 and Sr-90 concentrations of 20,000 pCi/L and 8 pCi/L, respectively." [Emphasis added] [226]

DOE fails to disclose all INL contaminate contributions to the underlying Snake River Plain Aquifer. The EA only discloses some contributors and ignores Radioactive Waste Management Complex (RWMC). The EA states: "Assessing the cumulative impacts to groundwater requires consideration of other sources of contaminants that either exist in the aquifer currently or will enter the aquifer in the future. Locations of the sources include upgradient [sic] contaminants that could migrate through the aquifer volume potentially impacted by the remote-handled LLW disposal facility, nearby sources that could overlap the impacted region and those sources downgradient [sic] that might be affected by the remote-handled LLW disposal facility. The potential for cumulative impacts to groundwater were analyzed for each candidate onsite location (INL 2011a)." [227]

Based on Environmental Defense Institute's Freedom of Information requests limited information, the below document previous waste streams at INL. Clearly, DOE/INL is failing to disclose detailed characterization (including radiation/curie content) of the nuclear waste slated for the new dump.

The EA states: "DOE is planning to develop capabilities to support nuclear research, development, and testing at the INL Site and at facilities located in Idaho Falls (DOE-ID 2011). At the INL site, the restart of the Transient Reactor Test Facility is being considered for testing fuel behavior over a brief interval of time. Potential new capabilities include an analytical laboratory for post-irradiation examination and facilities for conducting laboratory-and engineering-scale testing of aqueous separations and materials disposition. These projects are in the initial planning phases and insufficient data exists to support evaluation of whether they could have a cumulative effect on a remote-handled LLW disposal facility. As these projects progress, their potential for cumulative effects will be considered as part of project planning." [EA pg. 4-15] This waste stream must be characterized – if only estimated.

For instance, this EA does not disclose Materials and Fuels Complex (MFC's) underground transuranic/GTCC waste site Radioactive Scrap and Waste Facility (RSWF) which – according to previous DOE documents has 81 cubic meters of waste containing 9,823,000 curies of radioactive materials including 40.73 grams of plutonium. [228] The RSWF consists of a large array of vertical carbon steel pipes that contain the waste. The EA states: "In addition, DOE is continuing to remove and process for disposition remote-handled waste that was placed in

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224 EA-1793, pg. 2-1

225 EA-1793, pg.5-1

226 EA-1793, pg. 4-2

227 EA-1793, pg. 4-13

228 See DOE/INL document # ID-10054-81, page 19

storage at the Radioactive Waste and Scrap Facility at MFC between 1965 and 2007 (DOE 2009)." [229]

DOE fails to disclose the current RSWF inventory/characterization slated for the new dump. Also the MFC's pyrophoric EBR-II sodium coolant post-treatment residual waste is not disclosed.

INTEC's Integrated Waste Treatment Unit (IWTU) incinerator - currently operating to treat 900,000 gallons of high-level liquid waste remaining in the Tank Farm – post treatment waste destination is not disclosed. [230]

DOE fails to fully characterize Advanced Test Reactor (ATR) waste slated for the dump.
The EA states: "At the ATR Complex, change-out of reactor core components generates remote-handled activated-metal approximately every 8 years. These components are stored in water-filled canals to allow radioactivity to decay." [231] This designated waste includes irradiated reactor fuel and irradiated experimental fuel units and "reactor core components."

"INL also provides infrastructure and research, development, and testing for other federal tenants and sponsors. Remote-handled LLW could be generated over the next 50 years from other INL support facilities and operations as part of ongoing activities (such as spent nuclear fuel management) or from potential new missions." [232]

"The alternative of interim storage involved storage of remote-handled LLW at either the generator facilities or another acceptable, safe location until disposal capability is available. The generator facilities have very limited storage capacity available and there are no plans to expand interim storage capability. No other facilities exist or are planned onsite that could accommodate the remote-handled LLW for interim storage. Even if storage were available, implementation of an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017." [233]

The EA states: "The alternative of storage for decay considered storage of remote-handled LLW for sufficient time to enable its radioactive source term to decay to levels that would make it acceptable for disposal as contact-handled LLW. Storage for over 80 years would be required to provide time for the remote-handled LLW isotopes to decay to contact-handled LLW. Storage facilities do not exist to support this alternative. Even if storage were available, disposal capability for 80 to 130 years in the future is uncertain. In addition, an alternative for storage instead of disposal does not provide for permanent disposal of remote-handled LLW generated at the INL site beyond 2017." [234]

The above EA statements are grossly miss-leading because it fails to acknowledge existing onsite temporary "road-ready" storage of highly radioactive waste. The INL INTEC has for many years managed (Independent Spent Fuel Storage Instillation) – under NRC permit – heavily shielded dry casks filled with waste as interim-storage pending final geologic disposal facility availability.

"The Naval Nuclear Propulsion Program is a joint Navy and DOE organization responsible for all matters pertaining to U.S. nuclear-powered submarines and aircraft carriers. At the INL site, NRF supports the Naval Nuclear Propulsion Program by receiving, examining, and processing spent fuel assemblies as part of preparations for final disposition. Naval spent nuclear fuel is shipped by rail in shielded shipping containers from naval shipyards to NRF, where it is removed from the shipping containers and placed in water pools for examination. The assemblies are then prepared for dry storage prior to shipment for final disposition. The process for preparing spent fuel assemblies involves removing non-fuel structural components (activated metals), which are remote-handled LLW that require disposal. Filtration of water in the NRF pools as part of ongoing maintenance also generates spent ion-exchange resins that are remote-handled LLW." [235]

Naval Reactors FY 2013 Congressional Budget allocates $35,493,000 for the Remote-Handled Waste Disposal Project. [236] Since the Navy is the primary funder of this dump, it's a credible assumption that Navy waste will

[229] EA-1793 pg. 2-2
[230] Idaho Cleanup Project Progress Report 2009, CH2M-WG.
[231] EA-1793 pg.2-1
[232] EA-1793 pg. 2-2
[233] EA-1793 pg. 2-4
[234] DOE/EA-1793, page 2-5
[235] EA-1793 pg.2-2
[236] Naval Reactors FY 2013 Congressional Budget, Total Estimated Cost, pg. 489.

dominate the volume interned. The Navy's $70,895,000 expansion of the NRF Expanded Core Facility to accommodate significant additions to its Nuclear Navy Propulsion fleet additionally indicates corresponding increased waste flow to the new INL dump. [237]

"Outyear [sic] funding [2013] supports Naval Reactors' core mission of providing proper maintenance and safety oversight, and addressing emergent operational issues and technology obsolescence for 103 reactor plants. This includes 71 submarines, 11 aircraft carriers, and four research and development and training platforms (including the land-based prototypes)." [238] Even this near-term level (103 reactors) of decommissioning will generate significant quantities of highly radioactive remote-handled waste destined for the new INL dump. Therefore, it is crucial for the Navy to disclose full characterization of waste planned for internment in the new dump. [See pg. 17 below for past NRF waste dumped at INL]

"FY 2013, FY 2014 and FY 2015 includes an allocation to Naval Reactors from the Department of Defense's (DoD) Research, Development, Testing and Evaluation (RDT&E) account entitled "NNSA PROGRI-'M SUPPORT". The amounts included for Naval Reactors from this DoD account are FY 2013 $5.8 million; FY 2014, $2.0 million; and FY 2015, $0.9 million." [239]

Additionally, the Naval Reactor Facility (NRF) continues to use its dry cask storage for highly radioactive waste and thus is obliged to continue storing (not dump) its own waste until a permanent geologic repository is permitted. See below attached NRF pictures that document the Navy's existing extensive capacity to generate "road-ready" nuclear waste for interim storage. There is no credible/legitimate reason these and/or comparable interim storage facilities cannot be used for all INL nuclear remote-handled low-level waste.

DOE's Notice of Intent states: "The Low-level Radioactive Waste Policy Act Amendments of 1985 specifies that the GTCC low-level waste covered under section 3(b)(1)(D) is to be disposed of in a facility licensed and determined to be adequate by the [Nuclear Regulatory Commission] NRC." "NRC regulations at 10 CFR 61.55(a)(2)(iv) define GTCC LLW as that waste which would require disposal in a geologic repository as defined in 10 CFR Part 60 or 63." [240]

The DOE/INL EA apparently offers no confirmation of NRC "determination" or disclosure of "adequate" compliance of siting criteria of the new INL dump.

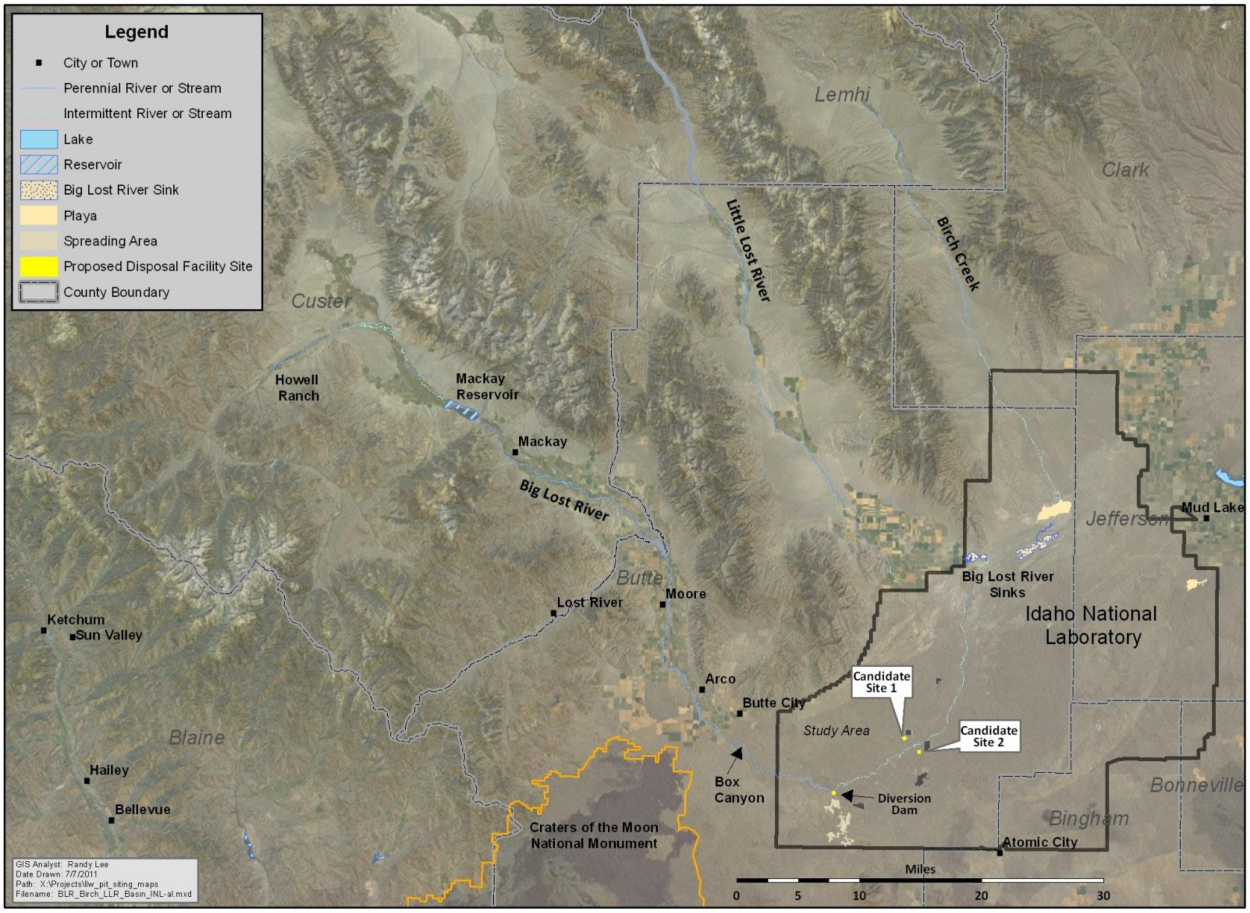
DOE's EA postulates that the new dump: "Be sited, designed, operated, maintained, and closed [once filled] such that the total all-pathways exposure to the public is less than 25 mrem/year effective dose equivalent (EDE) from the facility and to less than 30 mrem/yr EDE for all potential sources of radionuclides. [And] Limit the radionuclide concentrations for near surface disposal so that the potential exposure received by an inadvertent intruder (more than 100 years post-closure) would be limited to **100 mrem/year for acute exposure and 500 mrem total [effective dose equivalent] EDE for chronic exposure.**" [emphasis added] [241]

See INL flooding issues in Section IV.F for more details on the flooding problems with the Remote-Handled Radioactive Waste Facilities that are completely ignored by DOE.

See EDI's complete detailed comments at:

EDI Comments on DOE New Remote-Handled Radioactive ...
www.environmental-defense-institute.org › publications

[237] Ibid.; Also see; Notice of Intent, To Prepare an Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory
[238] Naval Reactors, Overview, Appropriations Summary by Program, FY-2013 Congressional Budget, pg.480.
[239] Ibid.
[240] Federal Register / Vol. 72, No. 40135, DOE Notice of Intent, 7/23/07.
[241] DOE/EA-1793, page 2-1



Remote-Handled Waste Disposal Facility top 2 candidate sites.
Also see Attached INL/EXT-10-18191 pg.1 Figure 1

Section IV. O. Environmental Management Sight Specific Advisory Board

In May 1994, DOE/ID convened the first meeting of the Environmental Management Sight Specific Advisory Board - INL EMSSAB also called Citizens Advisory Board (CAB). Fifteen individuals were chosen to serve on the Board by a selection panel. Since the first meeting the Board has met semi-monthly. The structure that DOE headquarters chose to meet the requirements of the Federal Advisory Committee Act was a single large board composed of all members of each of the eight DOE sites that have advisory boards. The individual DOE sites would convene subcommittee meetings.

The dominate SSAB-INL composition of current or former site workers, and economic development interests is not balanced. This strategy ensured that environmental interests would be marginalized not only numerically but also through a perverse interpretation of the “consensus process”. For over a year, the SSAB refused to put INL CERCLA (Superfund cleanup) issues on the agenda. This precisely mirrors INL site manager John Wilcynski’s priorities presented numerous times to the SSAB. Wilcynski encouraged the SSAB to focus on the big picture and become advocates for new nuclear missions for the INL and not get “bogged down” in the multitude of Environmental Restoration (ER) projects.

Admittedly, the SSAB did eventually and grudgingly allow an ER Issue Committee to be formed - Brett Hayball, Shoshone-Bannock Tribal then representative and this Guide’s author were co-chairs of this committee. However, this ER committee was shortly and summarily dissolved by the SSAB. New Waste Area Group issue committees were organized, but they are now dominated by individuals who are loath to allow substantive discussions concerning the details of specific INL remediation actions.

Environmental stakeholders are left with no other recourse than to pursue other venues within the CERCLA/Federal Facility Agreement mandates where INL environmental restoration actions can be fully discussed with the principal agencies. The departure of environmentalists from the SSAB in no way is an indication of a reduced interest in INL cleanup. Indeed, it represents a renewed commitment to the issues and a vigorous demonstration that environmental issues require full consideration by the policy makers. The SSAB effectively marginalized these environmental stakeholder interests yet claimed to accurately represent the diversity of Idahoans. Nothing could be further from the truth. The dominate SSAB opinion is to encourage DOE to build fences around contaminated sites and walk away from the problem. Continued participation on the SSAB by environmentally active individuals and organizations only lends unwarranted credibility to a failed process. [242]

It is instructive to see that the two DOE site boards experiencing environmental flight are the two remaining production sites - INL and Savannah River. Expansion of their respective nuclear production missions remains the priority today as it did sixty-years ago. Environmental restoration is perceived by the SSAB's as damaging to future INL nuclear missions because it exposes the extent of past and present environmental contamination caused by mismanagement of the most toxic substances known to humankind. This is a tragic legacy to thrust on future generations - not only the health and safety hazards, but also the $29 billion cleanup legacy mortgage costs that are now due. If at some future date current INL site director chooses to redirect the SSAB toward substantive involvement in environmental restoration projects, then EDI will be ready and willing to participate on the board.

Thatcher is a former nuclear safety analyst at INL and is now a nuclear safety consultant comments: [243]

"A presentation was given to the ICP Citizens Advisory Board by Bret Leslie about the findings and recommendations of the US Nuclear Waste Technical Review Board. The presentation can be unzipped and downloaded from the ICP CAB website for their April 19 meeting in Fort Hall.[244]

"It is important information that is more complete and candid than has been presented by the Department of Energy regarding Idaho's spent nuclear fuel challenges and may be of interest to the LINE commission.

"As you know, the Idaho Settlement Agreement stipulated the "Establishment of INEL as DOE Spent Fuel Lead Laboratory" and this entailed research, development and testing of treatment, shipment and disposal technologies of all DOE spent fuel. Basically, this was defunded around 2008 and the consequences of DOE's lapse are now more evident. In a nutshell:

"The presentation by the USNWTRB pointed out that a nuclear fuel packaging facility is needed in order to comply with the Idaho Settlement Agreement to have the fuel shipped out of Idaho by 2035. It also pointed out that estimates that it would take 15 years to package the fuel for shipping would need to start in 2 years. But the Department of Energy has not even decided whether to build a new facility or use an existing facility to repackage the fuel.

"Some highlights of the deficiencies identified include:

* The degradation of fuels stored is not being managed for degradation of the fuel and this may complicate future packaging, storage, transportation and disposal of the fuel;
* The Department of Energy has stopped developing the DOE standardized canister to store, transport, and dispose of nuclear fuel;
* More analysis on fuel drying and on hydrogen generation from corrosion products is needed
* The fate high-level waste streams of the sodium-bonded driver fuel at the Materials and Fuels Complex at the Idaho National Laboratory is uncertain and may not meet waste acceptance requirements for a disposal repository.

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[242] Chuck Broscious was a member of DOE's INL Environmental Management Sight Specific Advisory Board - INL Subcommittee and the CDC's INEL subcommittee for about six years when I resigned from both because it became clear that I was giving credence to a bogus process because CDC/DOE were putting committee members on the boards who were INL boosters and did not want to damage INL's public image.

[243] Tami Thatcher, For more information on sourcing for this guest column in PostRegister.com.

[244] Idaho Cleanup Project Citizens Advisory Board (formerly the Idaho National Laboratory Citizens Advisory Board) meeting schedules and presentations at https://energy.gov/em/icpcab/idaho-cleanup-project-citizens-advisory-board-icp-cab See presentations for the April 19, 2018 meeting at Fort Hall, Idaho.

* The DOE's spent nuclear fuel will be stored decades longer than expected, and DOE SNF is typically more degraded than commercial SNF. SNF degradation may complicated storage, transportation and disposal.
* While DOE has been making important progress, for years now the DOE has focused on what it has already accomplished. The tune has been to assert that everything is on track."

"It concerns me that the most important future ISA milestones are apparently going to be missed, perhaps by decades or more. Even in the optimistic scenario that a repository for spent nuclear fuel is obtained, the waste at the INL will likely be stored in Idaho for decades, writes Tami Thatcher. [245]

"The state of Idaho has ignored the Department of Energy's lack of focus on meeting future milestones in the Idaho Settlement Agreement. Idaho now stands assured of missing every major settlement agreement milestone in the future involving removal of spent nuclear fuel (SNF) and high-level waste (HLW) from the state.

"The currently missed milestones are the slowed pace of shipments of transuranic waste to the Waste Isolation Pilot Plant (WIPP) in New Mexico that resumed a year ago, and the failure to get the Integrated Waste Treatment Unit (IWTU) treating liquid radioactive waste it was supposed to have completed in 2012. DOE is paying fines to the state for not emptying the waste tanks and calcine treatment is delayed by continuing problems at the IWTU.

"Even with the progress of shipping of above-ground stored transuranic waste and some buried transuranic waste, the "cleanup" will still leave plenty of transuranic waste over Idaho's aquifer. The americium-241 buried at the RWMC not being exhumed would require six Snake River Plain aquifers to dilute to drinking water standards.

"Largely because of the failure to treat liquid waste with the IWTU, the shipping of non-naval spent nuclear fuel to the Idaho National Laboratory was suspended, including research quantities of commercial nuclear power reactor SNF.

"The environmental impact statements regarding DOE's SNF and HLW at INL, including the research quantities of SNF, all rely on the illusive Yucca Mountain repository for disposal. Even a Republican dominated congress is unable to revive the illusion of progress toward obtaining a license to construct the repository.

"The geology of Yucca Mountain does not prevent corrosion of the SNF or its containers and does not prevent the migration of radionuclides into nearby watersheds. Arguments that migration of the contaminants from the repository will be acceptably low hinge on the assumed protection of 11,500 5-ton titanium drip shields to be robotically installed after the waste is in place.

"In the optimistic scenario that a repository is obtained, the spent nuclear fuel and high-level waste at the INL will likely be stored in Idaho decades longer than expected and certainly beyond the milestone dates. The only thing certain is the hubris of nuclear boosters who will try to dismiss the problem of dealing with the nuclear wastes which remains unsolved despite decades of trying and billions of dollars spent.

"The settlement agreement date of January 1, 2035 to have the SNF shipped out of Idaho would require SNF repackaging to begin by 2020, but the DOE has not even decided whether to build a new facility or if it can use an existing one.

"According to a presentation at the Idaho Cleanup Project Citizens Advisory Board meeting held in April, the DOE has not completed the SNF fuel canister design, has not fully implemented fuel aging management programs for the SNF already at INL, is not addressing waste acceptance requirements affecting disposal of certain SNF/HLW and is not conducting the necessary research concerning degradation related to disposal.

"The DOE is simultaneously pretending that a repository will be operating soon and using the lack of a repository is an excuse not to make progress on the repackaging facilities that are essential for the removal of SNF and HLW from Idaho.

"And although the Settlement Agreement doesn't prevent new reactors such as the NuScale reactor from creating more SNF, this new commercial SNF would be at the back of the line should a repository open. Ask NuScale who will pay for extended storage decades after closure and the subsequent repackaging of the SNF it creates." [246]

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245 Tami Thatcher, Guest column: Missed clean up milestones (title is the Post Register's) Posted: May 19, 2018 1:43 a.m.

246 Tami Thatcher and Chuck Broscious Comment for Class 2 Permit Modification Request (PMR) Including a Request for a Temporary Authorization for Proposed Modifications to the Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery

Regulated Contaminants (Radionuclides Rule 66 FR 76708 December 7, 2000 Vol. 65, No. 236)

Regulated Radionuclide	MCL	MCL Goal
Beta/photon emitters*	4 mrem/yr	0
Gross alpha particle	15 pCi/L	0
Combined radium- 226/228	5 pCi/L	0
Uranium	30 µg/L	0

*A total of 168 individual beta particle and photon emitters may be used to calculate compliance with the MCL.

"Monitoring Requirements: Gross Alpha, Combined Radium-226/228, and Uranium (1)
Beta Particle and Photon Radioactivity (1);
(1) All samples must be collected at each entry point to the distribution system.
Vulnerable CWSs (2) must sample for:
• Gross beta: quarterly samples. • Tritium and Strontium-90: annual samples
(2) The rule also contains requirements for CWSs using waters contaminated by effluents from nuclear facilities.

"A system with an entry point result above the MCL must return to quarterly sampling until 4 consecutive quarterly samples are below the MCL. If gross beta particle activity minus the naturally occurring potassium-40 activity exceeds 50 pCi/L, the system must:

• Speciate as required by the State.
• Sample at the initial monitoring frequency.

4 consecutive quarterly samples. Systems with MCL violations must continue to take quarterly samples until 4 consecutive samples are at or below the MCL.

"Grandfathering of Data

When allowed by the State, data collected between June, 2000 and December 8, 2003 may be used to satisfy the initial monitoring requirements if samples have been collected from:

• Each entry point to the distribution system (EPTDS).
• The distribution system, provided the system has a single EPTDS.
• The distribution system, provided the State makes a written justification explaining why the sample is representative of all EPTDS."

[Source: Radionuclides Rule: A Quick Reference Guide, EPA 816-F-01-003, June 2001]

act (RCRA) Permit for the Materials and Fuels Complex at the Idaho National Laboratory (INL), Environmental Protection Agency (EPA) Identification Number ID4890008952 (referred to herein as the MFC Permit) September 28, 2017

Section V. Independent Health Studies

A. Studies Indicate Risk at INL

"*Radio-ecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory*" by Michael Blain, Ph.D., et al. presented to the American Association for the Advancement for Science annual meeting in May 1984 offers an evaluation of the radiological effects of INL operations.

Dr. Blain's 1984 study offered the first independent assessment of the health impact from INL operations. The Idaho Academy of Sciences as well as the State and DOE tried to discredit the analysis. American nuclear history is full of conscientious scientists who were subjected to pressure and discrimination by federal agencies because they told the truth. Dr. Blain's assessments are as true today as they were in 1984 and hopefully his work will receive the public credit it deserves. The following is the abstract in his report.

"Federal data on cancer mortality and state data on cancer incidence in the six counties near INL were analyzed. When the Idaho state population is employed as a control group, there was an excess number of deaths (1950-69) from cancer of the more radiosensitive organs (17 observed, 9.4 expected, P<.05) and minor excess of cancer cases (1971-80; 11 observed, 8.0 expected) in Clark county, Idaho downwind of INL. The minor excess is due to a lower than expected number of male cancers (2 observed, 2.8 expected) and a higher than expected number of female cancers (9 observed, 5.2 expected), particularly female breast tumors (6 observed, 2.8 expected). Mormons have a 23% lower rate of cancer than other populations and the six counties have large Mormon populations (range = 40% - 80%). When the cancer incidence in the counties is compared to a Mormon control population, there is an excess cancer incidence (1971-80) in Bannock (659 observed, 485.7 expected, P=.001), Bonneville (547 observed, 447.9 expected, p=.001), Butte (47 observed, 34.5 expected, p=.05), and Clark (11 observed, 6 expected) counties. There is a need for a comprehensive cohort study (1952-80) that considers membership in the Mormon Church." [Blain @I]

Due to the cancer latency period, which can be decades, a credible argument can be made to bring the study period to the present. Blain cites 1960 environmental monitoring data on milk samples of 2 x 10^{-7} mCi/cc for I-131 (cc=ml). The notation "m" in this sampling data appears to denote micro (10^{-6}) rather than the conventional m = mili (10^{-3}). This assumption is supported by the same reports citing the current standard at 100 x 10^{-9} mCi/ml (100 pCi/L). Proposed EPA Drinking Water Standard for I-131 is 108 pCi/L. The above sample of 2 x 10^{-6} mCi/ml converted would be 2,000 pCi/L. This represents 20 times more I-131 contamination than the current standard would allow. A 1961 Report cites I-131 in milk samples at 1 x 10^{-7} mCi/L [100 pCi/L]. Blain also cites 1963 reports that indicated Strontium-90 off-site milk samples of 230 mmc/L [230 pCi/L]. Wheat samples tested for Sr-90 for the same period were as high as 170 mmCi/kgm [170 pCi/kgm]; and for cesium-137 were 800 mmCi/kgm [800 pCi/kgm]. Gamma emitter manganese-54 samples were 560 mmc/kgm [560 pCi/kgm]. [Blain @ 24 , citing Monitoring Report No. 12 1963:1]

Animal studies found the "highest ratio in rabbit thyroids occurred near the ICPP and was 9.1 x 10^{-4}. Ratios from thyroids of rabbits collected off-site and adjacent to the INL were higher than the control area ratios (<4 x 10^{-7})." "During this same period mule deer thyroids collected at Craters of the Moon National Monument (54 km west of ICPP) had average I-129/I-127 ratios of 4.4 x 10^{-6} and were significantly ($P < 0.01$) higher than ratios in control animals (3.3 x 10^{-7}) [1983: Health Physics 45:31-38]." "I-129/I-127 ratios in vegetation on-site ranged from 1.5 x 10^{-3} to 1.9 x 10^{-5}." "From these data it seems probable that the increase ratios obtained from samples NE and SW of the INL are due to the atmospheric releases from the ICPP."[DOE/ID-12111,P.38] [no units offered for data] Blain also cites on-site antelope muscle samples for Sr-90 taken in 1959 having 31.1 pCi/g and samples taken between 1972 and 1976 having 9.6 p/Ci/g. 1982 samples taken for Cs-137 in antelope showed 382 pCi/g. [Blain @ 35- 37]

1974 INL Regional Radioactive Air Monitoring

City	Iodine-131	Strontium-90	Gross Beta
Carey, ID	3.6 uCi/ml (or) 3,600,000,000 pCi/L	9.0 uCi/ml (or) 9,000,000,000 pCi/L	810 x 10-15 uCi/ml .00081 pCi/L
Idaho Falls	3.9 uCi/ml (or) 3,900,000,000 pCi/L		[ERDA-1536 @III-45]

Animal Tissue Samples Containing Cesium-137 On and Off-site

	Muscle	Liver
Sheep		
On-site	96 pCi/kg	81 pCi/kg*
Off-site	599 pCi/kg	286 pCi/kg
Antelope		
On-site	1,520 pCi/kg	2,660 pCi/kg
Off-site	92 pCi/kg	139 pCi/kg

* One kilogram (kg) = 1,000 grams [ERDA-1536 @ III-39&53]

Plutonium-239&241 in soil samples outside INL boundary registered 1500 nCi/sq meter and inside INL at 2,000 nCi/sq. meter.[ERDA-1536 @ III-36&37] Converting to pico curies, the readings are 1,500,000 pCi/sq meter and 2,000,000 pCi/sq meter respectively.

Idaho's Division of Health is conducting a cancer survey in counties around INL and the agency is finding excessively higher rates than national averages. The 1995 study analyzed a 17-county area comparison of cancer incidence rates and compared it to the other 27 Idaho counties. The study counties include Bannock, Bingham, Blaine, Bonneville, Butte, Caribou, Cassia, Clark, Custer, Fremont, Jefferson, Jerome, Lincoln, Madison, Minidoka, Power, and Twin Falls. The aggregate 17 county study found cancer incidents (observed) compared to the other 27 county control group (expected). The results include stomach cancer (observed 390 with 383 expected); brain cancer (observed 385 with 378 expected); and leukemia (observed 461 with 438.7 expected). [IDH&W(d)] This comparison is believed to be understating the problem because the counties in northern Idaho (downwind) have high cancer rates possibly due to Hanford radioactivity. [1]

In 1996 the state narrowed the previous study down to six counties south and east of INL including, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison. The age-adjusted incidence rate for central nervous system cancers in the six-county area was 8.1 per 100,000. The rest of Idaho had a rate of 7.0 per 100,000 compared with national rates of 6.7 per 100,000 (SEER) and 6.3 (CBTRUS). The observed number of central nervous system cancers for the six-county area was 110 (89 expected, based on the rest of Idaho). The analysis was then confined to brain cancer (other central nervous system cancers such as chordoma and optic tumors were excluded) 182 were observed when 151 would be statistically expected in the six-county area for the years 1975 to 1994. A 1996 analysis of a reported cluster area around the town of Moreland in Bingham county revealed an increased rate of brain cancers, 4 observed with 1 expected between 1980 and 1995. [IDH&W(c)]

In Blaine county, a survey requested by a local physician found that the female population younger than 70 had significantly elevated rates of breast cancer. Epidemiologists are studying the same factors as in the ongoing eastern Idaho brain cancer study. In Clark County, the agency found eight cases of female breast cancer when only 3.2 cases were expected. In Minidoka County, the agency found 20 cases of stomach cancer when only 11.6 were expected. [Jackson]

Allen Benson also offers credible challenges to current dose estimate methodology in his book Hanford Radioactive Fallout. Dr. Benson's continued health research has unearthed an Atomic Energy Commission report titled "Radiation Standards, Including Fallout". This 1962 report focused on bone lesions which were characteristic of radiation exposure. "In summary, in 235 radium-bearing patient's radio-graphed of the 264 measured for radium content, minimally significant radiographic lesions were seen with some degree of confidence when the radium level exceeded 0.01 micro curie." [AEC]

This finding is significant not only in terms of the AEC's early knowledge of measurable radiation exposure but also that it can be reliably measured through simple X-rays. Dr. Benson is currently developing a new "holistic" approach to dose-reconstruction. Testifying before the INL Health Effects Subcommittee in 1996, Benson offered these recommendations:

"You look at the terrain. You look at the meteorology. You look at when they made their release. And then you go look and see if there is any clusters. What you do then is you bring in integrated science; meteorology...and start testing. You go with gene marking, for example. You choose who are the likely highest dose people, and you gene mark them.... You test the environment, depending upon what the pollutant is...depending if that particular nuclide could have stayed in the area, it can be stockpiled, for example, in trees. So you bio-marker different parts, artifacts in the living system, to see if you can trap the agent that credibly caused the cluster." [IHES(b)]

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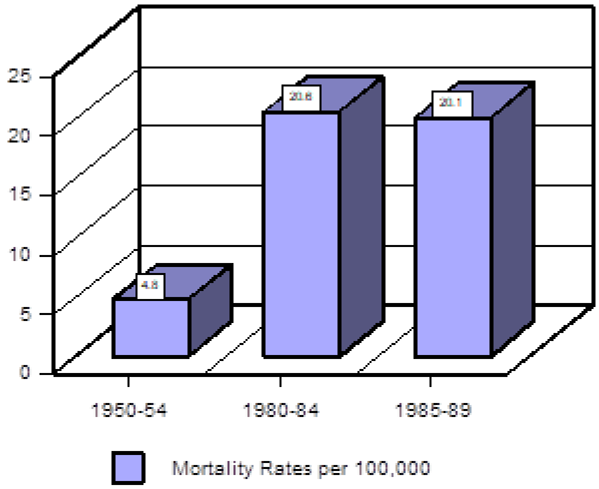
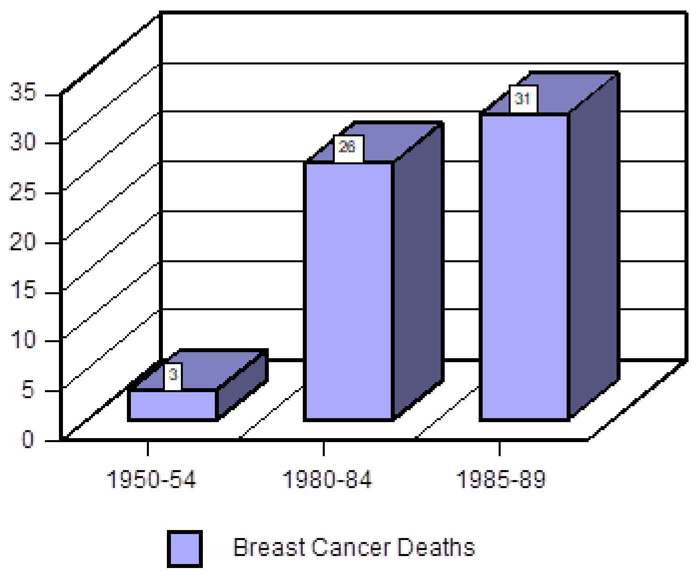
1 Comparison of Cancer Incidence Rates Between Selected Counties and the Remainder of the State of Idaho, Cancer Cluster Analysis Group, Idaho Department of Health and Welfare, March 1995

Age-Adjusted White Female Breast Cancer Rates 1950-89 Within 50 Miles of INL [2]



Breast Cancer Mortality Rates per 100,000 1950 to 1989 Within 100 Miles of INL [3]



[2] The Enemy Within, by Jay Gould with Members of The Radiation and Public Health Project, Ernest Sternglass, Joseph Mangano, William McDonnell, 1996.

[3] Ibid.

Age-Adjusted Incidence Rate per 100,000 1985-94 for Central Nervous System Cancers in Bingham, Bonneville, Butte, Clark, Jefferson, and Madison Counties around INL [4]

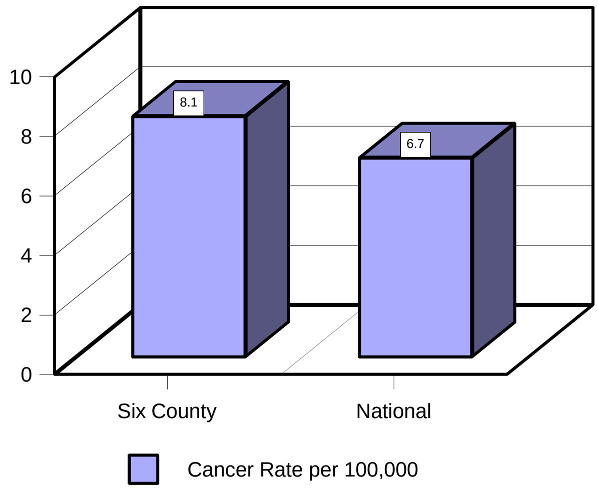


Figure 1

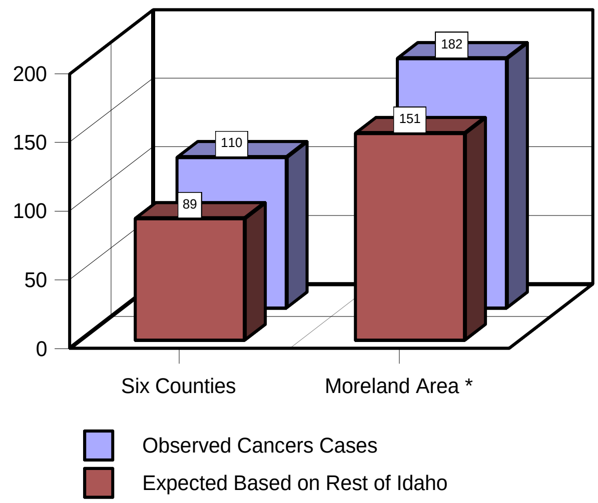
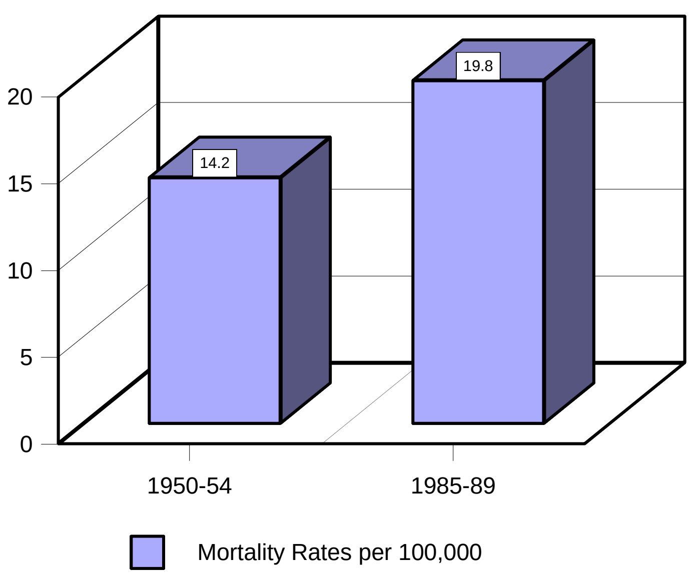
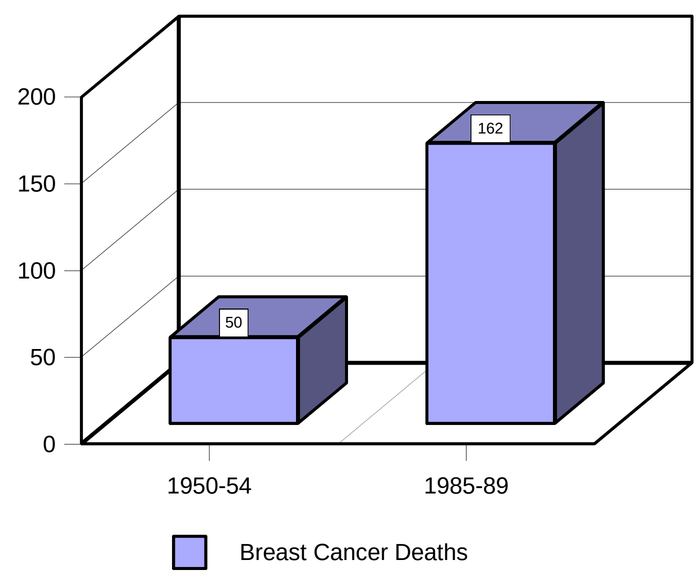


Figure 2

Figure 55

Figure 6 6





[4] Idaho Division of Health, "Idaho Public Health Brain Cancer Study" April 25, 1997 Idaho Department of Health Welfare, Division of Health, Idaho Public Health Brain Cancer Study, 8/8/97. Idaho Department of Health Welfare, Division of Health, Idaho Public Health Brain Cancer Study, 4/25/97. 1997 Idaho Public Health Brain Cancer Survey Eastern Idaho Cases, (1978-1997), Idaho Department of Health Welfare, Division of Health, Christine G. Hahn, MD, et.al. 11/28/97.

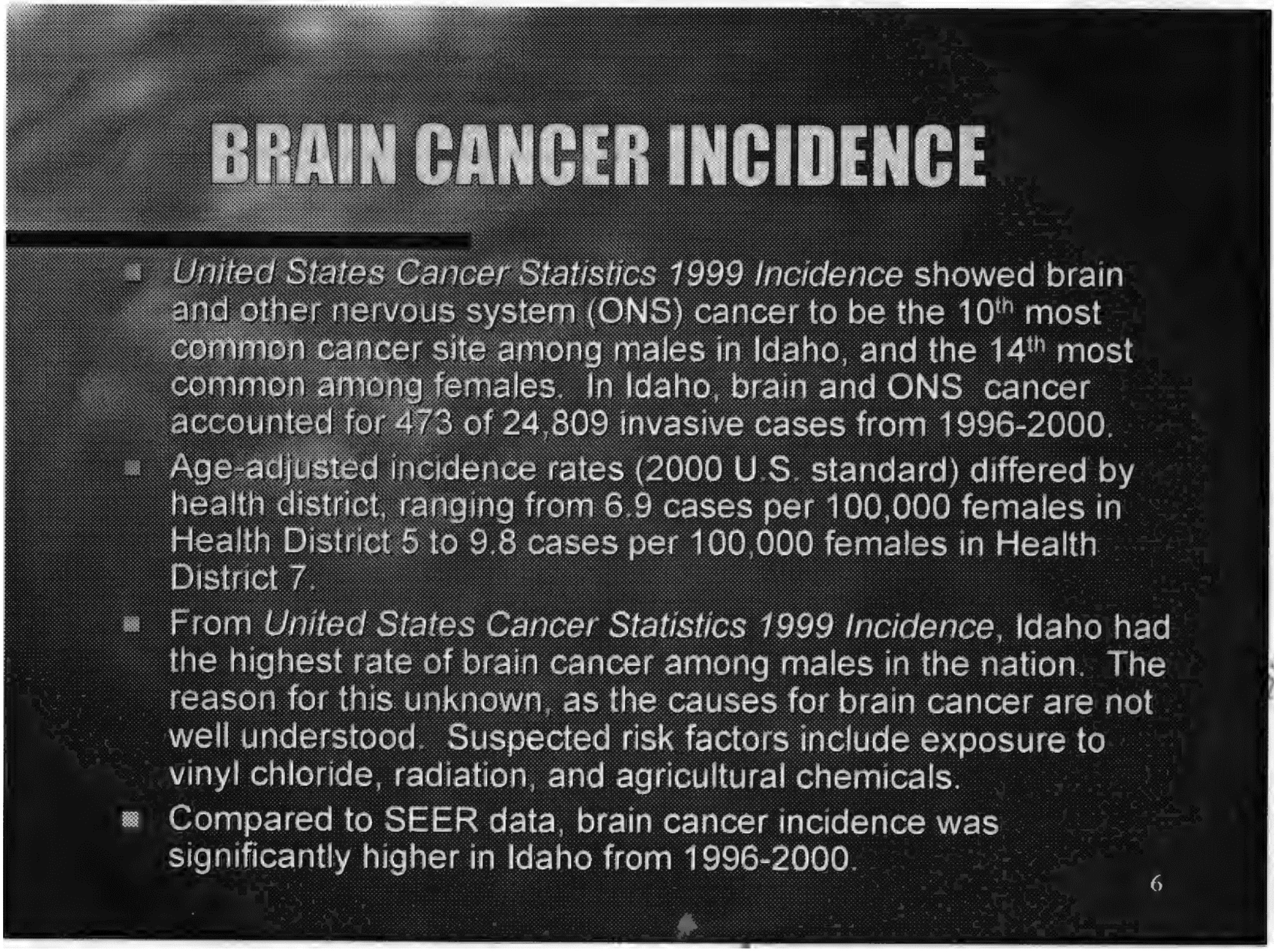
White female Breast Cancer Mortality Rates 1950-89
Counties Within 50 and 100 Miles of INEEL

	Age-Adjusted Mortality Rates Per 100,000			Percent Change		Number of Deaths		
	1950-54	**1980-84**	**1985-89**	**1980-84/ 1950-54**	**1985-89/ 1950-54**	**1950-54**	**1980-84**	**1985-89**
Gould 50 Mile 100 Mile	4.8 14.2	20.6 22.3	20.1 19.8	333% 57%	322% 39%	3 50	26 161	31 162
Land (NCI) 50 Mile	12.6	23.5	21.1	87%	67%			123
Idaho	18.9	22.3	18.9	18%	0%	242	585	571
United States	24.4	24.9	24.6	2%	2%			

Source: Enemy Within

Section V. B. below Cancer Data Registry of Idaho Reports [5]

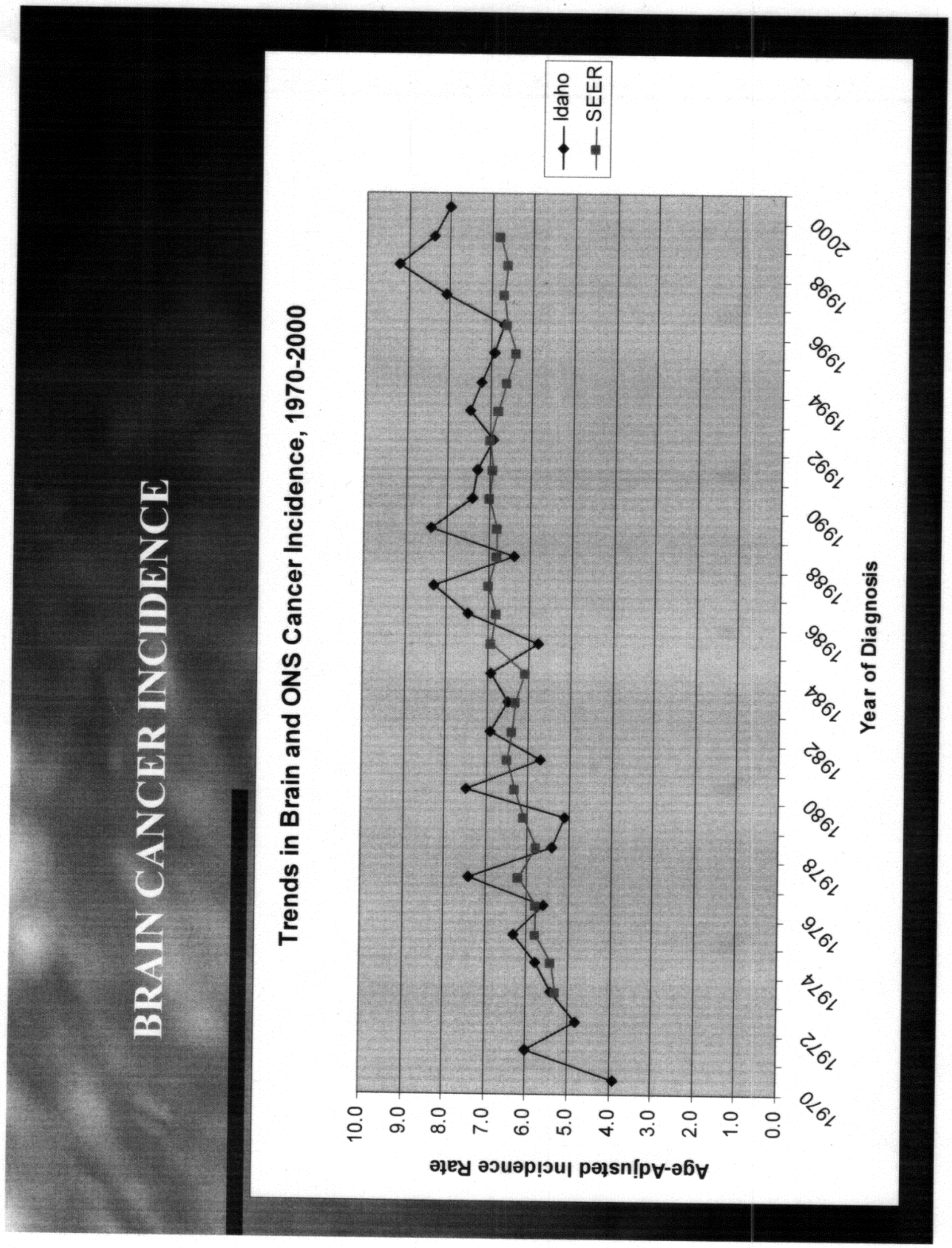
5 Cancer Data Registry of Idaho Cancer in Idaho – https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf



Above states:

"From United States Cancer Statistics 1999 Incidence, Idaho had the highest rate of brain cancer among males in the nation."

Source: Brain Cancer in Idaho 1996-2000, Pg. 6, Cancer Data Registry of Idaho. It must be noted how the Idaho Cancer Registry, like all Idaho agencies, nearly completely ignore the massive radioactivity released by DOE facilities at INL Idaho health districts [HD 6 &7]) and Hanford (effecting northern Idaho health districts. [HD 1 &2]).


BRAIN CANCER INCIDENCE
Trends in Brain and ONS Cancer Incidence, 1970-2000
Idaho
SEER
Age-Adjusted Incidence Rate
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Year of Diagnosis

CANCER INCIDENCE 2009-2013

COMPARISON BETWEEN BINGHAM COUNTY AND THE REMAINDER OF THE STATE OF IDAHO

Cancer Site/Type	Sex	Bingham County						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All Sites Combined	Total	922	227,608	405.1	438.9	992.3	0.025 <<	36,322	7,689,683	472.3
All Sites Combined	Male	487	114,327	426.0	458.1	**530.7**	0.058	19,225	3,850,623	499.3
All Sites Combined	Female	435	113,281	384.0	418.1	463.4	0.193	17,097	3,839,060	445.3
Bladder	Total	32	227,608	14.1	15.2	49.6	0.010 <<	1,817	7,689,683	23.6
Bladder	Male	24	114,327	21.0	22.5	39.9	0.009 <<	1,442	3,850,623	37.4
Bladder	Female	8	113,281	7.1	7.8	10.1	0.654	375	3,839,060	9.8
Brain - malignant	Total	16	227,608	7.0	7.3	13.7	0.593	482	7,689,683	6.3
Brain - malignant	Male	9	114,327	7.9	8.3	8.4	0.934	298	3,850,623	7.7
Brain - malignant	Female	7	113,281	6.2	6.4	5.2	0.536	184	3,839,060	4.8
Brain and other CNS - non-malignant	Total	20	227,608	8.8	9.5	22.6	0.685	824	7,689,683	10.7
Brain and other CNS - non-malignant	Male	6	114,327	5.2	5.6	8.0	0.616	291	3,850,623	7.6
Brain and other CNS - non-malignant	Female	14	113,281	12.4	13.4	14.5	1.000	533	3,839,060	13.9
Breast	Total	125	227,608	54.9	59.6	137.9	0.289	5,055	7,689,683	65.7
Breast	Male	1	114,327	0.9	0.9	1.4	1.000	52	3,850,623	1.4
Breast	Female	124	113,281	109.5	119.2	135.6	0.342	5,003	3,839,060	130.3
Breast - in situ	Total	15	227,608	6.6	7.2	28.1	0.010 <<	1,029	7,689,683	13.4
Breast - in situ	Male	-	114,327	-	-	0.1	1.000	4	3,850,623	0.1
Breast - in situ	Female	15	113,281	13.2	14.4	27.8	0.012 <<	1,025	3,839,060	26.7
Cervix	Female	6	113,281	5.3	5.7	6.3	1.000	228	3,839,060	5.9
Colorectal	Total	**99**	227,608	43.5	47.3	**80.5**	**0.050 >>**	2,953	7,689,683	38.4
Colorectal	Male	**65**	114,327	56.9	61.2	**43.9**	**0.003 >>**	1,592	3,850,623	41.3
Colorectal	Female	**34**	113,281	30.0	33.0	**36.6**	0.750	1,361	3,839,060	35.5
Corpus Uteri	Female	25	113,281	22.1	24.1	27.4	0.739	1,014	3,839,060	26.4
Esophagus	Total	12	227,608	5.3	5.7	**10.2**	0.645	373	7,689,683	4.9
Esophagus	Male	11	114,327	9.6	10.3	**8.5**	0.483	309	3,850,623	8.0
Esophagus	Female	1	113,281	0.9	1.0	**1.7**	0.985	64	3,839,060	1.7
Hodgkin Lymphoma	Total	3	227,608	1.3	1.4	5.9	0.325	211	7,689,683	2.7
Hodgkin Lymphoma	Male	2	114,327	1.7	1.9	3.2	0.772	114	3,850,623	3.0
Hodgkin Lymphoma	Female	1	113,281	0.9	0.9	2.7	0.499	97	3,839,060	2.5
Kidney and Renal Pelvis	Total	29	227,608	12.7	13.8	34.5	0.399	1,260	7,689,683	16.4
Kidney and Renal Pelvis	Male	20	114,327	17.5	18.8	21.9	0.796	790	3,850,623	20.5
Kidney and Renal Pelvis	Female	9	113,281	7.9	8.6	12.8	0.364	470	3,839,060	12.2
Larynx	Total	2	227,608	0.9	0.9	5.5	0.172	202	7,689,683	2.6
Larynx	Male	1	114,327	0.9	0.9	4.5	0.125	162	3,850,623	4.2
Larynx	Female	1	113,281	0.9	1.0	1.1	1.000	40	3,839,060	1.0
Leukemia	Total	27	227,608	11.9	12.5	36.1	0.143	1,288	7,689,683	16.7
Leukemia	Male	13	114,327	11.4	11.8	21.6	0.067	757	3,850,623	19.7
Leukemia	Female	14	113,281	12.4	13.2	14.6	1.000	531	3,839,060	13.8
Liver and Bile Duct	Total	12	227,608	5.3	5.7	13.2	0.886	479	7,689,683	6.2
Liver and Bile Duct	Male	6	114,327	5.2	5.6	9.8	0.280	353	3,850,623	9.2
Liver and Bile Duct	Female	6	113,281	5.3	5.8	3.4	0.259	126	3,839,060	3.3
Lung and Bronchus	Total	90	227,608	39.5	43.0	112.7	0.031 <<	4,138	7,689,683	53.8
Lung and Bronchus	Male	46	114,327	40.2	43.3	58.7	0.103	2,126	3,850,623	55.2
Lung and Bronchus	Female	44	113,281	38.8	42.5	54.2	0.181	2,012	3,839,060	52.4
Melanoma of the Skin	Total	37	227,608	16.3	17.6	57.8	0.005 <<	2,117	7,689,683	27.5
Melanoma of the Skin	Male	19	114,327	16.6	17.9	34.3	0.007 <<	1,245	3,850,623	32.3
Melanoma of the Skin	Female	18	113,281	15.9	17.2	23.7	0.279	872	3,839,060	22.7
Myeloma	Total	11	227,608	4.8	5.2	13.6	0.583	499	7,689,683	6.5
Myeloma	Male	7	114,327	6.1	6.6	8.7	0.724	315	3,850,623	8.2
Myeloma	Female	4	113,281	3.5	3.8	5.0	0.881	184	3,839,060	4.8
Non-Hodgkin Lymphoma	Total	**47**	227,608	20.6	22.3	**40.0**	**0.303**	1,462	7,689,683	19.0
Non-Hodgkin Lymphoma	Male	**28**	114,327	24.5	26.3	**21.7**	**0.218**	784	3,850,623	20.4
Non-Hodgkin Lymphoma	Female	**19**	113,281	16.8	18.3	**18.4**	**0.942**	678	3,839,060	17.7
Oral Cavity and Pharynx	Total	28	227,608	12.3	13.4	29.2	0.924	1,070	7,689,683	13.9
Oral Cavity and Pharynx	Male	16	114,327	14.0	15.1	20.3	0.405	736	3,850,623	19.1
Oral Cavity and Pharynx	Female	**12**	113,281	10.6	11.6	**9.0**	**0.393**	334	3,839,060	8.7
Ovary	Female	**15**	113,281	13.2	14.5	**13.1**	**0.664**	485	3,839,060	12.6
Pancreas	Total	**25**	227,608	11.0	12.0	**27.4**	**0.735**	1,014	7,689,683	13.2
Pancreas	Male	**15**	114,327	13.1	14.2	**14.6**	**0.984**	533	3,850,623	13.8
Pancreas	Female	**10**	113,281	8.8	9.7	**12.9**	**0.528**	481	3,839,060	12.5
Prostate	Male	**147**	114,327	128.6	139.6	**146.8**	**1.000**	5,366	3,850,623	139.4
Stomach	Total	10	227,608	4.4	4.8	**10.1**	**1.000**	373	7,689,683	4.9
Stomach	Male	6	114,327	5.2	5.6	7.0	0.887	255	3,850,623	6.6
Stomach	Female	**4**	113,281	3.5	3.9	**3.1**	**0.771**	118	3,839,060	3.1
Testis	Male	**8**	114,327	7.0	7.6	**6.3**	**0.591**	229	3,850,623	5.9
Thyroid	Total	**50**	227,608	22.0	23.6	**33.3**	**0.008 >>**	1,209	7,689,683	15.7
Thyroid	Male	**8**	114,327	7.0	7.6	**7.9**	**1.000**	287	3,850,623	7.5
Thyroid	Female	**42**	113,281	37.1	39.4	**25.6**	**0.004 >>**	922	3,839,060	24.0
Pediatric Age 0 to 19	Total	**16**	80,289	19.9	20.0	**13.5**	**0.565**	385	2,284,390	16.9
Pediatric Age 0 to 19	Male	7	41,497	16.9	16.9	7.6	1.000	216	1,168,829	18.5
Pediatric Age 0 to 19	Female	9	38,792	23.2	23.2	5.9	0.280	169	1,115,561	15.1

Bold emphasis added

CANCER INCIDENCE 2009-2013
COMPARISON BETWEEN JEFFERSON COUNTY AND THE REMAINDER OF THE STATE OF IDAHO

Cancer Site/Type	Sex	Jefferson County						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	**Expected Cases (3)**	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All Sites Combined	Total	451	131,848	342.1	420.4	507.0	0.012 <<	36,793	7,785,443	472.6
All Sites Combined	Male	245	66,162	370.3	449.6	272.1	0.103	19,467	3,898,788	499.3
All Sites Combined	Female	206	65,686	313.6	388.6	236.3	0.048 <<	17,326	3,886,655	445.8
Bladder	Total	23	131,848	17.4	22.3	24.2	0.910	1,826	7,785,443	23.5
Bladder	Male	19	66,162	28.7	35.8	19.7	0.996	1,447	3,898,788	37.1
Bladder	Female	4	65,686	6.1	8.0	4.9	0.923	379	3,886,655	9.8
Brain - malignant	Total	**8**	131,848	6.1	6.8	**7.4**	0.924	490	7,785,443	6.3
Brain - malignant	Male	**5**	66,162	7.6	8.4	**4.6**	0.975	302	3,898,788	7.7
Brain - malignant	Female	**3**	65,686	4.6	5.1	**2.8**	1.000	188	3,886,655	4.8
Brain and other CNS - non-malignant	Total	**15**	131,848	11.4	13.6	**11.7**	0.407	829	7,785,443	10.6
Brain and other CNS - non-malignant	Male	**5**	66,162	7.6	8.9	**4.2**	0.829	292	3,898,788	7.5
Brain and other CNS - non-malignant	Female	**10**	65,686	15.2	18.5	**7.5**	0.440	537	3,886,655	13.8
Breast	Total	52	131,848	39.4	48.0	71.4	0.020 <<	5,128	7,785,443	65.9
Breast	Male	-	66,162	-	-	0.7	0.956	53	3,898,788	1.4
Breast	Female	52	65,686	79.2	97.6	69.6	0.034 <<	5,075	3,886,655	130.6
Breast - in situ	Total	10	131,848	7.6	9.0	14.7	0.268	1,034	7,785,443	13.3
Breast - in situ	Male	-	66,162	-	-	0.1	1.000	4	3,898,788	0.1
Breast - in situ	Female	10	65,686	15.2	18.4	14.4	0.299	1,030	3,886,655	26.5
Cervix	Female	1	65,686	1.5	1.7	3.5	0.265	233	3,886,655	6.0
Colorectal	Total	**41**	131,848	31.1	38.9	**40.7**	1.000	3,011	7,785,443	38.7
Colorectal	Male	**25**	66,162	37.8	46.0	**22.7**	0.690	1,632	3,898,788	41.9
Colorectal	Female	16	65,686	24.4	31.4	18.1	0.739	1,379	3,886,655	35.5
Corpus Uteri	Female	13	65,686	19.8	24.4	14.1	0.914	1,026	3,886,655	26.4
Esophagus	Total	3	131,848	2.3	2.8	5.2	0.472	382	7,785,443	4.9
Esophagus	Male	2	66,162	3.0	3.7	4.5	0.357	318	3,898,788	8.2
Esophagus	Female	1	65,686	1.5	2.0	0.8	1.000	64	3,886,655	1.6
Hodgkin Lymphoma	Total	4	131,848	3.0	3.3	3.3	0.820	210	7,785,443	2.7
Hodgkin Lymphoma	Male	2	66,162	3.0	3.3	1.8	1.000	114	3,898,788	2.9
Hodgkin Lymphoma	Female	2	65,686	3.0	3.3	1.5	0.875	96	3,886,655	2.5
Kidney and Renal Pelvis	Total	11	131,848	8.3	10.1	17.8	0.120	1,278	7,785,443	16.4
Kidney and Renal Pelvis	Male	7	66,162	10.6	12.7	11.4	0.241	803	3,898,788	20.6
Kidney and Renal Pelvis	Female	4	65,686	6.1	7.5	6.5	0.442	475	3,886,655	12.2
Larynx	Total	2	131,848	1.5	1.9	2.8	0.951	202	7,785,443	2.6
Larynx	Male	2	66,162	3.0	3.7	2.2	1.000	161	3,898,788	4.1
Larynx	Female	-	65,686	-	-	0.6	1.000	41	3,886,655	1.1
Leukemia	Total	**26**	131,848	19.7	23.3	**18.5**	0.113	1,289	7,785,443	16.6
Leukemia	Male	**13**	66,162	19.6	22.7	**11.1**	0.647	757	3,898,788	19.4
Leukemia	Female	**13**	65,686	19.8	24.0	**7.4**	0.079	532	3,886,655	13.7
Liver and Bile Duct	Total	3	131,848	2.3	2.8	6.7	0.193	488	7,785,443	6.3
Liver and Bile Duct	Male	2	66,162	3.0	3.6	5.1	0.237	357	3,898,788	9.2
Liver and Bile Duct	Female	1	65,686	1.5	2.0	1.7	0.969	131	3,886,655	3.4
Lung and Bronchus	Total	37	131,848	28.1	35.6	55.9	0.010 <<	4,191	7,785,443	53.8
Lung and Bronchus	Male	20	66,162	30.2	37.6	29.4	0.090	2,152	3,898,788	55.2
Lung and Bronchus	Female	17	65,686	25.9	33.5	26.7	0.063	2,039	3,886,655	52.5
Melanoma of the Skin	Total	30	131,848	22.8	27.3	30.0	1.000	2,124	7,785,443	27.3
Melanoma of the Skin	Male	20	66,162	30.2	36.2	**17.6**	0.632	1,244	3,898,788	31.9
Melanoma of the Skin	Female	10	65,686	15.2	18.0	12.6	0.584	880	3,886,655	22.6
Myeloma	Total	3	131,848	2.3	2.9	6.8	0.187	507	7,785,443	6.5
Myeloma	Male	2	66,162	3.0	3.7	4.4	0.374	320	3,898,788	8.2
Myeloma	Female	1	65,686	1.5	2.0	2.4	0.596	187	3,886,655	4.8
Non-Hodgkin Lymphoma	Total	22	131,848	16.7	20.7	20.3	0.758	1,487	7,785,443	19.1
Non-Hodgkin Lymphoma	Male	**12**	66,162	18.1	22.1	**11.2**	0.879	800	3,898,788	20.5
Non-Hodgkin Lymphoma	Female	**10**	65,686	15.2	19.3	**9.2**	0.865	687	3,886,655	17.7
Oral Cavity and Pharynx	Total	**17**	131,848	12.9	15.8	**14.9**	0.661	1,081	7,785,443	13.9
Oral Cavity and Pharynx	Male	**11**	66,162	16.6	19.9	**10.5**	0.965	741	3,898,788	19.0
Oral Cavity and Pharynx	Female	**6**	65,686	9.1	11.5	**4.5**	0.610	340	3,886,655	8.7
Ovary	Female	**9**	65,686	13.7	17.1	**6.7**	0.457	491	3,886,655	12.6
Pancreas	Total	**19**	131,848	14.4	18.5	**13.5**	0.182	1,020	7,785,443	13.1
Pancreas	Male	**13**	66,162	19.6	24.4	**7.3**	0.072	535	3,898,788	13.7
Pancreas	Female	6	65,686	9.1	12.1	6.2	1.000	485	3,886,655	12.5
Prostate	Male	66	66,162	99.8	122.5	75.2	0.313	5,447	3,898,788	139.7
Stomach	Total	3	131,848	2.3	2.9	5.1	0.503	380	7,785,443	4.9
Stomach	Male	3	66,162	4.5	5.6	3.6	1.000	258	3,898,788	6.6
Stomach	Female	-	65,686	-	-	1.6	0.408	122	3,886,655	3.1
Testis	Male	2	66,162	3.0	3.2	3.8	0.547	235	3,898,788	6.0
Thyroid	Total	**26**	131,848	19.7	22.0	**18.7**	0.128	1,233	7,785,443	15.8
Thyroid	Male	2	66,162	3.0	3.5	4.3	0.385	293	3,898,788	7.5
Thyroid	Female	**24**	65,686	36.5	40.3	**14.4**	**0.025 >>**	940	3,886,655	24.2
Pediatric Age 0 to 19	Total	3	49,787	6.0	6.1	8.5	0.060	398	2,314,892	17.2
Pediatric Age 0 to 19	Male	3	25,242	11.9	11.9	4.7	0.632	220	1,185,084	18.6
Pediatric Age 0 to 19	Female	-	24,545	-	-	3.9	**0.042 <<**	178	1,129,808	15.8

Bold emphasis added

Source for above two tables: *A fact sheet from the Cancer Data Registry of Idaho, Idaho Hospital Association* Cancer Incidence 2009-2013 Cancer Mortality 2010-2014 BRFSS 2011-2014. CANCER INCIDENCE 2009-2013 COMPARISON BETWEEN BINGHAM COUNTY; CANCER INCIDENCE 2009-2013 COMPARISON BETWEEN JEFFERSON COUNTY and state.

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).

2. Age and sex-adjusted incidence (A.A.I.) rates for county use age and sex-specific crude rates for the remainder of the state as standard.

3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed). Comparison between “Observed Cases” and “Expected Cases (3)” Bold Emphasis Added

4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution. "<<" denotes significantly fewer cases observed than expected, **">>" denotes significantly more cases observed than expected (p=.05).**

Statistical Note: Rates based upon 12 or fewer cases (numerator) should be interpreted with caution. Pg.3

Cancer Screening and Risk Factor Prevalence Estimates, 2011-2014 by health district (HD #)

	State of Idaho	HD 1	HD 2	HD 3	HD 4	HD 5	HD 6	HD 7	Jefferson County
Access to Care									
Health Insurance, Age <65 (2012-2014)	77.8%	74.2%	83.7%	70.5%	82.7%	69.1%	80.1%	81.8%	78.2%
Not See Doctor Due to Cost Past Year (2012-2014)	16.3%	16.8%	12.9%	21.0%	15.4%	17.5%	14.1%	14.9%	13.9%
Cancer Screening									
Mammogram Past 2 Years, Age 50-74 (2012, 2014)	69.5%	72.4%	69.7%	62.0%	73.8%	68.5%	67.1%	68.1%	61.5%
Pap Test Past 3 Years, Cervix Intact Age 21-65 (2012, 2014)	76.4%	77.2%	80.8%	67.2%	80.9%	75.1%	75.7%	74.9%	81.4%
Colorectal Cancer Screening, Age 50-75 (2012, 2014)	61.6%	60.3%	65.0%	56.2%	67.5%	57.7%	59.4%	60.5%	70.3%
Tobacco Use									
Current Smoker (2012-2014)	16.5%	17.5%	15.0%	18.6%	17.1%	18.9%	15.7%	10.4%	7.4%
Current Smokeless Tobacco User, Males (2012-2014)	9.3%	10.8%	15.7%	11.4%	7.4%	11.1%	6.3%	6.6%	2.3%
Other Cancer-Related									
Sunburn in Previous 12 Months (2014)	50.4%	46.3%	52.2%	45.6%	53.4%	47.9%	52.3%	54.0%	52.9%
Artificial Tanning Appliance Use (2011, 2014)	5.1%	6.6%	3.9%	4.0%	3.4%	5.5%	6.6%	8.3%	3.2%
Weight Classification by Body Mass Index (2012-2014)	33.3%	35.4%	38.0%	26.8%	36.1%	31.7%	31.7%	32.6%	35.8%
Meet Physical Activity Guidelines (2011, 2013)	21.5%	20.7%	16.3%	20.3%	24.7%	21.0%	22.2%	18.8%	17.6%
Home Ever Tested for Radon (2012, 2014)	15.7%	22.7%	9.8%	11.0%	15.3%	14.0%	17.5%	18.1%	11.7%

Use Table below to identify the above Idaho health district (HD) numbers

Idaho Health Districts	Counties
District 1 (HD) 1	Benewah, Bonner, Boundary, Kootenai, Shoshone
District 2 (HD) 2	Clearwater, Latah, Lewis, Idaho, Nez Perce
District 3 (HD) 3	Adams, Canyon, Gem, Owyhee, Payette, Washington
District 4 (HD) 4	Ada, Boise, Elmore, Valley
District 5 (HD) 5	Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, Twin Falls
District 6 (HD) 6	Bannock, Bear Lake, Bingham, Butte, Caribou, Franklin, Oneida, Power
District 7 (HD) 7	Bonneville, Clark, Custer, Fremont, Jefferson, Lemhi, Madison, Teton

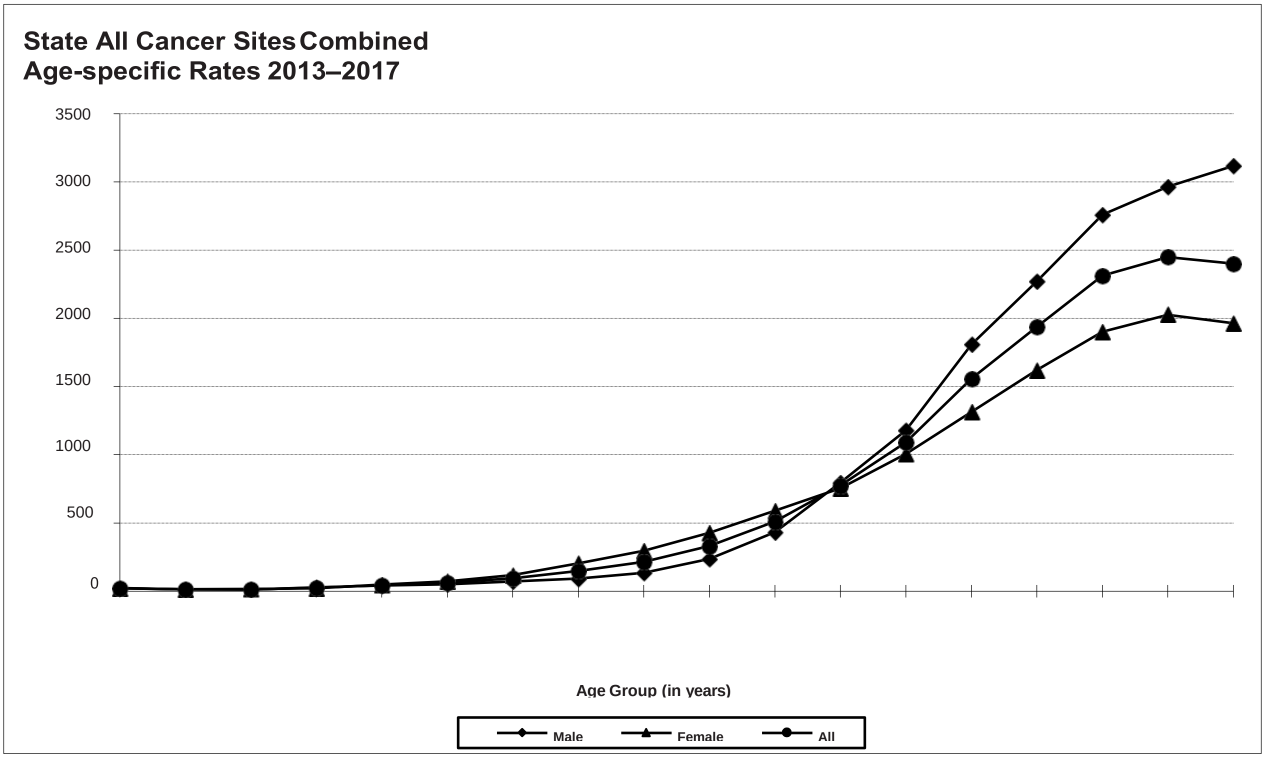
SUMMARY MEASURES OF CANCER BURDEN IN IDAHO — 2017

Primary Site	Incident Cases	Deaths	Median Age at Diagnosis	Median Age at Death	Estimated 10-Year Limited Duration Prevalence Count	Total Number of YPLL Before Age 75	Average Number of YPLL per Death, Persons Aged < 75 Years	% Change Incidence Rate, 2016 to 2017
All Sites	8,624	3,015	68.0	73.0	44,000	18,692	10.8	-0.7%
Bladder	418	95	73.0	78.0	2,400	218	6.1	2.0%
Brain	121	92	63.0	65.0	400	1,159	15.9	**11.9%**
Breast	1,333	225	64.0	69.0	8,600	2,003	13.1	**9.9%**
Cervix	60	14	48.0	61.0	400	207	17.3	-3.7%
Colorectal	648	256	68.0	72.5	3,500	1,869	12.6	-2.4%
Corpus Uteri	253	39	63.0	69.0	1,700	286	11.0	-10.6%
Esophagus	101	99	67.0	69.0	200	827	13.1	-0.2%
Hodgkin Lymphoma	44	7	48.0	-	300	-	-	**23.6%**
Kidney	334	83	67.0	75.0	1,800	433	10.3	**7.4%**
Larynx	37	9	70.0	76.0	200	44	11.0	-22.3%
Leukemia	300	131	70.0	77.0	1,500	783	12.6	**7.4%**
Liver and Bile Duct	149	121	68.0	70.0	200	824	9.9	-7.1%
Lung and Bronchus	961	605	72.0	73.0	2,000	3,165	8.7	-1.7%
Melanoma of Skin	522	48	65.0	69.5	3,500	418	12.7	-8.5%
Myeloma	137	76	71.0	77.5	500	216	7.7	**5.6%**
Non-Hodgkin Lymphoma	351	119	67.0	77.0	2,000	507	9.2	-10.8%
Oral Cavity and Pharynx	235	47	65.0	68.0	1,400	391	12.2	-15.5%
Ovary	97	68	63.0	70.5	400	477	11.6	-14.7%
Pancreas	298	244	72.0	73.0	300	1,315	9.3	**17.6%**
Prostate	1,159	164	68.0	82.0	8,700	264	5.4	**5.8%**
Stomach	90	40	69.0	73.5	300	260	10.8	-10.1%
Testis	46	1	33.5	-	500	-	-	-23.3%
Thyroid	217	10	51.0	73.5	2,400	98	16.3	-22.2%

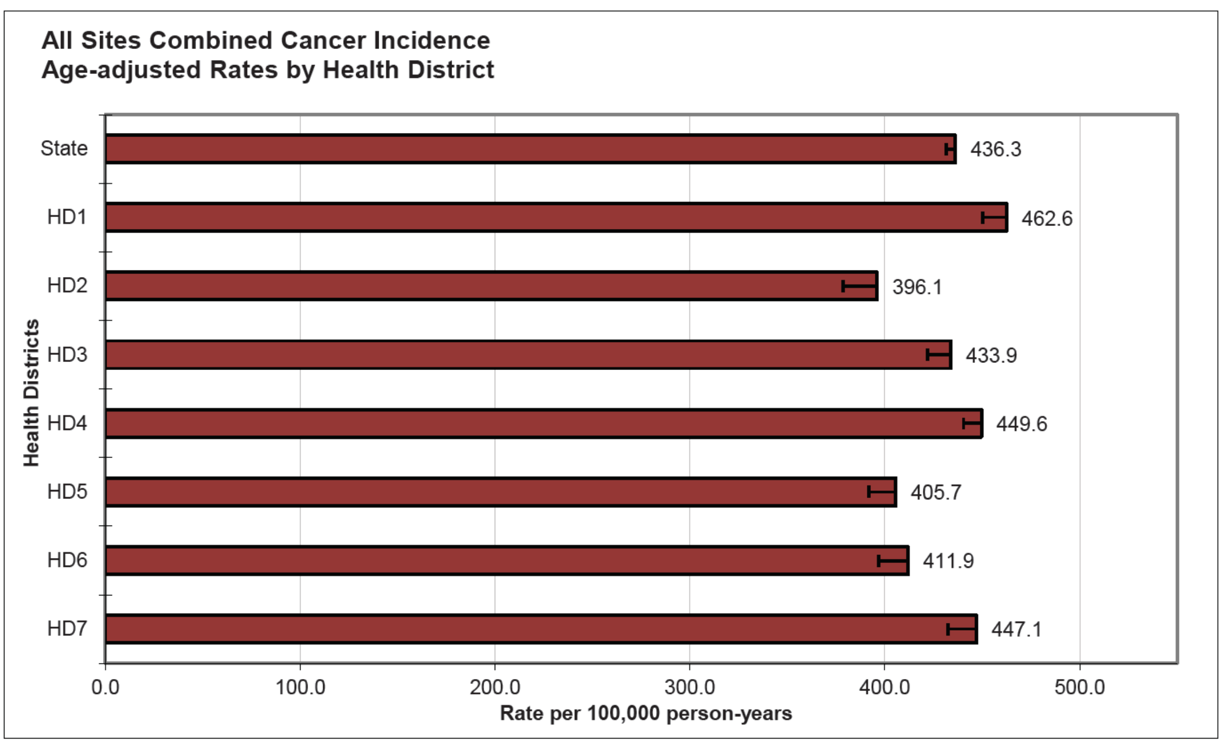
Pg.6 Notes: Incidence cases include all invasive and bladder in situ cases newly diagnosed among Idaho residents in 2017.
Years of potential life lost (YPLL) is a statistic used to measure the number of years of life lost in a population when persons in that population die prematurely (standard of 75 years of age used for this table). [Bold emphasis added]

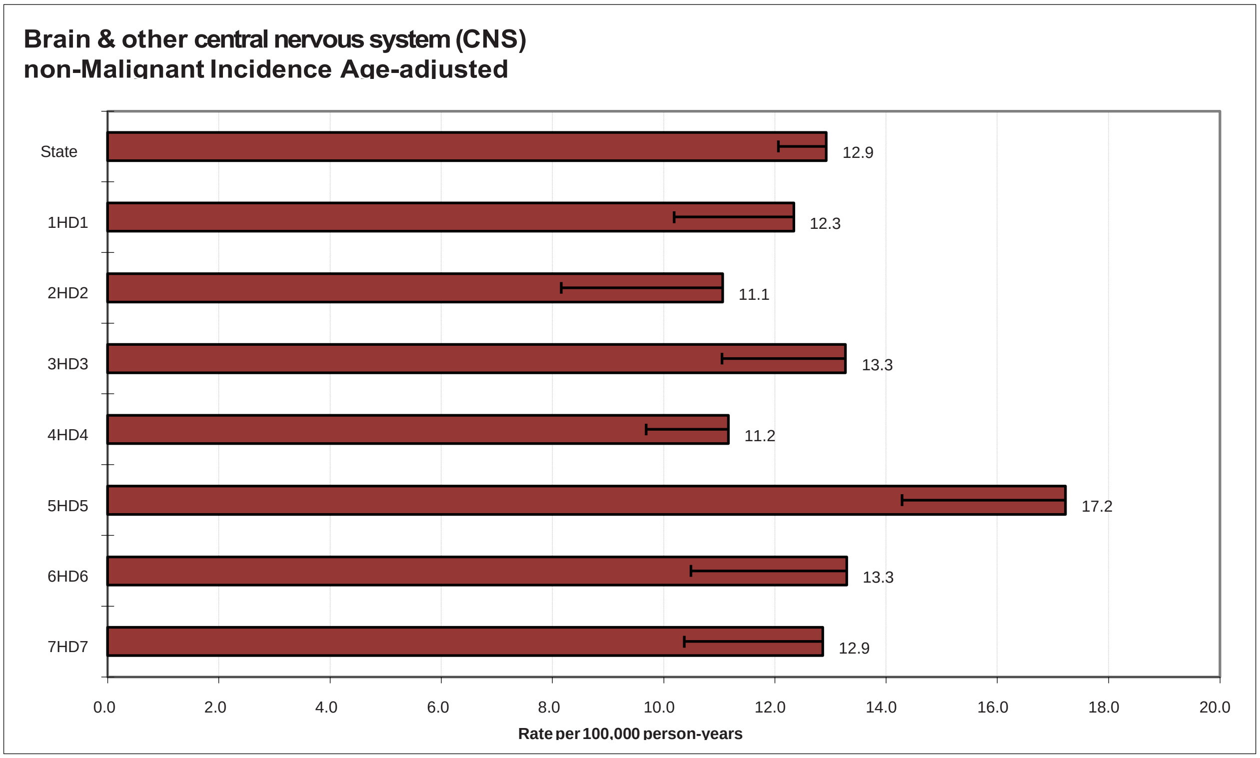
Mortality-related statistics are suppressed for Hodgkin lymphoma and testis primary sites due to small number of deaths.
Source: Annual Report of the Cancer Data Registry of Idaho Cancer in Idaho – 2017 December 2019
https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf

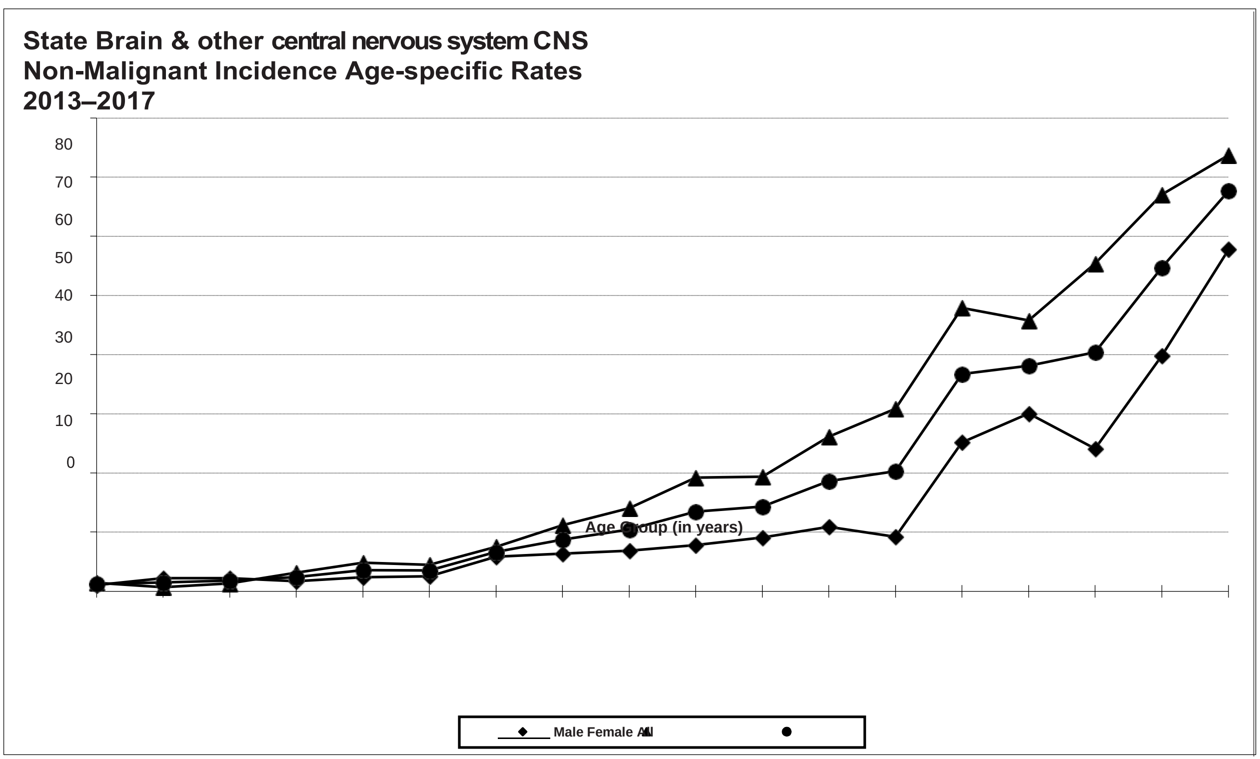
All Idaho Health Districts
All Sites Combined Cancer Incidence Age-adjusted Rates by Health District (H) State (Stat)



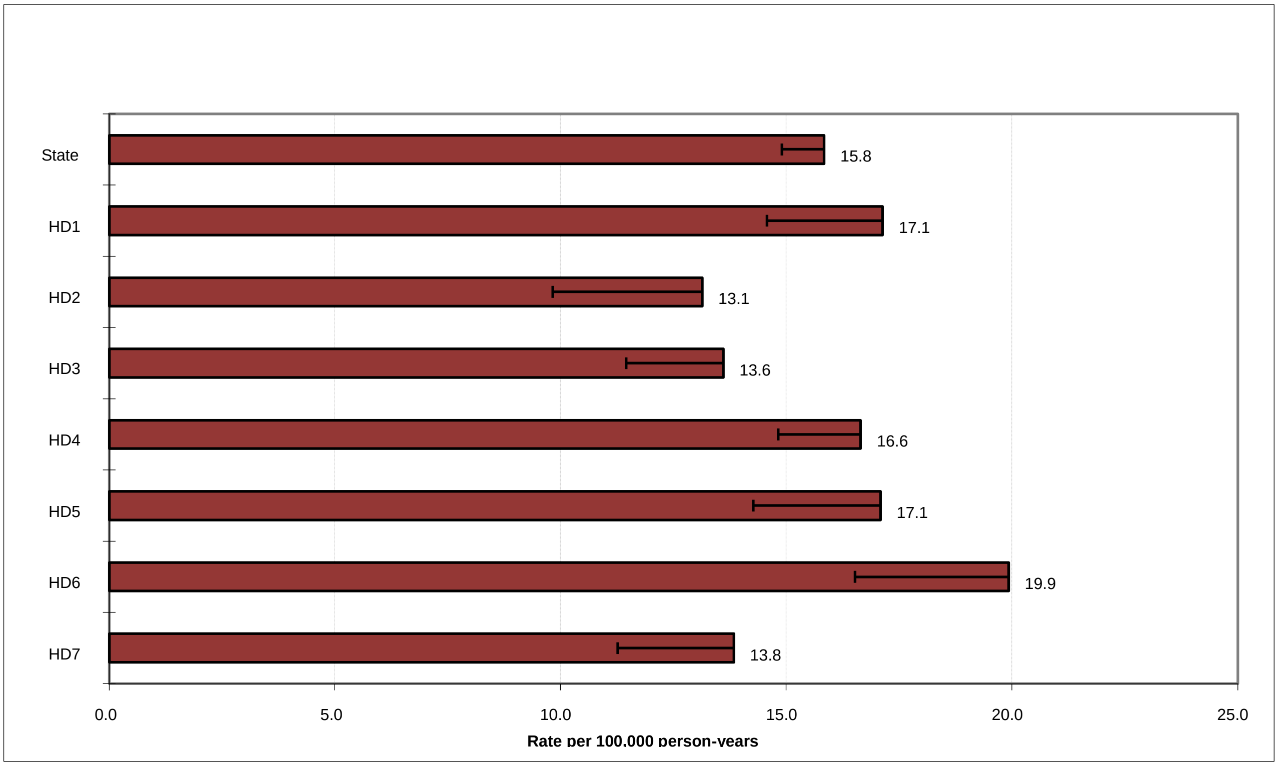
Brain Cancer Incidence
Age-adjusted Rates by Health District (H) State (Stat)



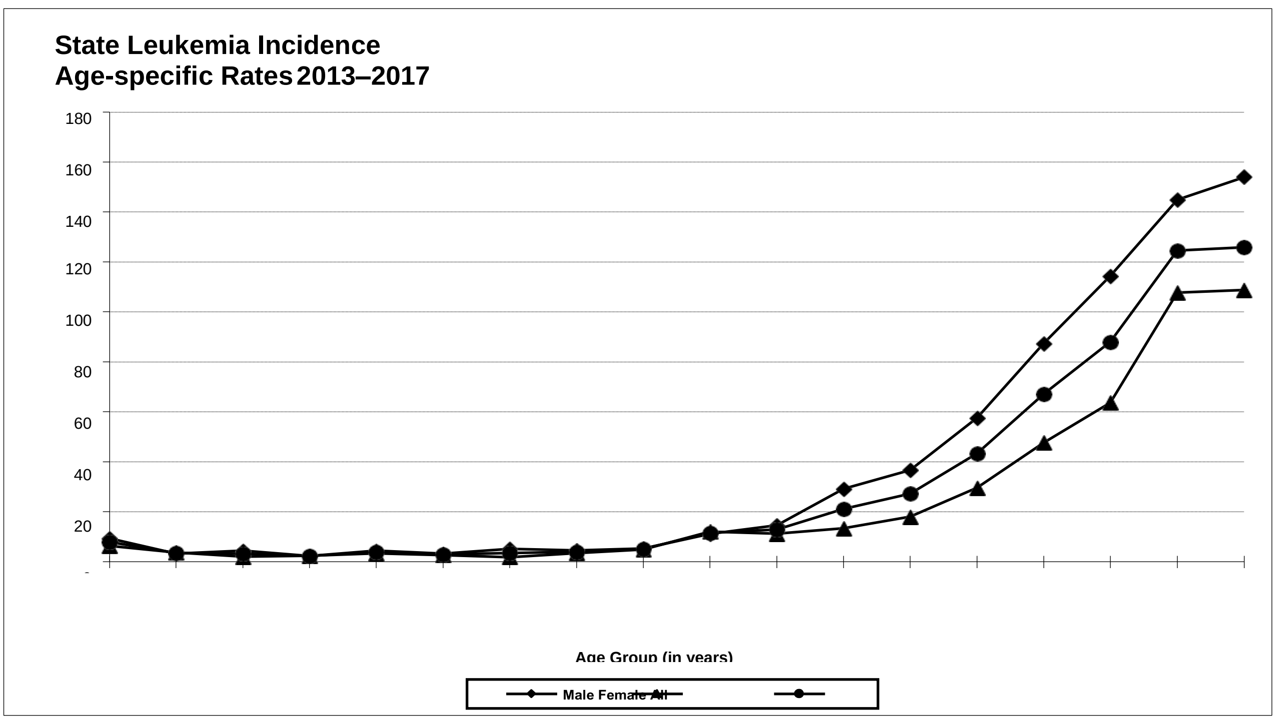

Brain & other central nervous system (CNS)
non-Malignant Incidence Age-adjusted
State
1HD1
2HD2
3HD3
4HD4
5HD5
6HD6
7HD7
12.9
12.3
11.1
13.3
11.2
17.2
13.3
12.9
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0
Rate per 100,000 person-years


State Brain & other central nervous system CNS
Non-Malignant Incidence Age-specific Rates
2013–2017
80
70
60
50
40
30
20
10
0
Age Group (in years)
Male Female All

Leukemia Incidence Age-adjusted Rates by Health District



Leukemia Incidence Age-adjusted Rates by Health District



2017 OBSERVED VERSUS EXPECTED NUMBERS BY HEALTH DISTRICT FEMALES

	HD 1		HD 2		HD 3		HD 4		HD 5		HD 6		HD 7	
	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP
All Sites	**723**	**663.5+**	265	292.8	**671**	**658.5**	**1,191**	**1,170.7**	419	471.5 +	370	394.2	**461**	**440.0**
Bladder	**19**	**14.2**	5	6.6	14	14.1	**31**	**22.5**	8	10.3	2	9.0 +	9	9.3
Brain	**8**	**7.0**	2	3.2	7	7.3	13	13.0	3	5.5	**8**	**4.0**	4	5.2
Brain & CNS non-Malignant	**27**	**25.6**	11	11.1	19	27.2	38	49.4	**29**	**16.8 ***	**21**	**14.7**	15	17.7
Breast	**226**	**214.9**	**92**	**91.5**	212	214.7	**433**	**366.5 ***	107	154.6 *	110	127.9	**146**	**141.9**
Breast (in situ)	**50**	**38.0**	13	16.8	**42**	**39.2**	**78**	**68.8**	19	28.2	17	23.7	25	26.3
Cervix	**15**	**7.6 +**	**4**	**3.7**	**10**	**9.8**	15	19.8	4	7.0	**6**	**5.8**	6	6.9
Colorectal	**58**	**48.5**	22	22.3	**60**	**46.4**	70	92.8 +	34	35.1	23	29.9	**37**	**32.3**
Corpus Uteri	**50**	**40.9**	10	18.2	38	40.9	62	77.9	31	28.0	**27**	**23.7**	**35**	**26.0**
Esophagus	2	2.4	1	1.0	**4**	**1.9**	3	4.3	**2**	**1.6**	1	1.4	1	1.5
Hodgkin lymphoma	2	3.2	**2**	**1.3**	3	3.3	**6**	**5.6**	**3**	**2.1**	**3**	**1.8**	1	2.8
Kidney & renal pelvis	**24**	**17.9**	**9**	**8.2**	**21**	**18.1**	21	37.3 *	**17**	**12.7**	5	11.6	**18**	**11.7**
Larynx	0	1.2	**2**	**0.3**	0	1.2	**2**	**1.6**	**2**	**0.5**	0	0.6	0	0.7
Leukemia	**22**	**19.9**	**9**	**8.9**	19	19.9	**35**	**34.0**	**15**	**13.9**	**14**	**11.5**	8	13.9
Liver & bile duct	6	6.2	0	2.9	**6**	**5.7**	**14**	**8.6**	4	4.1	3	3.5	3	3.9
Lung & bronchus	**102**	**79.8 +**	**48**	**35.8**	70	80.3	**140**	**134.8**	51	57.1	33	48.3 +	46	52.3
Melanoma of skin	20	33.8 +	10	13.8	28	33.0	**81**	**48.4 ***	15	23.4	**21**	**18.8**	**24**	**21.5**
Myeloma	6	10.5	2	4.4	**13**	**8.4**	16	16.3	**7**	**6.4**	**7**	**5.3**	6	6.0
N-H Lymphoma	**28**	**23.5**	3	11.3*	**30**	**22.3**	33	45.0	16	16.8	**19**	**13.5**	**18**	**15.5**
Oral cavity & pharynx	**13**	**8.8**	3	4.2	7	9.5	15	16.8	**9**	**6.2**	**7**	**5.3**	3	6.5
Ovary	**20**	**15.1**	3	7.1	15	15.8	20	31.4 +	**15**	**10.4**	9	9.2	**15**	**10.1**
Pancreas	**29**	**22.2**	10	10.6	21	22.5	36	40.2	16	16.1	**17**	**12.9**	10	15.3
Stomach	2	5.1	1	2.2	**7**	**3.9**	10	7.1	3	3.3	**4**	**2.6**	1	3.3
Thyroid	14	23.2	8	9.6	21	24.5	41	45.6	14	16.6	13	14.3	**36**	**14.8***
Pediatric (age 0-19)	4	4.5	2	2.1	**7**	**6.7**	7	11.5	7	4.3	**6**	**3.9**	5	5.9

Bold emphasis added to show observed cancers exceeding expected

Also see TRENDS IN PANCREATIC CANCER IN IDAHO, 2013–2017, August 2019
https://www.idcancer.org/ContentFiles/special/Trends_in_Pancreatic_Cancer_in_Idaho_2013_2017.pdf

Cancer Data Registry of Idaho Incidence of Cancers Associated with Modifiable Risk Factors and Late Stage Diagnoses for Cancers Amenable to Screening Idaho 2013–2016 October2019, http://www.idcancer.org

Idaho Cancer Data Registry Cites for above tables:
https://www.idcancer.org/ https://www.idcancer.org/sitespecific

* Trends in Pancreatic Cancer in Idaho, 2013–2017 (PDF file)
* Evaluation of Potential Associations between Arsenic Concentrations in Ground Water and 2000-2004 Cancer Incidence Rates in Idaho by Zip Code (PDF file)
* Colorectal Cancer in Idaho 2002-2004 (PDF file)
* State and National Statistics: Basic Epidemiology of Skin Cancer (PDF file)
* Tobacco Facts and Figures 2003 (Lung Cancer) (PDF file)
* Breast Cancer in Idaho, 1997-2001 (PDF file)
* Idaho Breast Cancer Facts and Figures 2002 (PDF file)
* Idaho Colon and Rectum Cancer Facts and Figures 2002 (PDF file)
* Brain Cancer, 1996-2000 (PDF file)
* Brain Cancer in Eastern Idaho, 1976-96
* Brain Cancer in Shoshone County, 1990-2000 (PDF file)

https://www.idcancer.org/ContentFiles/special/Brain9600.pdf

Section V. C. Radiation Exposure Standards

Current radiation exposure standards are being challenged by researchers studying the health effects - particularly low-level exposure. Historical standards were set based on Hiroshima bomb victim studies of high-level exposure. These early government studies considered low-level exposure of little significance. Recent studies have found that rather than killing a cell, low-level exposure can damage or mutate the genetic structure of a cell. This damage can, in time, result in a wide range of effects from cancer to multiple generational birth defects.

Karl Z. Morgan, M.D. is the founder of the science of health physics and was Director of the Health Physics Division of the Oak Ridge National Laboratory from 1943 to 1972. Dr. Morgan states that, "the most significant damage from low-level radiation results from the direct interaction of the stream of ions produced by radiation with the nucleus of one of the billions of irradiated cells. The cell may be killed, the radiation may produce no damage, or such damage as is caused may be repaired. But there is a fourth possibility that concerns us: that the cell nucleus may be damaged but the cell survives and multiplies producing over a period of years, a clone of cells that is diagnosed as a malignancy." [Morgan,(a)]

"From 1960 to the present, an overwhelming amount of data has been accumulated that show there is no safe level of exposure and there is no dose of radiation so low that the risk of a malignancy is zero. Therefore, the question is not: Is there a risk from low level exposure? Or, what is a safe level of exposure? The question is: How great is this risk." [Morgan (b)]

In 1990, EPA set the standard to 10 mrem/yr. (0.01 rem/yr.) effective dose equivalent. Idaho standard for gross beta is 4 mrem/yr. That means the accumulation of all beta-emitters to an individual cannot exceed 4 millirem (mrem) per year. In 1991 EPA released new proposed standards for maximum concentrations of radionuclides in drinking water (40-CFR-141-142) that will greatly increase the allowable limits contrary to the scientific literature. For instance, EPA wants to raise the current limit for tritium from 20,000 pCi/L to 60,000 pCi/L. Tritium contamination is the most common groundwater problem around commercial and DOE reactor facilities.

“Tritium, even in low levels, has been linked to developmental problems, reproductive problems, genetic abnormalities, and other health problems in laboratory animals. Additionally, there is evidence of adverse health effects on populations near facilities which utilize tritium (e.g. Darlington tritium extraction facility in Ontario, Canada). Tritium most commonly enters the environment in gaseous form (T_2) or as a replacement for one of the hydrogen atoms in water (HTO, called tritiated water), instead of ordinary, non-radioactive H_2O). Tritiated water can replace ordinary water in human cells (approximately 70% of the soft tissue in the human body is water). It can also enter fetuses through the placenta due to its similarities to ordinary water. Once in living cells, tritium can replace hydrogen in the organic molecules in the body. Thus, despite tritium’s low radio toxicity in gaseous form and its tendency to pass out of the body rather rapidly as water, its health effects are more severe by its property of being chemically identical to hydrogen.” [IEER(g)]

Dieudonne Mewissen, professor of radiology at the University of Chicago, believes the International Commission for Radiation Protection (ICRP) sets high tritium limits because it is generally assumed that tritium is evenly distributed into body tissues. "In fact," says Mewissen, "tritium becomes predominantly incorporated into DNA thus irradiating selectively the cell nucleus at a relatively high dose rate as a consequence of the cell's very small volume."[Quigg,]

Dr. Mewissen's extensive studies of the long-term (ten-generation) genetic damage to mice caused by tritium exposure make for shocking reading. Researchers at Japan's National Institute of Radiological Sciences and Poland's Central Laboratory for Radiological Protection also document shocking genetic effects from tritium exposure. See Tritium listing in Reference Section. There can be little doubt that the US government's analysis of inconsequential effect from tritium exposure is driven by the fact that they simply cannot control tritium releases. Therefore, standards have been adopted that ensure continued operation of nuclear facilities that are not based on the actual health risk to exposed populations.

R. Lowry Dodson, a research scientist at the Lawrence Livermore National Laboratory, reported in 1974, "that chronic low levels of tritium in a range comparable to the [ICRP] Commission's then allowable limits can kill egg cells developing in the ovaries of mice. At levels commonly found in the environment, tritium beta radiation was about three times as destructive to developing egg cell as cobalt-60 gamma rays, an external radiation source widely used in human therapy." [Quigg,]

The current scientific trend is to dramatically reduce the exposure limits. The recent 1990 report by the International Commission of Radiological Protection recommends a reduction of radiation exposure by a factor of five. [Greenpeace(a),] The National Academy of Sciences also released a new report. This BEIR-5 study concludes that the risks have been underestimated. This report further states that the likelihood of getting cancer after being exposed to a low dose of radiation is three to four times higher than that given in the earlier Academy Report.

A British research team (Gardner, et al) studying England’s Sellafield nuclear plant found genetic prenatal damage which resulted in childhood diseases in succeeding generations. "Relative risks for leukemia and non-Hodgkin's lymphoma were higher in children born near Sellafield and in children of fathers employed at the plant, particularly those with high radiation dose readings before their child's conception." [British Medical Journal,vol.300,p.423] Gardner's finding suggests that fathers receiving as little as 1 rem exposure to radiation, (less than six months before conception) may be passing on a mutation to their offspring that increases the offspring's subsequent risk of cancer. Seascale, a village near Sellafield, had 12 times as many childhood cancers as expected. [Quiggley(a)] A dose-response relationship was observed, the association being strongest in the highest paternal dose group. Gardner demonstrated a case/control study that a high proportion of these cancers were linked to father's occupation at the Sellafield plant. [British Medical Journal, 2/90]

A study by Hatch and Susser of Columbia School of Public Health in New York just published in the International Journal of Epidemiology found a positive correlation between background gamma radiation and childhood cancers in census tracts within ten miles of the Three Mile Island Nuclear Facility. For childhood cancers, as a whole, incidence rates relate significantly to background radiation; the association is strongest in children ages 10-14 years. Their data indicate a 50% increase in risk of cancer of children under 15 with every 0.1 mgy increase in estimated annual background gamma ray dose rate. [Quigley(b)]

Inhalation of alpha emitting nuclides poses significant biological risk. Less than one microcurie of plutonium (the size of a grain of pollen) will cause lung cancer and death if inhaled or ingested. "Plutonium (Pu) is an alpha emitter, and no quantity inhaled has been found to be too small to induce lung cancer in animals." [Bertell,p.24] DOE-funded experiments with beagle dogs demonstrate that inhalation of less than one microcurie of Pu-239 oxide result in an incidence of lung cancer approaching 100%. [Parks]

A National Research Council report also has found that cancer risks from low level X-ray and gamma ray radiation are three to four times greater than earlier believed. [AP(b),12/26/89] As research and data are added to the collective scientific understanding of the health effects of low level radiation exposure, regulatory authorities are being asked to reevaluate their standards. Prudence would dictate a sensitivity to this trend in analyzing the impact of INL operations.

"Dr. Karl Morgan, also former head of the International Commission on Radiological Protection (ICRP) who is known as the 'father of health physics', has called the organization he used to run `reckless' for relaxing its standards. `Given that we are beginning to recognize that radiation risks are greater than we used to consider them,' Morgan says. He is now urging both the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) to reject the relaxed allowances." [Statesmen(b)] EPA and NRC adopt the standards set by the ICRP. In December, 1990 the NRC finally revised its thirty-year old standards to one-fifth the exposure level currently allowed, though the regulations will not take effect until 1993. [Tribune(b)]

According to the Nuclear Information and Resource Service, "The commission (NRC) is straining its credibility by adopting an obsolete standard. The new standards reflect recommendations made by leading scientists thirteen years ago." [Tribune(b)] Profiles of all radionuclides of concern, including tritium, must be reassessed to provide additional analyses to ensure the government protects the public health through adequate exposure standards.

Oil, Chemical, and Atomic Workers Union is proposing contract language which requests a 90% reduction of work exposure. "At the present level of 5 rem/year for a work life of forty years, the increase risk for developing cancer is estimated to range from eight times greater than that for the reference "safe industry" according to the Nuclear Regulatory Commission, to 20 times greater by the US Environmental Protection Agency. This risk estimate assumes that in the reference "safe industry" one death per 10,000 workers is acceptable. This accounts only for the cancer risk linked to radiation exposure; it does not reflect the other health and safety risks in the nuclear industry." [OCAW @ I-A] Exposure to non-radioactive carcinogens by DOE contract workers is considered by Union members to be equally as hazardous as radioactive exposures. Additionally, the synergistic (combined) effect of radiation and chemicals is a risk- area workers believe the health agencies have overlooked.

The Three Mile Public Health Fund, created and supervised by Federal District Court in Harrisburg, PA announced the results of its study of DOE workers at Hanford, Rocky Flats, and Oak Ridge. Though the court authorized the study in 1987, DOE refused to release the data until 1990 after a protracted court battle which DOE ultimately lost. Dr. Alice Stewart, an internationally recognized epidemiologist, headed up the study. The study confirmed findings reported by Dr. Stewart, George Kneale, and Thomas Mancuso in 1977 which was under contract with DOE. The 1977 Hanford study contract was terminated and all data seized when DOE became aware of the research preliminary findings. It took another 13 years and numerous court orders before the researchers could continue their work.

The research found that workers exposed to very small doses of radiation in the same order of magnitude as background exposure may be at significant increased risk of developing radiogenic cancers. Stewart and Kneale's analysis of Hanford workers showed that there were extra deaths from radiogenic cancers due to occupational exposures. The additional cancer cases were mainly older workers over 40 years at the time of exposure. When exposure reached 26 rems, researchers found an increase of 100% in cancer incidence. Older workers (60 to 65 years) exposed to the same level (26 rem) showed an increase cancer risk 20 times higher than for all workers.

Physicians for Social Responsibility *Dead Reckoning*, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr. and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military (including Navy) personnel. [Dead Reckoning@41]

Also see Tami Thatcher's, *Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About —How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies that states:*

"Brief Summary: Radiation workers and non-radiation workers at the Idaho National Laboratory since 1952 have been exposed to direct radiation sources, airborne radiological releases, contaminated soil, and contaminated drinking water — often without their knowledge. This report highlights historical operations at what is now called the Idaho National Laboratory and the contaminants. It discusses shortcomings in worker radiation protection standards and radiological monitoring. Former workers often have little idea of their potential exposures or health risks of the exposures. This report discusses the radiation exposure, ingestion and inhalation of radionuclides and exposure to chemical hazards that may be affecting their health —information that may be helpful as they receive care from health care providers to address their health challenges. The oxidative stress caused by ionizing radiation is described. The role of antioxidant systems, detoxification systems and nutritional support is also described which may aid a reader to seek further information to address chronic health issues." [6] [7]

See Section VIII.C for information on radiation standards.

[6] Tami Thatcher, *Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About —How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies,* Environmental Defense Institute Special Report April 2017; http://environmental-defense-institute.org/publications/Radchemreport.pdf

[7] Tami Thatcher, Idaho National Laboratory, Hanford, and Nevada Test Site Radiation Exposure Radiation Victim Stories Revision 26 Edited by Chuck Broscious And Tami Thatcher Updated September 2014. http://environmental-defense-institute.org/publications/Radchemreport.pdf

Section VI. Centers for Disease Control INL Health Studies

A. Health Studies Background

In July 1990, a legal petition drafted by the Environmental Defense Institute (EDI) was filed with U.S. Health and Human Services (HHS) under a provision of the Superfund Act. The petition requested independent INL health studies be conducted by the Centers for Disease Control (CDC). Michael Blain, Ph.D. offered his "Radio-ecological Effects on Animal and Human Populations Near the Idaho National Engineering Laboratory [Blain] as supportive documentation to the petition. The following organizations were co-petitioners:

American Friends Service Committee, Denver, CO
Citizens for Environmental Quality, St. Maries, ID
Citizens Against Nuclear Weapons & Extermination, Coeur d'Alene, ID
Environmental Defense Institute, Moscow, ID
Focus on Peace and Justice, Burley, ID
Friends of the Earth, Washington, DC
Greater Yellowstone Coalition, Bozeman, MT
Greenpeace USA, Washington, DC
Moscow Chapter, Idaho Conservation League, Moscow, ID
Northern Rockies Chapter Sierra Club, (ID-WA), Hailey, ID
Physicians for Social Responsibility, Washington, DC
Radioactive Waste Campaign, Warnick, NY
SANE/FREEZE: Campaign for Global Security, Washington, DC

Responding to a September 1990 critical report by a peer review panel on DOE's INL Historical Dose Evaluation, then Idaho Governor Cecil Andrus subsequently requested on March 4, 1991 that CDC conduct a dose reconstruction study at INL.

EDI supports CDC's choice to divide the dose reconstruction study into phases and sub-tasks. This is a logical approach that builds on research blocks. INL is an extremely complex site with possibly the most diverse range of operations of any of the DOE sites. Evaluating INL's five operating decades will require equally diverse scientific disciplines.

CDC's INL Dose Reconstruction study was launched in October 1992. Not until January 1995 did CDC establish a formally chartered INL Health Effects Subcommittee (IHES) to give the agency public input into the health research. Unfortunately, CDC appointed individuals to the committee that had a conflict of interest. EDI wrote a letter to David Satcher, then Director of CDC, objecting to the appointments to the IHES. EDI found that the inclusion of Mr. Gassell, former director INL Radiological Environmental Science Laboratory and Mr. Horan former INL health physics technician on the IHES do not meet the legal criteria for balanced representation, independence, and freedom from conflict of interest. [45 CFR 11.3]

CDC's National Center for Environmental Health's (NCEH) position, as expressed to EDI at various meetings, is that conflict of interest is narrowly defined as direct financial interest. HHS regulation cites Executive Order 11222 which states: "An employee shall not have a direct or indirect financial interest that conflicts substantially, or appears to conflict substantially, with his or her duties as a Federal employee. An employee need not have a financial interest that actually conflicts with his or her duties to violate the prohibition of EO 11222. Any financial interest that could reasonably be viewed as an interest which might compromise the employee's integrity, whether or not this is in fact true, is subject to this prohibition." [45 CFR ss 73.735-802]

EDI's legal consultants believe that a direct financial interest exists with respect to John Horan. He has operated as an employee and as an independent contractor to DOE/ID, and it is reasonable that he will continue to do so in the future. Part of the mission of the IHES will be to assess Mr. Horan's work product. This work product includes his recent INL worker dosimetry study and his environmental safety and health monitoring reports. His direct interest is validating his past assessments since if his work product is found to be inadequate, it will seriously affect his ability to secure future contracts. Additionally, his interest is validating his work product since it will enhance the possibility of future contracts.

Mr. Horan's environmental health and safety monitoring data and reporting spans decades to the Atomic Energy Commission (AEC) era. Mr. Horan was an AEC "expert witness" brought in to defend General Electric (INEL contractor) in the radiation injury suit filed by James Dennis who died of a radiogenic disease caused by exposure during the SL-1 reactor accident cleanup.

The potential for economic loss creates a climate where preferential treatment may be given to DOE and RESL ES&H data and thereby losing the appearance of impartiality of action that will adversely affect public confidence in the integrity of the government's health study research efforts at INL. HHS's regulations state that: "Appropriate safeguards shall be taken to assure that an advisory committee advise and recommendations will not be inappropriately influenced by special interest, but shall instead be the result of the advisory committee's independent judgment." [45 CFR ss 11.4]

NCEH official's suggestion that the conflict of interest test has been met and if the IHES wishes to impose additional conflict of interest criteria then it is free to do so at its first meeting. CDC is inappropriately relinquishing its legal responsibility in appointing individuals who have a conflict of interest under law. Moreover, CDC cannot allocate responsibility to the IHES when existing regulation would prohibit appointment of certain individuals in the first case. Mr. Horan may have violated disclosure and reporting requirements [45 CFR ss 73.735-901] by failing to inform CDC of his three-year INL worker dosimetry contract with DOE/ID while concurrently he was a member of the CDC's INL Interim Technical Working Group convened to advise CDC on its INL dose reconstruction study. This advisory group was intended to fill a federal advisory committee gap between the initiation of the dose reconstruction study in 1992 and the formation of the FACA chartered IHES in 1995.

Then CDC Director Satcher chose to ignore EDI’s conflict concerns. Mr. Gassell, however, voluntarily removed himself, and CDC replaced him with a Lockheed Martin manager who also has a conflict of interest. Lockheed Martin is the current prime contractor at INL.

Section VI. B. CDC’s INL Phase I Final Report

The Report failed to acknowledge or identify problem areas. An inexperienced reader will question why INL is a Superfund site and why CDC is conducting a multi-million-dollar INL Historical Dose-Reconstruction study. The Report’s illogical format scatters the individual contaminate sources throughout the document to the point that a reader is unable to gain any comprehensive perspective of any given source facility. The non-sequential format is not even related to contaminate pathways. Notwithstanding the need to merge pathways, there is also a need to merge releases by facility. The Report also failed to describe and analyze facilities through developmental time. Most descriptions characterize current emission systems and waste disposal practices rather than evolutional stages. There must be an effort to differentiate the developmental stages and ramifications on contaminate releases. The drafters of the Report and the agency representatives responsible for quality assurance clearly put aside the scientific method and replaced it with value laden discussions far removed from objective, dispassionate science. This type of quasi-science is all too common and it has earned the federal health agencies research the dubious distinction of “inconclusive by design”.

The Report’s response to the public’s concerns [CDC(c)@xii] is indicative of not only the inadequate applied science but also CDC’s disdain for issues brought to the attention of the agency. For instance, “Issue No. 1: Waste Buried at the RWMC” dismisses public concerns related to spent nuclear fuel burial as being only from test reactors (Materials Test Reactor) and not from power reactors. The table titled “Spent Reactor Fuel Dumped at INL” (Section I(E)(1) shows that CDC’s claim is not supported by fact. The ninety metric tons of irradiated fuel dumped in the burial ground are hardly insignificant and the table also shows that the Test Reactor Area (location of the Materials Test Reactor) is the least significant contributor to the spent nuclear fuel volumes buried at the RWMC.

The report also trivialized public concerns related to the amount of plutonium buried at the RWMC and failed to quantify the amount using available data. Perhaps CDC does not consider 3,208 pounds (1,455 kg) of plutonium, 1,329 pounds of Americium (603 kg) significant. [ER-BWP-82] But when DOE’s own contractor studies show that there is no threshold for internal plutonium exposure that does not cause 100% fatality in test animals [Parks], the public is justifiably concerned. CDC claims that only beta and gamma waste was dumped at the RWMC. [A-22] Similar statements appear at A-21, A-26, and A-30. Perhaps CDC does not know that plutonium, americium, and uranium are alpha emitters. Indeed more than 62,000 cubic meters of Transuranic waste are buried in the Subsurface Disposal Area. [EG&G-M-24884] Transuranic waste is defined as having radionuclides heavier in atomic weight than uranium and in concentrations greater than 100 nano curies per gram.

Characterization in the Report of RWMC Subsurface Disposal Area (SDA) missed the Transuranic Disposal Area within the SDA. Moreover, the Report fails to acknowledge significant volumes of what would be classified Transuranic waste that was dumped (1952-1975) in the SDA’s pits and trenches along with low-level waste. The Transuranic Storage Area was added much later (1975), and therefore the Report misrepresents the historic progression and the dumping practices at the site. This is a fundamental point that was specifically emphasized by the Environmental Defense Institute to CDC and Sanford Cohen & Associates at the very beginning of the research project. Namely, each facility must be evaluated chronologically through time because of periodic upgrades and changes to emission control systems. The Report habitually uses current operating procedures and infrastructure to characterize the whole history of the facility.

CDC perpetuates the DOE’s propaganda by adopting the Department’s descriptions however misleading. “The stated mission of the RWMC is to provide the waste management for the present and future needs of the INL and assigned DOE off-site generators of low-level and Transuranic waste; to retrieve, examine, and certify stored Transuranic waste for ultimate shipment to the DOE WIPP in New Mexico; and to initiate and support research, development and demonstration projects for waste management."[A-20] The words dump, disposal site, radioactive waste internment are nowhere to be found here, thus, making the RWMC sound quite innocuous. CDC perpetuates the myth by characterizing the RWMC as having "good surface drainage and clay sediments to exclude moisture." [A-21] No mention of the fact that the RWMC lies in a flood plain some 40 feet in elevation below the Big Lost River. Flooding of the burial grounds has been a constant problem since the beginning of site development. Dikes were later built but even they were breached on numerous occasions. The dikes now also hold in precipitation so that sump pumps are used to reduce flooding. CDC suggests the U.S. Geological Survey concurred with the site-selection however the historical technical reports show dire warnings against using the site for radioactive waste burial. The Atomic Energy Commission chose to ignore its own experts and proceed with the dump. This decision was made as much because the RWMC site was unusable for anything else because of the flooding problems. Flooding has facilitated the migration of contaminates into the underlying soils and groundwater.

CDC's obsequious description of the RWMC continues. "In the mid-1960's, the Atomic Energy Commission changed waste disposal methods to increase personnel safety and environmental protection. Up to this time, waste containers were stacked to minimize volume occupied. To reduce worker exposure and to reduce risk of accidents during rigging, waste operations specified that waste containers simply be dumped into the open burial pits and trenches. The Atomic Energy Commission subsequently reversed this practice when it recognized the need to minimize burial volume." [A-22] The report fails to mention that change in dumping practices coincided with a labor strike that meant there was not the personnel available to stack waste containers in the trenches. No mention is made of chemical and radionuclide migration 240 feet into underlying ground water, or that all the water faucets at the RWMC have warning signs not to drink the water. Presumably CDC considered the facts potentially disturbing for the reader and chose to provide a calming Report at the cost of science, candor, and credibility.

CERT experiments [2-16] discussed by the Report states "all participants were volunteers," but there is no mention that there was no full disclosure and/or informed consent. The Report also fails to acknowledge that there was no medical follow up to the radiation experiments to determine long-term health impacts on the "volunteers." [CRS(b)]

The Report claims that the Central Facilities Area (CFA) has no significant emissions [3-74] yet DOE documents cite the Health Physics Laboratory at CFA as second on the INL for gamma radiation releases on an aerial monitoring survey. The laundry at CFA is also a high emission area. [ERDA-1536] The laundry has since been privatized to an off-site contractor.

Test Reactor Area (TRA) chemical contaminate sample data offered in the Report is 400,000 times lower than data in CERCLA 12/92 Record of Decision (ROD) for TRA Remedial Action. This ROD is a signed cleanup agreement between the State, EPA, and DOE. No mention is made of TRA's radionuclide ground water contamination 176,470 times over EPA's maximum contaminate levels (MCL) in drinking water. The Report only lists 14 radionuclides released at TRA as liquids. Again, the TRA ROD lists 28 nuclides. CDC perpetuates the myth that "The natural absorptive and ion-exchange properties in the soil of the leaching pond were thought to remove most of the radioactive impurities in the pond water." [B-31] With current data available to CDC showing massive migration of chemicals and radionuclides into the groundwater, an objective reader of the Report can only conclude that CDC is deliberately concealing relevant information.

The lack of comprehension of the Report drafters can also be seen in the description of the Idaho Chemical Processing Plant (ICPP). "The plant reprocessed uranium from research reactors and experiments from the US Navy's nuclear propulsion program." [A-1] It is difficult to imagine how CDC could have missed the fact that the ICPP was the final destination of all the Navy warship and training reactors spent nuclear fuel as well as military and commercial reactor fuel. By volume, INL has 60% of the total DOE (all DOE sites across the country) owned spent nuclear fuel. By fissile mass, INL has 61% of DOE's total.

Feel-good value statements are peppered like saltpeter throughout the report, and emphasize the trivial tone geared to put the reader at ease with the assurance that the INL is a well-run facility. "Strict operational procedures were used from the start of operations at Naval Reactor Facility [NRF] to control the release of radioactive materials".[B-73] Yet the Report is silent on the fact that the NRF is the largest generator (8 million curies) of nuclear waste dumped in the burial grounds. [RWMIS] With such fine management and controls, how on earth did the NRF become a designated Waste Area Group on the INL Superfund site? By not stating problems (errors of omission) the Report authors literally conclude that there are no problems!

The Report's claim that "earthquake activity is absent from this portion of the [Snake River] plain" is not supported by DOE's own Quarterly Seismic Reports. [REP-79-061 to 82-004] CDC could not even get the most recent lava flow right (75,000 years) when it occurred within the last 2,000 years. No mention is made of major INL facilities that do not meet seismic structural codes not the least of which is the ICPP's high-level waste tank farm.

CDC's characterization of the LOFT experiments (intentional reactor meltdowns) again misrepresents the program. "Each test or experiment conducted at LOFT was subjected to extensive safety analyses including LOFT Integrated Test System Final Safety Analysis Report, LOFT Technical Specifications, and extensive meteorology of the TAN site." [A-63]

With all these controls, CDC leads the reader to believe there were no problems here to be concerned with because of all the safety systems. The Report does not mention the 941,912 curies per year were released out the stack or out of leakage in the containment structure. The last test run of the ten-year testing series alone released more than 8,800 curies. [ERDA-1536]

The Report's characterization of the Naval Reactor Facility (NRF) is equally erroneous. "The NRF then began disposal by pumping radioactive liquids from the S1W and other Radioactive Waste Discharge System tanks to leaching beds. The radioactivity in the water was removed as water percolated into the ground from two infiltration pit areas designated A1W and S1W."..."The leaching beds disposal technique relied on the assumption that radioactive wastes were contained for a sufficient time to render - as their contribution to the regional water table during the waste removal operation - a negligible consequence. This process was affected by ion exchange within alluvial materials or through radioactive decay when radioactive wastes are pooled above sedimentary levels as perched water zones." [B-72] One could only suppose that CDC thinks the radioactive contaminates under the NRF as acknowledged in the CERCLA Record of Decision got there from Soviet nuclear bomb tests.

The preceding comments on CDC's Final Report on the Phase I of the INL Dose Reconstruction study are by no means an exhaustive analysis. The cited areas are only representative of the overall quality of the Report. Clearly, a page by page review of the Report is indicated.

Any member of Congress looking for fat in agency appropriations could readily conclude from CDC's Report that spending additional millions of scarce dollars on this study is not an appropriate use of taxpayer's resources. Since the Report clearly indicates that there is no problem that warrants public concern, we should not be surprised to see funding dry up like a cow pie on a hot southeast Idaho day.

"Inconclusive by Design" is a National Toxics Campaign report that analyzed CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) health studies. This critique of the public health agencies' research demonstrated how they deliberately excluded data from their analysis so that the findings would be inconclusive. The political motivation to add a layer of bureaucratic cover for the polluter - especially when it is another sister agency - has won again.

"Two federal agencies, the Centers for Disease Control (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR), bear the primary responsibility for safeguarding the nations' environmental health. They are responsible for studying communities exposed to toxic pollution and wastes and making recommendations for public protection. Instead of ensuring a margin of safety and recommending measures to end public exposures to toxins, both of these agencies have routinely funded and conducted studies of efforts of toxic pollution on public health which is inconclusive by design. These intentionally inconclusive studies have been used by polluters and government officials to mislead local citizens into believing that further measures to prevent toxic exposures are unnecessary. In systematically engaging in such practices, the two agencies are violating sound public health policy." [NTCF]

CDC used the Health Effects Subcommittee as a token public participation process. After reviewing the Working Group meeting transcript it is clear that the agency and its contractor Sanford Cohen & Associates (represented by John Mauro) were told in no uncertain terms that their reporting was inaccurate, misleading, and a rehash of DOE public relations material. And as the transcripts show, Mauro was obliged to state that "we agree". Yet despite this admittance, the Final Report was not corrected. The word science must never be used to describe CDC's Phase I Report unless in conjunction with science-fiction. CDC has again perpetuated its reputation for generating studies that are "inconclusive by design." Or as Ed Martell said, "ignorance is compounded by the sins of omission".

CDC's Phase-I contract with Sanford Cohen and Associates (SC&A) also required them to compile a database of all documents that would be useful in calculating radioactive and chemical doses to the public from site releases. This work product was delivered to CDC in January of 1995. This database is to provide the informational foundation upon which all subsequent phases of the dose-reconstruction study will be built. Consequently, the database is the most crucial part of the whole study. CDC delayed responding for nearly two years to requests from members of its INL Health Effects Subcommittee for copies of the database.

Over the years the Environmental Defense Institute (EDI) has built a modest library of INL operating history documents. Most of these documents were obtained through Freedom of Information Act requests or by making copies of documents in the INL Technical Library in Idaho Falls. These documents have provided the information basis for EDI's Citizens Guide to INL.

EDI after finally receiving a copy of the INL Phase-I database from CDC has conducted a cursory review and finds SC&A's work product wanting. EDI's review consisted of running spot checks to see if selected documents from EDI's library were in the database. The selected documents are of indisputable importance to a credible dose reconstruction study. For instance, the accident reports on the Idaho Chemical Processing Plant (ICPP) criticalities in October 1959, and January 1961 are not in the database. These two criticalities were significant occurrences that resulted in large radioactive releases and dozens of worker exposures. The ICPP RaLa green reactor fuel reprocessing campaigns between 1953 and 1963 released significant amounts of radionuclides to the atmosphere. Dozens of Phillips Petroleum Co. (Operator of the ICPP) reports describing the individual RaLa process runs are not in the database.

Any credible dose reconstruction study must have a thorough understanding of plant emission control systems through evolutionary time. Many documents that review the efficiency of ICPP emission control systems and offer recommendations for system upgrades are not in the database. As we saw from the Hanford Dose Reconstruction study, the emission control system efficiency is a major factor in calculating the release fractions from fuel reprocessing.

Environmental surveillance reports are essential for verifying the calculated source terms. Important documents in this category are missing from the database. Documents relating to the ICPP's Bluenose releases are similarly absent from the database. EDI recently submitted another FOIA request for additional documents related to the Bluenose program - a copy of which was forwarded to CDC.

EDI's library contains a limited number of INL contractor document indexes. Comparing document bibliographies listed in these indexes - documents from their titles suggest a clear relevance to a dose reconstruction study - again, are missing from the Phase-I database. Also, the lack of database indexes on document number suggests that a document specific quality assurance review has never been conducted - besides EDI's cursory review.

EDI lacks the resources and makes no claims to have conducted an exhaustive quality assurance review of the Phase-I database. Only a spot check of selected documents based on a limited knowledge of the site was done. Even at this relatively low level of quality, the database has flunked the test. EDI submitted a list of 122 essential documents that were not found in the database.

EDI renewed its previous demand that CDC convene a quality assurance and control team with adequate resources to conduct a credible review of the Phase-I database. Questions about the adequacy of the Phase-I work have plagued the process and clearly lead to the dismissal of the original contractor, Sanford Cohen and Associates. EDI's legitimate request to have the Phase-I work products peer reviewed have been ignored. Nothing in the current Phase-II task order with Radiological Assessments Corp. mandates a quality assurance review of the Phase-I products let alone the resource allocation to conduct a review. Proceeding on with such uncertainty about the adequacy of the information base is not good science.

EDI's Phase-I quality assurance recommendation is based on four reasons. First, it is part of the National Research Council's Radiation Dose Reconstruction for Epidemiologic Uses report that states the following. "In addition to public participation, other means exist for ensuring the credibility of the study. One of these is through periodic review of the study by scientists who are not engaged in its conduct and have no interest, or appearance of interest, in its outcome." Second, EDI's analysis of the Phase-I final report identified serious inadequacies. Third, only someone with a "Q" security clearance could assess the quality of the Phase-I report, which is beyond the capabilities of the INL Health Effects Subcommittee (IHES) that monitors CDC's research. Fourth, this must be initiated soon because Phase-I provides the informational basis for all subsequent research phases in the dose reconstruction study. Uncertainties about the adequacy of this research foundation component will literally compromise the rest of the work. If inadequacies are found, they must be corrected before proceeding with Phase-II source terms.

In this era of significant Congressional cut backs to CDC on its DOE related health research, EDI advocates that these limited resources be applied solely to document review and source term calculations. A limited window of opportunity exists to access this information that may not exist five or ten years hence. INL documents are being destroyed according to two quarterly contractor reports to CDC. There is simply no incentive on the Department, contractors, or responsible individuals to preserve potentially compromising information.

INL represents orders of magnitude in complexity over relatively simple - single mission production sites - such as Fernald or Rocky Flats. No other site in the DOE complex has had the diversity of nuclear programs as INL. Fifty-two reactors have operated at the site -highest concentration in the world. INL has also had forty-two reactor meltdowns, sixteen of which were accidents and the remaining twenty-six were intentional. Moreover, information on these varied programs is not centralized, but dispersed throughout the country in various government, contractor, and university archives. Accessing the relevant INL information is a monumental task that, if not done correctly and thoroughly, compromises all subsequent work. Contaminate dispersion/pathway modeling and dose calculations can be done at any future time without compromise. Indeed, these methodologies are still in their infancy and are evolving through an arduous trial and error process. Every month, year, and decade that passes, the source term reconstruction process becomes more difficult and problematic. EDI recommended focusing the limited resources on the time sensitive research that will provide a reliable and credible foundation for later dose estimates.

The June 1997 meeting of the INL Health Effects Subcommittee (IHES) generated a consensus recommendation for CDC to convene a quality assurance and control review of its INL Historical Dose Reconstruction Phase-I database and that the reviewers be scientists that are not directly involved in the study, either as participants or as advisors, and that time and resources would be allocated for resolving discrepancies in the results. Quality assurance reviewers must also have appropriate security clearances needed to access classified document holdings. Under intense pressure, CDC reluctantly agreed to initiate the review within the next few months. This represents a significant step in the right direction as to establishing the scientific method to the research project.

Section VI. C. CDC's INL Health Study Phase-II

The Centers for Disease Control and Prevention (CDC) is moving into Phase-II of its Historical Dose-reconstruction at the Idaho National Environmental Engineering Laboratory (INL). This health study is designed theoretically to quantify what radioactive and chemical contaminates were released from INL and estimate the probable doses to effected populations. Two separate CDC agencies are involved in the research. The National Center for Environmental Health (NCEH) is evaluating off-site impacts and the National Center for Occupational Safety and Health (NIOSH) is studying on-site effects.

To further complicate the issue, NCEH contracts out all the research work to private contractors. The Phase-I contract was awarded to Sanford Cohen Associates and due to questionable work they were not offered the Phase-II contract. NCEH instead turned to Radiological Assessments Corporation who is also conducting studies for NCEH at Department of Energy (DOE) Fernald, Ohio and Savannah River, South Carolina sites.

The Environmental Defense Institute (EDI) reviewed NCEH's Phase-II work plan presented to Radiological Assessments Corporation. EDI continues to strenuously object to tasking the contractor with: "Reviewing the dose calculations performed by DOE in their Historical Dose Evaluation (HDE), comparing the original documents to the summary information used in the HDE to see if any of the information in the original documents might significantly change the exposures calculated in the HDE". The HDE was peer reviewed in 1990 by a nine-member panel headed by John Till. The findings of the peer review were issued in a September 15, 1990 report to Dr. Thomas Gesell, DOE Idaho Operations Office. [Till] The HDE was also extensively reviewed over a two year period by the state sponsored Dose Evaluation Review and Assessment (DERA) Advisory Panel chaired by Dr. Margret von Braun. [1] The findings of the fourteen- member panel were released in its final report January 1993. [DERA@80] Both of these review panels recommended that an independent dose reconstruction be conducted by CDC.

"The Panel concludes that the Draft INEL Historical Dose Evaluation does not satisfactorily meet the stated objective. The methodology presented is not sufficiently state of the art nor complete to lend confidence that the dose estimates truly represent upper bounds of exposure. It is likely that if thyroid doses to infants and children had been calculated, they would have exceeded those for adults reported in the study." [RAC@2]

Therefore, it makes no sense now that CDC is well into its INL dose reconstruction study to be doing anything but independent source terms and dose calculations. If DOE wants to compare its calculations with CDC's on their own time and dime that is fine; but reviewing HDE is not CDC's mission here. All review and comparisons of the HDE must be dropped from the task order not only because it is redundant to the work of the other two review panels but also CDC cannot assume accurate analysis of data and accuracy of calculations.

"Future work should include independent collection and verification of data, comparisons between modeled and monitored data, rigorous uncertainty analyses, and a quality assurance program for all data collection and analysis. Doses should be reconstructed for hazardous chemicals and all potential exposure pathways, including groundwater and soil ingestion." [DERA@4]

Is the institutional memory so short that DOE's health studies at other sites like Fernald and Hanford showed only half or a quarter of the radioactive releases ultimately uncovered by independent dose reconstruction studies at those sites. Credibility will only be attached to this research if it utilizes the best available science and that it be completely independent.

Prioritizing the release sites and radionuclides, as mandated in the task order, is perhaps an interesting exercise but if it leads to shortcuts of only conducting source term analysis on the biggest releases then it is unacceptable. The reason for this position is that individually perhaps some sources were relatively small, but collectively and cumulatively, the total may be significant. The public demands that CDC either do the research right or don't do it at all.

Again, the deliverables requiring: "A final report listing the most likely top three sources to the off- site public from those sources considered in the HDE", should be completely dropped from the task order as previously explained. Additionally, the task order is not explicit as to the degree to which the various source terms would be identified and what the exact extent of the spectrum of pollutants to be analyzed would be. There is no mention on protocol the contractor is to follow concerning classified information deemed necessary to the research. In view of the ongoing obfuscation by DOE/DOD on this declassification problem, not providing for it in the task order is a significant error. There is no provision

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[1] DERA; Report of the Dose Evaluation Review and Assessment (DERA) Advisory Panel, to the Idaho Department of Health and Welfare, January 1993, Review of INEL Dose Models and INEL Historical Dose Evaluation, Margrit von Braun, Ph.D., P.E. Chair.

in the task order for the physical accumulation of all relevant information into a single publicly accessible archive in Idaho where both CDC and public analysts can conduct their research. The Peer Review Panel recommended that: "Public credibility is strongly enhanced by the availability of these records to permit public repetition of that process." [Till@18] The DERA Panel recommended that: "The public needs to have access to all data and results. We recommend that all relevant classified documents be declassified, and that all documents used in the CDC dose reconstruction be available for public review." [DERA@81,72]

Source terms and dose calculations for the water pathway absolutely must include contaminates in all groundwater not just the aquifer. Specifically, perched water zones must be included. The academic distinction between these two ground waters by CDC is not shared by the general public. This perched water provision is mentioned by the Peer Review Panel. "It would be of interest to include radioactivity that has seeped into the perched water zones as well as the aquifer from the RWMC and any percolation ponds that have been used." [Till @ 19]

The contractor must also be instructed to work collaboratively with NIOSH researchers to ensure that any informational findings relevant to either on-site or off-site research effort must be shared. The need to specifically accommodate resource allocation to this intra-agency exchange cannot be overstated. The capricious division between on-site (NIOSH) and off-site (NCEH) dose research opens a huge crack that workers who have not yet had a medical outcome are going to fall through. The on-site populations closest to the releases and most likely to have been effected have a right to know what they were exposed to even though they are not on the Idaho Tumor Registry yet or happened to be badged or had one of those rare whole body counts at CFA's "copper room". Categories of possible impacted individuals in addition to badged workers are the un-badged construction workers, university biological and environmental monitoring researchers, security guards, bus drivers, Central Facilities maintenance staff, ranchers herding cows and sheep on site. Arbitrarily calculating doses at the fence line and beyond will structurally understate the doses. Screening criteria that excludes short lived isotopes because the site boundary is 20-30 miles from the release point obscures the fact that there were thousands of on-site workers who may have been immersed in the plume as it traveled toward the fence. The DERA Panel recognized this short-coming and recommended the following:

"Because the same models that will be used for the dose reconstruction can be used to estimate doses to workers, we strongly recommend that the proposed future dose reconstruction take advantage of this opportunity to clarify risks to all persons who have worked on the INEL site including military, research, and construction personnel. Omitting these dose estimates would provide an incomplete picture of health risks at the INEL [sic]. Such estimates would also be useful for quantifying risks to members of the public who may have been on the INEL [sic] property during releases." [DERA@79]

Questions about the adequacy of the Phase-I work have plagued the process and may have led to the dismissal of the original contractor, Sanford Cohen and Associates. EDI's legitimate request to have the Phase-I work products peer reviewed have been ignored. Nothing in the current task order mandates a quality assurance review of the Phase-I products. Proceeding on with such uncertainty on the adequacy of the information base is not good science.

EDI's Phase-I peer review recommendation is based on four reasons. First, it is part of the National Research Council's Radiation Dose Reconstruction for Epidemiologic Uses report which states the following.

"In addition to public participation, other means exist for ensuring the credibility of the study. One of these is through periodic review of the study by scientists who are not engaged in its conduct and have no interest, or appearance of interest, in its outcome." [NAS(c)@15]

Second, EDI's analysis of the Phase-I final report suggests serious inadequacies. Third, only someone with a "Q" security clearance could assess the quality of the Phase-I report, which is beyond the capabilities of the IHES Committee. Fourth, this must be initiated soon because Phase-I provides the informational basis for all subsequent research phases in the dose reconstruction study. Uncertainties about the adequacy of this research foundation component will literally compromise the rest of the work. If inadequacies are found, they must be corrected before proceeding with Phase-II source terms.

In this era of significant Congressional cut backs to CDC on its DOE related research, EDI advocates that these limited resources be applied solely to document review and source term calculations. There is a limited window of opportunity to access this information that may not exist five or ten years hence. INL documents are being destroyed. [SC&A@5] There simply is no incentive for the Department, contractors, or responsible individuals to preserve potentially compromising information.

The Department of Energy (DOE) admitted to destroying an additional 700 boxes of documents identified by the Centers for Disease Control (CDC) as relevant to the agency's health study at INL. This is the second group of documents that the DOE has admitted to destroying. The first group, destroyed in 1998, was stored in Idaho at the INL site and involved a reported 600 boxes. This second announcement in June involved 700 boxes of INL documents stored at the Federal Records Center in Seattle, Washington.

CDC's dose reconstruction health study task is to estimate how much radiation was released from INL over its fifty-year operating history. The first step for CDC researchers is to review the historical operating records to determine what was released, how much was released, and when it was released. This process is made more difficult when much of the information is still classified secret and therefore can only be viewed by personnel with a "Q" security clearance. DOE continues to drag its bureaucratic feet in declassifying all this information despite the fact that releasing it would not compromise national security because it only involves radioactive and chemical releases to the environment. The only conceivable national security issue at stake would be a diminished public confidence in the government's ability to manage nuclear operations in a way that protects public health and safety.

DOE claimed that 667 of the 700 boxes destroyed were irreverent "purchasing and contract records." In some cases, the department claims to have been able to recreate the records from other archival sources. However, repeated requests for box inventories prior to destruction have not been produced. Consequently, there is no way of knowing if the "recreated" boxes are complete. Each box of documents could contain up to 5,000 pages of information. That means that if the 31 destroyed boxes (700-667) that even DOE acknowledges are relevant, is equivalent to about 150,000 pages of information. Losing even one box of crucial records could compromise the health studies if it contained information on a significant release data.

CDC's INL Health Effects Subcommittee (IHES), a citizen group that advises the agency on its health study research, wrote letters to then Secretary of the U.S. Department of Health and Human Services, Donna Schalala, and then Secretary of the Department of Energy, Bill Richardson, asking that the documents CDC identified as relevant, be preserved. After this approach failed, the IHES issued a formal recommendation calling for a total moratorium on all DOE document destruction. DOE did not comply despite the fact that it is required to under a Memorandum of Understanding between DHHS and DOE signed in 1996.

CDC in the meantime is keeping a low profile on the issue and generally doing damage control for DOE and claiming success in working with the department to "ensure the problems do not reoccur." As a federal public health agency, CDC does not have to report about government sponsored disasters they do not know about because the records have been destroyed.

CDC gave DOE a list of all the documents in 1994 that the health agency wanted preserved for later analysis, however, that notification was not enough to save the information. Some of the destroyed documents included radiation emission records that are essential to quantifying radioactive releases to the environment.

Lockheed Martin's INL employee newspaper "*Star*" ran six articles between May 1997 and November 1998 describing a two-year campaign to clean-out files. The article titled "Site-wide files clean-out a big success" notes that 13,231 cubic feet of documents were destroyed in 1997 and 14,859 cubic feet were destroyed in 1998 for a total of 28,090 cubic feet over the two year campaign. "It costs approximately $2,150 annually to maintain a single five-drawer filing cabinet in a local government office. Based on this last statistic alone, nearly $3 million in soft dollar savings may be realized by eliminating a total equivalent of 1,426 file cabinets worth of records and non-records." [2]

It is uncertain if there is a connection between the Lockheed Martin file clean-out initiative and the documents CDC wanted preserved, but the coincidence is telling. Certainly, the eleven boxes CDC identified as relevant that were destroyed in INL office spaces may fall into this category.

DOE is non-committal in taking specific steps to preserve INL related documents at other archives. Of particular concern are Hanford reactor throughput records because in the 1950's and 1960's a considerable amount of highly enriched uranium fuel slugs were shipped to the Idaho Chemical Processing Plant (ICPP). These ICPP reactor fuel reprocessing campaigns are collectively known as the RaLa Runs and are the INL equivalent to the infamous Hanford Green Runs that released huge quantities of radiation into the air.

Section VI.D Destruction of INL Documents Worse than Previously Reported [3]

The CDC's National Center for Environmental Health (NCEH) in Atlanta, GA conducted the dose reconstruction health study at the INL. During the study process in 1994, NCEH researchers identified over 15,000 documents or boxes of documents that may be relevant to the health study. The Department of Energy (DOE), through a formal memorandum of understanding, agreed to place the information under a destruction moratorium until after NCEH had completed its health study. CDC's National Institute for Occupational Health (NIOSH) continues to study individual cohorts of INL workers.

In the fall of 1998, NCEH requested physical retrieval of 4,948 boxes of previously identified documents from DOE's

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[2] Denson, W.J., President and CEO, Lockheed Martin Idaho Technologies Co., letter to John Wilcynski, Manager U.S. Department of Energy Idaho Operations Office, Concern with Destroying Epidemiological records, December 4, 1998, cover letter for "Corrective Action Plan for the Continued Protection of Epidemiological Records at the Idaho National Engineering and Environmental Laboratory, December 8, 1998.

[3] See EDI Document Distruction Report at: http://environmental-defense-institute.org/publications/DocDestruction.pdf

INL archives. DOE contractor Lockheed Martin responded to the NCEH's request by stating that 602 boxes had been destroyed and an additional 72 boxes were missing from the archive due to being "permanently recalled by the custodian," which is an obtuse way of saying the originator of the box of documents ordered the box sent back to them without leaving any copies or record of its current location. This potentially represents over three million pages of information that NCEH researchers will not have available to determine how much radiation was released from INL over its nearly five-decade operating history. If the boxes were stacked, the pile would be more than 1,030 feet tall.

John Till, Risk Assessments Corp. (RAC), NCEH Phase-II research contractor, believes "the issue of records being destroyed before we have had an opportunity to verify the content is very disconcerting. This should not have happened, and shows that whatever system was supposed to be in place to prevent it, did not work" [4]

The INL/Lockheed Martin December 1998 report, titled "Corrective Action Plan" acknowledges the destruction of 602 boxes of documents that were identified by NCEH as pertinent (Pertinence- 1,2,3,and 9). The report notes "359 boxes were destroyed as a normal course of business because they were not included in the list of frozen records schedules or had been lifted from the freeze by the DOE Historian. Forty-four boxes were destroyed because they were incorrectly scheduled as 'non-records'. And 199 boxes were destroyed because they were incorrectly scheduled in the past, reviewed and rescheduled using schedules that were not identified as frozen." [5]

The fact that the DOE historian was allowed to unilaterally override the NCEH freeze moratorium could be considered obstruction of justice if it was in the context of a civil law suit or other judicial proceedings.

At a December meeting in Salt Lake City of the INL Health Effects Subcommittee that advises NCEH on its INL Dose Reconstruction Study, NCEH reported that INL related documents at four other Federal Records Centers may also be at risk of destruction. Additionally, 11 boxes of pertinence-1 documents in DOE offices have disappeared and are presumed to have been destroyed. DOE is attempting to trivialize the importance of the problem by saying that the bulk of the destroyed boxes were category-9 (pertinence-9) or of lesser importance than category-1 records. [6]

John Till notes that "we [RAC] have recategorized a number of boxes from what they were categorized to be by [former CDC contractor Sanford Cohen and Associates] SC&A. Therefore, I think it is important that no further boxes be destroyed until we have had a chance to verify their contents, even the category 9 boxes. I think it is critical that the Committee takes stock in what has happened and weighs in to recommend some rules that should be followed. It should be recognized that document destruction may be necessary to continue, but not until everyone is absolutely certain what is being destroyed." "...if any boxes of records are to be reviewed during the cleanup process, they must not be destroyed until after they have been looked at. Further, it must be made clear that pert 9 documents from the SC&A review should not be construed as of no value until we have a chance to verify this." [7]

The issue of the 72 boxes permanently "recalled" is also crucial. DOE's statement that "They may still be available to some extent through the recall requestor or returned under another box" is equally spurious. First there is no record of whom the “recaller” was or even that the box was recalled at all . . . the boxes are just no longer in the archive. If it is returned in another box with another number, it will go unnoticed unless NCEH/RAC does a new search.

The DOE does outline some "corrective actions" to enforce the moratorium on document destruction, however it is like closing the door after the thieves have looted the store. Also, there is no assurance on DOE or NCEH's part to clamp down on other archives where INL related documents are housed (i.e., Federal Records Centers in Atlanta, Los Vegas, Chicago, Germantown, Seattle, and Hanford). DOE/Idaho controls the deposition of INL documents at Federal Records Centers and do, on a quarterly basis, order their destruction.

John Till stated that "The Seattle records center is a special situation which is becoming more problematic. There are quite a few pert 9 boxes there, and I do not want them destroyed either until we decide how to verify the contents of some or all of the boxes, depending on the strategy we take during the review. Hopefully we will have some information on alternatives that can be used at the next meeting. Things have gotten a bit frustrating over there."

A legitimate question to ask is: when did NCEH learn about the document destruction problem and what - if anything is being done about it? NCEH's Phase-I research contractor Sanford Cohen and Associates (SC&A) quarterly reports (October-December 1993) and (January-March 1994) acknowledge that document destruction is a significant problem area. SC&A's 1994 draft final Phase-I report quantifies the document destruction at 65,000 boxes. Five years later NCEH

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[4] John Till email January 31, 1999 to Chuck Broscious

[5] Britz, Wayne, Project Manager, Sanford Cohen and Associates letter to Leeann Denham, Project Officer, Centers for Disease Control and Prevention, Subject Quarterly Report, October-December 1993, page 10; Quarterly Report, January- March 1994, Contract No 200-92-0538, page 7.

[6] Draft Identification, Retrieval and Evaluation of Documents and Data Pertinent to a Historical Dose Reconstruction At The Idaho National Engineering Laboratory, Revision 1, Prepared by S. Cohen and Associates, Inc for Centers for Disease Control and Prevention, September 2, 1994, page 3-13

[7] John Till email January 31, 1999 to Chuck Broscious

is still sitting on their hands without an effective plan to stop the destruction of more documents.

The National Institute for Occupational Safety and Health (NIOSH) based in Cincinnati, Ohio is conducting a completely separate health study of the INL workforce called an epidemiologic morbidity study. Document destruction is a major problem with this study as well. In a September 1993 protocol report, NIOSH states: "While stored files are no longer being destroyed under the DOE-ordered moratorium in March 1990, prior to its implementation approximately 11,000 boxes of INEL records had been destroyed. Many of these boxes contained information germane to INEL's operations during its earlier years, and the only way to compensate for their loss is by obtaining oral histories for each INEL facility from its long-term employees." By sheer volume alone, the worker health study has a major document destruction problem along with the National Center for Environmental Health's dose reconstruction study. [8]

Mary Burket, daughter of Clair Burket, is trying to obtain radiation exposure records pertaining to her father's involvement in the INL SL-1 reactor explosion that occurred in 1961. Three reactor operators and a nurse died initially in the explosion. Ms. Burket claims that NIOSH has no record of her father's radiation exposure records while working on the SL-1 but acknowledges they have records of her father while doing administrative work at INL's Test Area North. Clair Burket died prematurely a year and a half later of a massive stroke at the age of 33.

NIOSH critics contend that the agency should be doing dose reconstruction and risk assessment, instead, NIOSH only does epidemiological analysis with false negative findings often used as confirmation of no effects. Radiation is a known carcinogen, the dose response is most likely linear, and thus there is no reason why NIOSH cannot conduct dose and risk analyses for their employees like NCEH does this for members of the public.

Critics also note that as the Hanford Thyroid Dose Study is showing, it is important to have a suitable control group. Also, they should look for a dose response within the exposed group. Moreover, they should take uncertainty in dosimetry into account when analyzing for a dose response and guard against misinterpretation of potential negative findings. [9]

CDC gave DOE a list of all the documents in 1994 that the health agency wanted preserved for later analysis, however, that notification was not enough to save the information. Some of the destroyed documents included radiation emission records that are essential to determine what kinds of radioactive isotopes were released, when they were released, and how much was released. This is called establishing the source term.

As previously noted: Lockheed Martin's INL employee newspaper "Star" ran an article on November 24, 1998 describing a two-year campaign to clean-out files. The article titled "*Site-wide files clean-out a big success*" notes that 13,231 cubic feet of documents were destroyed in 1997 and 14,859 cubic feet were destroyed in 1998 for a total of 28,090 cubic feet over the two-year campaign. Lockheed Martin believes that "it costs approximately $2,150 annually to maintain a single five-drawer filing cabinet in a local government office. Based on this last statistic alone, nearly $3 million in soft dollar savings may be realized by eliminating a total equivalent of 1,426 file cabinets worth of records and non-records." The 2,809 cubic feet are the equivalent of 1,872 boxes. It is uncertain if there is a connection between the Lockheed Martin file clean-out initiative and the documents CDC wanted preserved, but the coincidence is telling.

In 1990, then DOE Secretary Watkins issued a memorandum mandating the retention of epidemiological and other related health study records. Every succeeding DOE Secretary including current Secretary Bill Richardson, have reauthorized the freeze order. Elaborate records management plans were developed to establish categories or document series that were to be included in the destruction moratorium. Unfortunately, at INL, the plans were not adequately implemented. The DOE Idaho Operations office is actually attempting to unilaterally drop some of the freeze categories from the moratorium. It is uncertain if the public health agencies will challenge this action.

Technically speaking, CDC has little authority over DOE documents. This is due to a Memorandum of Understanding (MoU) signed in 1996 between DOE and Department of Health and Human Services (DHHS) that establishes mechanism for DOE to provide DHHS with funding for health studies at DOE sites. CDC is an agency under DHHS. The MoU however specifically stipulates that all documents reviewed by CDC during the health studies remains under the control of DOE. The MoU states:

> "The Department of Energy and its contractors shall continue to maintain documents, records, record systems, and other information sources for the conduct of epidemiologic research. Although the Department of Health and Human Services will be provided with access to relevant information and will possess copies of such data for use in its research, the data will remain the property of the Department of Energy." [10]

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[8] Preliminary Protocol For An Epidemiologic Study of Workers at the Idaho National Engineering Laboratory, Health and Energy Related Research Branch Division of Surveillance, Hazards Evaluation, and Field Studies, National Institute for Occupational Safety and Health, September 23, 1993

[9] Memorandum of Understanding between Department of Energy and Department of Health and Human Services, Hazel O'Leary, Secretary, May 14, 1996; Donna Shalala, Secretary, July 1, 1996, Section IV(A).

[10] Memorandum of Understanding between Department of Energy and Department of Health and Human Services, Hazel O'Leary, Secretary, May 14, 1996; Donna Shalala, Secretary, July 1, 1996, Section IV(A).

“Boxes of Documents Destroyed 609 Boxes Documents Permanently recalled 72 Boxes Removed from offices (presumed destroyed) 11 Total Boxes 692”

These health studies are not just another academic exercise, or the equivalent to determining where to put a new interchange on Interstate 15. It is about determining why southeastern Idahoans had next to the lowest cancer rate in the nation during the first half of the century, and now in the second half of the century after INL's start up, southeastern Idaho ranks up there with the polluted big cities. This is about the health and safety of hundreds of thousands of Idahoans who live in the shadow of that nuclear reservation. Idaho Division of Health studies around INL indicates increased rates of radiogenic diseases. The Tennessean newspaper conducted surveys of INL downwinders and generated a list of forty individuals with health problems that they believed were related to INL emissions.

INL represents orders of magnitude in complexity over relatively simple - single mission production sites - such as Fernald or Rocky Flats. No other site in the DOE complex has had the diversity of nuclear programs as INL. Moreover, information on these varied programs is not centralized, but dispersed throughout the country in various government, contractor, and university archives. Accessing the relevant INL information is a monumental task that, if not done correctly and thoroughly, compromises all subsequent work. Contaminate dispersion modeling and dose calculations can be done at any future time without compromise. Indeed, these methodologies are still in their infancy and are evolving through an arduous trial and error process. Every month, year, and decade that passes, the source term reconstruction process becomes more difficult and problematic. Let us focus the limited resources on the time sensitive research that will provide a reliable and credible foundation for later dose estimates.

CDC’s had six years of this INL Dose Reconstruction health study. Two agencies within CDC are working on the health study - the National Centers for Environmental Health (NCEH) and the National Institute for Occupational Safety, and Health (NIOSH). Much of the information needed to determine the radioactive releases is classified secret. CDC researchers with security clearances claim they have reviewed the relevant secret documents and prepared a list for the Department of Energy (DOE) to declassify. DOE continues to drag its bureaucratic feet to these public health agency requests for timely declassification.

At a INL Health Effects Subcommittee (IHES) meeting in September 1997, the Environmental Defense Institute’s (EDI) representative put a recommendation before the committee that would provide a means by which the committee and independent researchers could determine if CDC was asking for all the relevant secrets.

EDI proposed that the IHES consider a recommendation to DOE that an index of classified documents be generated and made available to the committee and CDC. Such an index would give independent reviewers some means of determining if CDC was requesting declassification of all the information needed to quantify how much radiation was released. Currently, there is no way for IHES or the public to evaluate CDC's work because of the security clearance requirement.

In a remarkable display of unanimity, NCEH and NIOSH together with DOE, and the Navy closed ranks to make a solid front opposing the classified index proposal. Agency arguments opposing the classified index covered a wide range. NIOSH said, “trust us we looked at all the classified documents.” NCEH said, “it would not be useful for a dose reconstruction.” The Navy argued that “it is a waste of tax payer money.” DOE complained that “it will stall the declassification process because reviewers will be bogged down with generating the index.” The majority of the committee was so impressed by this collective agency reasoning that they voted the proposal down. However, the Committee did recommend that CDC generate a list of work for others projects conducted at INL.

Since that avenue for transparency was effectively blocked by the public health agencies, the INL Research Bureau (IRB) a coalition sponsored by the Environmental Defense Institute filed a Freedom of Information Act (FOIA) for the index of classified documents. DOE Idaho Operations denied the FOIA request stating that such an index “did not exist.” The IRB appealed the denial to DOE headquarters’ Office of Hearings and Appeals (OH&A) who overruled the Idaho Operations’ denial. OH&A’s ruling was based on the fact that an index did exist and that the Idaho Operations deception about its non-existence constituted a violation of FOIA. The officials in OH&A deserve considerable credit for standing up to their field office’s position.

In subsequent negotiations with Idaho to comply with the OH&A’s ruling, Carl Robertson, head of INL’s Office of External Affairs, stated that the index would be mailed in a few days. Robertson acknowledged that the reason for the rapid response was because DOE had already sent a copy of the index to CDC during Phase I of the INL Dose Reconstruction Study.

This is a compelling revelation. CDC never disclosed that they had the index and went to the mat trying to kill any attempt by the public to get a copy. Is this a situation where CDC just does not want the public to be able to substantively evaluate the quality of their science; or is the agency an active conspirator in obstruction; or is it both? At the April 1998 IHES meeting, CDC was confronted with their deception and obstruction and admitted that agency did request and receive an index of classified DOE documents during the early part of CDC's INL Dose Reconstruction Study.

Another example of obstruction occurred in 1994 when CDC stated that after reviewing all the classified documents on Operation Bluenose that they concluded that the secret project did not release any radioactivity to the environment and therefore was not relevant to the INL dose reconstruction study. Unsatisfied with this position, the INL Research Bureau (IRB) [11] filed a series of FOIA's on Operation Bluenose which showed conclusively that there were significant releases. It took CDC four years to finally acknowledge that the Operation Bluenose releases would be included in the dose reconstruction study.

A big part of the problem is money. CDC is loath to admit that additional document searches are needed its Phase-I database is not complete. If a Quality Assurance review finds that another search of the archives will be required, CDC will have to go back to DOE for more money to correct the deficiencies.

It's bad enough having one federal agency (CDC) investigating another (DOE), but it gets even more incestuous, when DOE is paying CDC to reveal its darkest secrets. DOE cut CDC's budget nearly a third from its earlier meager allocation. The Environmental Defense Institute along with other public interest groups tried to convince Congress that CDC's numerous dose reconstruction studies at DOE sites should be funded directly through the U.S. Department of Health and Human Services without any funding from DOE that has a direct conflict of interest.

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[11] The INL Research Bureau (IRB) was a coalition of 10 environmental organizations that EDI formed to meet DOE's arbitrary criteria for FOIA requests to satisfy "in the public interest." Initially, DOE tried to charge the IRB over $2 million for printing and shipping of the FOIA documents. The IRB won an appeal via the Office of Hearings and Appeals. INL Research Bureau Members include: Citizens Against Nuclear Weapons & Extermination, Coeur d'Alene Idaho; Citizens for Environmental Quality St. Maries, Idaho; Environmental Defense Institute, Troy, Idaho; Focus on Peace and Justice, Burley Idaho; Government Accountability Project, Seattle, Washington; Greater Yellowstone Coalition Bozeman, Montana; Greenpeace USA Washington, DC; Radioactive Waste Campaign, Warnick, New York; Moscow Chapter Idaho Conservation League Moscow Idaho; Wood River Chapter Idaho Conservation League, Ketchum, Idaho

VIII. Protection of Radiation Victims

A. Empty Promises

The DOE promises to run its nuclear weapons production facilities safely. They promise that new projects planned for INL will not affect the health and safety of the general public and facility workers will be protected.

The truth of the matter is that the federal government established the Atomic Energy Act which exempts them from any liability due to injuries sustained by their nuclear weapons production and testing. The Price-Anderson Amendments Act of 1988 was signed into law to continue indemnification to DOE contractors. This legislation goes on to limit contractors working for DOE from liability even if injuries are caused by gross negligence or failure to follow safety regulations. The law "... subjects DOE contractors to potential civil penalties for violations of DOE rules, regulations, and compliance orders relating to nuclear safety requirements. Reduction of up to 50% of a base civil penalty may be given when a DOE contractor promptly identifies a violation and reports it to DOE. Additionally, the Enforcement Policy gives DOE discretion to not issue a Notice of Violation in certain cases." [Operating Experience] An example of how this system failed is when DOE tried to discipline Rocky Flats contractor Rockwell International for violations. Rockwell received a light slap on the wrist amounting to their bonus for the year because they could prove that DOE as the employer knew about the violations for decades.

Witness the 10th U.S. Circuit Court of Appeals decision to overturn US District Judge Bruce Jenkins' finding in 1984 that the government negligently failed to warn or educate downwind residents of radiation hazards from tests conducted by the Atomic Energy Commission at the Nevada Test Site from 1951 to 1962. Jenkins' earlier ruling came after a trial of 24 "bellwether" claims which represented nearly 1,200 plaintiffs suing the government for some 500 deaths and injuries. The U.S. Supreme Court subsequently refused to hear an appeal on the 10th Circuit Court decision because the Atomic Energy Act provides government-contractor exemption from liability. Congress has steadfastly refused to repeal the Atomic Energy Act; however, they recently awarded some limited compensation to Nevada Test Site Downwinders.

There was no question that the government was negligent in conducting the tests and that it gave false and misleading information at the trials. The legal bottom line is that Congress created laws that specifically exempt the government and any contractors who work for the government from liability.

Radiation victims from INL can find no compensation for their injuries. [Cawley] Not only can they not sue the government or the contractors for whom they worked, but Idaho law does not recognize long term radiation injuries. Typically, it takes 10-20 years for radiation related injuries to surface after exposure. Again, the legal bottom line exempts even the state Workman Compensation Commission from covering long term radiation injuries.

Sweetheart contracts between AEC/DOE and the state Workmen Compensation Commissions provided for: "Hiring of the state's claims administrator in the Tri-Cities [Hanford] was subject to approval by the Atomic Energy Commission (now DOE). That language is still in the current contract. From the beginning of the contract until today, state officials agreed to accept censored and deleted files on workers radiation injuries. The (Labor and Industries) Department will accept the Contractor's description of any accident, even though full details may not be given. This procedure is necessary in order to ensure against the possibility of disclosure of secret information." [Spokesman(e)]

"In 1984, the Ninth Circuit Court of Appeals in San Francisco ruled the workers could sue because the Nevada contract with DOE nullified the integrity of the state's industrial insurance system." [Ibid] The New York Times states, "The DOE has routinely awarded millions of dollars in performance bonuses over the last decade to contractors that run nuclear weapons factories racked by safety, health, and environmental deficiencies according to Government Accounting Office records." [Schneider] INL contractors were awarded $7.3 million in bonuses for 1993, $14.36 million in 1995. [AP(d),1/4/96]

Promises made by the Department of Energy must consequently be viewed as hollow promises. Individuals or communities have no legal standing in court. Safety would by definition have a low priority because there is no accountability.

The author interviewed Michael Cawley who worked at INL between 1955 and 1974 as a machinist. Mr. Cawley was diagnosed as having extensive pulmonary and pleural fibrotic disease that is an incurable and life threatening lung disease. Court documents support his allegation that he was exposed to radiation many times over the course of his eighteen years of employment at INL. This included unprotected exposure to beryllium. Dr. William R. Berry and Dr. Grady at the Boulder, Colorado Medical Center both substantiate Mr. Cawley's contention that his lung disease was caused by radiation exposure while working at INL. [Cawley, 1988] "In 1966 Cawley was exposed to a significant amount of radioactive material. Having passed through a storage area, he was informed by a health physicist that the area was contaminated. He was instructed to remove his clothing and take a shower. The health physicists discovered that Cawley had radioactive particles lodged in his nose, which the health physicist attempted to remove through the use of a small brush." [Cawley© @2] Cawley's notice of injury and claim for benefits was filed with the Idaho Industrial Commission [Workman's Compensation] June 29, 1979. The State Commission would not even give Cawley a hearing on the merits until 1990 when the Idaho Supreme Court ordered the State to respond and pay Cawley $983.23 for legal costs. [Ibid] The benefits the State tried to deny Cawley totaled $207,900.56. [Cawley(d)] Cawley's legal documents list the following exposures: 1) Fast Neutron beam exposed from the Materials Test Reactor Neutron Chopper in 1956; 2) Plugged pneumatic radioactive material (W.A.P.D. B.4 sample) transfer tube requiring MTR evacuation; 3) MTR July 1966 storage area exposure; 4) SL-I reactor explosion January 1961; 5) J.A.-10 Fuel element loading at the ETR canal. [Cawley(e)]

The author interviewed Richard Hansen who lives near Rupert, Idaho (Minidoka county) southwest of INL, in an area characterized as "Cancer Ridge" by the local residents and media. [AP(I), 2/18/89] Rupert residents are the first domestic users of the Snake River Aquifer down-gradient of INL. Hansen says that within the 36- square mile area around his home, there are 60 cancers. These diseases range from thyroid, pancreas, colon, leukemia, and female reproductive cancers. Hansen, a staff researcher in archaeology with the University of California at Los Angles and a Rupert farmer, is asking for scientific studies to determine whether the cancer rate is excessive. Hot-spot phenomenon is discussed Allan Benson's book "Hanford Radioactive Fallout". [Benson, p.28 & 36] In 1997, State health studies of cancer rates in Minidoka county found that there are elevated levels of seven types of cancers when the county incident rates (observed) were compared with the state as a whole (expected). This comparison likely understates the problem because the Idaho counties in the north have high cancer rates likely due to Hanford radioactivity. Also see Section V.A Independent health studies.

Cancers in Minidoka County

Cancer Site/Type	Observed	Expected
Parotid/Salivary	4	3.6
Stomach	37	22.09
Rectosigmoid/Rectum	48	43.82
Bone	4	2.79
Ovary	30	29.2
Brain/CNS	28	21.47
Liver	6	3.82

[IDH&W(d)]

As previously stated, Physicians for Social Responsibility's *Dead Reckoning* report, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr., and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military personnel. [Dead Reckoning@41]

An example of non-monitored subcontract workers is Kenneth Grover who worked as a night security guard at INL between 1956 and 1959. The author interviewed Grover's daughter who clearly remembers that her father was irradiated during an accident at the site. As a result of his exposure and induced radiation sickness, he was forced to take a three month medical leave from work. Kenneth Grover died a few years later after suffering from cancer and heart disease. The Grover's lived in Monteview, Idaho, just east of the site. Three of Grover's children have thyroid dysfunction problems and one daughter has periodic hair loss, both are symptoms of radiation exposure. A partial listing of 100+ INL accidents and intentional radioactive releases between 1952 and 1995 is provided in attached Appendix.

Clair Burket moved his wife and four old daughter Mary to Idaho Falls in 1958 to work on the Aircraft Nuclear Propulsion Project (ANP) at INL's Test Area North. General Electric was the operating contractor for both the ANP as well as the SL-1 Reactor accident cleanup at the Auxiliary Reactor Area. When the SL-I blew up in 1961, Burket along with other ANP workers were called down to the SL-1 site to extract the three dead bodies and cleanup the contamination. Clair Burket died several years later of a massive brain hemorrhage at the age of 33 and his family believes his premature death was the result of exposure to radiation at the site. Mary attributes her thyroid problems to exposure as an infant to iodine-131 releases from the site. Mary's attempts through Freedom of Information Act requests to access her father's dosimetry records have thus far been denied on the grounds that DOE claims not to have any of Burket's exposure records. Even though the National Institute for Occupational Safety and Health is doing an INL worker mortality study, the agency is uncooperative in assisting in Mary's quest for her father's records.

The author interviewed Jean Dennis, the widow of James Dennis, who was a member of the SL-1 involuntary Army demolition crew brought in by General Electric under contract with AEC to dismantle the reactor after it blew up in January 1991. The 38 eight by ten photographs taken by the AEC and submitted as evidence in Dennis' litigation against General Electric, shows Dennis right beside the damaged reactor core placing the explosive charges on the support beams that held up the 80 ton concrete and lead operating room floor above the reactor vessel. The photos also show the two huge clouds of debris that went into the air when the two separate charges went off, covering Dennis, his partner Arthur Limeruk, and spreading the residual contaminates over a large area. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia (blood & bone marrow cancer), which his medical documents confirm, was caused by exposure to 50 rem/hr for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1,CAB] as grossly understated. Dennis claimed he received internal exposure because of the contamination in his nose. GE's health physics technicians however made no attempt to swab out his nose to remove the contamination or provide chelates to flush out the contaminates. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis ,p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. The US Justice Department defended General Electric John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Horan was also in charge of the Health Physics Department at the site and in charge of worker monitoring of the SL-1 cleanup workers. See Section I Accident History.

Time ran out for self-described INL Downwinder Chuck Walker who died at the age of 44 from chronic myelogenous leukemia - the rarest form of all leukemia. Walker's testimony to the State Oversight Committee and recorded by Idaho State Journal reporter Mary Duan stated that:

"As a young boy in Jefferson county near the border of the INL he remembers an explosion in the late 1950's that lit up the night sky from his home in Dubois. He remembers smoke pouring from stacks at the then Atomic Energy Commission site, and government workers running frantically at a monitoring station a mile away from his family's farm."..."I've spent hours and hours going over my health history with doctors from the University of Utah and the Fred Hutchinson Cancer Institute," he said. "They say that I must have gotten a good-sized dose of radiation at one time or another. The first time they identified this kind of cancer was after Hiroshima and Nagasaki."..."I don't understand why the department is not looking at Jefferson County. It's closer to the site than any other", Walker told the committee. "If the doctors are right in telling me that the only place, I could have gotten this from is the site, what will the oversight committee do to make sure they don't get away with this again." [Id St Journal(b)]

Between 1989 and 1992, over $39 million of taxpayer money has been spent defending DOE Hanford contractors against radiation victims. A class-action suit has been filed by thousands of Hanford's Downwinders against DOE's contractors for health and environmental damage. Documents gained through the Freedom of Information Act by the Seattle Times revealed that DOE is paying all the contractor's legal expenses - $15 million for 1992 alone.

Judith Jurji, President of the Hanford Downwinders Coalition says that, "what we have here is taxpayer money going to fight its own people, which is the ultimate slap in the face." Contractors being defended by DOE are Du Pont, UNC Nuclear Industries, Atlantic Richfield Hanford Co., General Electric, Rockwell, and

Westinghouse. Jurji believes the trial will bring everything out in the light of day, in a public forum, and the government would have to answer some very tough questions.

Other cases against DOE contractors operating the Nevada Test Site and the Fernald nuclear weapons plant in Ohio have been settled. Fernald residents received $73 million in compensation for environmental damage. It is unconscionable that the federal government has turned against its own people and sided with its big business contractors. The government simply does not own up to its responsibility to compensate people injured by its nuclear bomb factories. Instead of fighting the people and wasting collectively hundreds of millions on legal defense of the criminals, the responsible thing to do is use the money to help those injured.

"Inadequate oversight at the DOE allowed some of the nations' largest law firms to bill the government excessively, including steep photo copying fees in a Hanford case and expensive dinners in Seattle, investigators say. The lawyers, doing work defending DOE contractors against class-action suits, claimed $70 million in legal bills for six lawsuits since 1990, the DOE estimates. About $29 million of that was spent in a case involving the Hanford nuclear reservation in Richland, Wash., including $175,000 in copying fees at 20 to 25 cents a page. Investigators for the General Accounting Office told Congress on July 13, 1994 that DOE officials often did not receive copies of the bills and rarely reviewed the legal costs. 'This was the standard way for the DOE - turning an operation over to a contractor and just paying the bill.' Victor S. Rezendes of the GAO told the House Energy and Commerce subcommittee on oversight and investigation. 'The agency does not know the full costs associated with defending its contractors in litigation, does not have criteria setting forth what costs are allowable for legal services and does not have procedures requiring detailed contractor and DOE review of billed costs', he said." [AP(m)]

The Congressional Office of Technology Assessment (OTA) released a report in April 1993 that cites that DOE is unprepared to protect tens of thousands of workers who would soon embark on a 30-year cleanup of the DOE complex. OTA's 80-page report said that protection of workers in environmental restoration projects of any kind was often inadequate, but that the DOE, because of the way it is organized, might do worse than private polluters in cleanup. DOE and its contractors continue to operate under an organizational structure that presents serious obstacles to progress in safeguarding worker health and safety, the report said. [Times ©]

Between July 1961 and January 1966, 3,210 whole body counts of workers at INL's TRA, ICPP, SPERT, TAN, and CFA. Forty-six of these counts showed activity greater than 0.1 uCi (uCi = micro-curie or 10-6). Six of the more significant exposures are listed in the following table. [PTR-789 @5]

Case	Nuclides observed	Activity (uCi)	Remarks
A	I-131	0.20	Medical Experiment (count taken at termination)
B	Zr-95 Nb-95	0.10	Contamination on external surface of body
C	Hg-197	0.29	8.75 mrem to kidney, 7.3 mrem to gastrointestinal tract
D	Co-60	0.10	Radioactive contamination on external surfaces of body
E	Mn-54	0.15	Radioactive contamination on external surfaces of body
F	Co-60	1.50	93 mrem to lungs, 94 mrem to gastrointestinal tract, 3 mrem to whole body

Section VIII. B. Stories of Radiation Victims [1] [2] [3]

The Environmental Defense Institute (EDI) has over several decades collected interviews and news stories [4] about individuals who have been affected by radiation exposure at or near the Department of Energy's Idaho National Laboratory (INL) previously called the Idaho National Engineering and Environmental Laboratory (INEEL) located northwest of Idaho Falls, Idaho, the Hanford nuclear reservation in eastern Washington State, and the fallout from over a thousand nuclear weapon detonations at the Nevada Test Site (NTS). [5] EDI hopes that sharing this small sampling of stories of men and woman harmed by radiation exposure will help put a face on the thousands of INL workers and Nevada Test Site "downwinders," [6]

EDI considers all these people victims of America's nuclear legacy - regardless of whether the source was from current operations or fallout from previous INL, Hanford, NTS operations, or the exposure happened while they were employed by Department of Energy contractors. At this time it is not possible for the public to differentiate between INL, Hanford, and nuclear weapons fallout from the Nevada Test Site. The National Cancer Institute conducted a 1997 study that found that four of the five counties in the US that received the most radioactive iodine-131 from the Nevada Test Site (NTS) nuclear bomb fallout were in Idaho. [7] In this report, a special emphasis has been placed on Idahoans since their suffering is least reported. [8]

In 1990, the Radiation Exposure Compensation Act (RECA) was passed to provide monetary compensation of people, including atomic veterans who contracted cancer and a number of other specified diseases as a direct result of their exposure to atmospheric nuclear testing undertaken by the United States during the Cold War. States included Arizona, Utah, and Nevada. The 1990 act provided the following remunerations:

* $50,000 to individuals residing or working "downwind" of the Nevada Test Site
* $75,000 for workers participating in atmospheric nuclear weapons tests
* $100,000 for uranium miners, millers, and ore transporters [9]

Revisions to the act were passed in 2000 and in 2002. However, subsequent attempts to amend the act to include the downwind states of Colorado, Idaho, Montana, and New Mexico have been not been brought to a

[1] Tami Thatcher, Idaho National Laboratory, Hanford, and Nevada Test Site Radiation Exposure Radiation Victim Stories Revision 28, Edited by Chuck Broscious And Tami Thatcher Updated December 2014 http://environmental-defense-institute.org/publications/RadCBC.pdf

[2] Tami Thatcher The Truth about the SL-1 Accident — Understanding the Reactor Excursion and Safety Problems at SL-1. remembered later by the spouse of the second *victim* about his concern that the reactor might blow up. Obscured History of Sticking Control. www.environmental-defense-institute.org/

[3] Tami Thatcher, Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About — How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies Environmental Defense Institute Special Report By Tami Thatcher, April 2017 Radiological and Chemical Exposures at the Idaho National Laboratory That Workers May Not Have Known About - How Health is Harmed by Uranium, Plutonium and Other Radionuclides and Chemicals and Possible Nutritional Support Strategies, by Tami Thatcher, April 2017 www.environmental-defense-institute.org/publications

[4] J. Preston Truman, Jeremy Maxand, and Dr. Peter Rickards sent many of the news stories to EDI that are contained in this report.

[5] "DOE Facts, Declassification of Unannounced Nuclear Tests at the Nevada Test Site, Summary List of Previously Unannounced Tests," DOE Office of Public Affairs, Sam Grissle that states, "There were 925 [announced] nuclear tests at the Nevada Test Site in addition to 204 unannounced tests." The total number of tests would number 1,129.

[6] Tami Thatcher, Radiation Workers at the Idaho National Laboratory and Around the DOE Complex Need to Understand Blood Count Changes That Can Indicate a Significant Radiation Exposure, By Tami Thatcher, July 14, 2018 http://environmental-defense-institute.org/publications/RadCBC.pdf

[7] Specific radiation fallout deposition can sometimes be evaluated with sampling and chemical/radiological analysis to "differentiate" between different fallout depositions.

[8] See the National Cancer Institute mapping of Nevada Test Site fallout and the red hot spots in Idaho on this NCI webpage. http://cancer.gov/cancer_information/doc_img.aspx?viewid=556f5603-23e3-4171-aa5e-77f79d46b27c&docid=ed441687-03f6-4f2e-8eab-4296e8f44606

[9] http://environmental-defense-institute.org/radhealth.html

vote. (See H.R. 1645 113th Congress)

In 2000, another law was passed by congress providing monetary compensation to former Department of Energy workers who get illnesses, such as cancer and qualify for compensation due to their exposure at DOE facilities. The Energy worker compensation act (EEOICPA) law includes this statement: "studies indicate than 98 percent of radiation-induced cancers within the nuclear weapons complex have occurred at dose levels below existing maximum safe thresholds." [10] Even with a large percentage of claims denied, the law has paid out over 10 billion dollars paid in compensation to date.

Two award winning video documentaries "Idaho's Nuclear Dilemma" and "Voices of Victims" that document many of the above and many more victims, are available from Palouse Clearwater Environmental Institute, Moscow, Idaho, or the Environmental Defense Institute website;
http://environmental-defense-institute.org **;** edinst@tds.net

Ian Goddard Explains the Linear No-Threshold Model and Looks at Epidemiology Since the 2006 BEIR VII Report

Ian Goddard put together a video explaining the often debated "linear no-threshold" radiation health risk model. Nuclear proponents often argue that at doses below 10 rem there is no harm; they propose that there is a threshold below which radiation causes no harm. Other proponents argue that hormesis theory shows that radiation at low doses has a protective effect. Ian reviews human epidemiology studies that have been published since the National Academy of Sciences published its radiation health study in 2006. The BEIR VII study had concluded that the linear no-threshold model provided the best fit of the available human epidemiology. Ian's look supports that the BEIR VII study represents or underrepresents radiation health risk and that the linear no-threshold model is still appropriate. [11]

See National Academy of Sciences (2006). BEIR VII. http://www.nap.edu/read/11340

Ralph Stanton's "Nuclear Nightmare"—A "Must Read" for Radiation Workers and Their Families [12]

Tami Thatcher reports: "Ralph Stanton's life and his family's life were forever changed by the plutonium inhalation event on November 8, 2011 at the Idaho National Laboratory's Materials and Fuels Complex (MFC) during examination of fuel plates for the Zero Power Research Reactor (ZPPR). He has written a detailed narrative, titled Our Nuclear Nightmare describing his experience. You can find it on our website.1Idaho National Laboratory management directed Stanton to proceed with ZPPR fuel plate inspection, despite unclear warnings on the plates and despite previously warning, 17 times, by the Safety Oversight Chairman for MFC, that plate inspections in the facility were unsafe. 2Ralph describes numerous irregularities that occurred with regard to records pertaining to his dose and how his radiation dose was assessed. This is an important warning to all radiation workers for Department of Energy sites. Radiological dose estimated by Department of Energy contractors are used in determining eligibility of state Worker's Compensation and for determining eligibility for Energy Employee Occupational Illness Compensation. So, if the contractor underestimates your radiation exposure, you might not be eligible for compensation for illnesses arising from your exposure.

"The assumption that past radiation worker exposures at INL were carefully monitored and recorded is changing as analysts in radiation dose reconstruction for the National Institute for Occupational Safety and Health (NIOSH) 3continue to investigate the ability to reconstruct radiation doses for worker illness compensation claims under the Energy Employee Occupational Illness Compensation Act. 4Recently, their investigations have led to

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[10] See 42 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended.)
[11] http://environmental-defense-institute.org/radhealth.html
[12] Tami Thatcher, Environmental Defense Institute Newsletter June 2019.

statement [13] [14] [15] that radiation monitoring may not have been conducted effectively for alpha contamination in the 1960 and 70s —but other decades remain to be investigated.

"While radiation dose reconstruction for Energy Employee compensation does not rely solely on DOE contractor dose estimates for inhalation of radiological materials, it relies on available records, including logbooks and other records documenting contamination levels as well as worker lung count and bioassay information. Without the information, reasonable dose reconstruction impossible—and illness compensation may be denied.

"Since 2011, the Environmental Defense Institute has provided many newsletter articles pertaining to the November 8, 2011 ZPPR plutonium accident, 5lung counts, dose estimation and the Energy Employee Occupational Illness Compensation Program.

After the ZPPR event, workers were not told of their radiation dose for almost 9 months. Ralph Stanton was told his lung counts indicated a very low intake. Yet, Ralph could not return to radiation work for months because of his elevated bioassay (urine and fecal) results because he was excreting elevated levels of radionuclides. Only after returning to radiation work would he later find out that his excretion rates had remained elevated and did not justify his return to radiation work.

Throughout the ordeal, he was being denied radiation dose estimate information from the company. Obtaining his radiation dose estimation documentation required a lengthy Freedom of Information Act request process. And once obtained, he was on his own to interpret the technical information. Instead of medical help that interfaced with dosimetry experts as policy would suggest, there was months of stonewalling and refusing to provide dose information to Ralph or in-house medical folks. An "expert" was hired who was told that their doses were low simply lectured the men contaminated in the ZPPR accident not to be concerned. Then the expert admitted not knowing that the men had positive bioassay results from excreting elevated levels of americium-241 and other radionuclides months after the accident.

Ralph wrote: "My years spent working at the Idaho National Laboratory showed me that there was the way it was supposed to be, and then there was the way it was." [16] [17]

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[13] Ralph Stanton, Our Nuclear Nightmare, 2019 at; http://www.environmental-defense-institute.org/publications/OURNUCLEARNIGHTMARE.pdf

[14] Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, "Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory" accident 11/8/11 at the Materials and Fuels Complex (MFC). http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor.

[15] NIOSH Radiation dose reconstruction for EEOICPA at http://www.cdc.gov/niosh/ocas/ and http://www.cdc.gov/niosh/ocas/ineel.html 442 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended and see the website for the Center for Disease Control, National Institute of Occupational Safety and Health, Division of Compensation Analysis and Support at http://www.cdc.gov/niosh/ocas/and U.S. Department of Labor, Office of Workers' Compensation Programs, EEIOCPA Program Statistics, http://www.dol.gov/owcp/energy/regs/compliance/weeklystats.htm

[16] Read his complete story, Our Nuclear Nightmare, 2019 at; http://www.environmental-defense-institute.org/publications/OURNUCLEARNIGHTMARE.pd

[17] Tami Thatcher, Environmental Defense Institute, newsletter articles for the ZPPR accident, search our website newsletters at http://www.environmental-defense-institute.org/edipubs.html and see, in particular, these articles: all articles in the October 2013 newsletter; "INL Managers Deny Any Responsibility for ZPPR Accident," and Boise Weekly Half-Life Article Debate, by Ralph Stanton," in May 2014; "Three events show that the Idaho National Laboratory still doesn't know how to monitor airborne alpha contamination," in May 2016; "Public Integrity reports that widespread bad behavior of Department of Energy contractors goes unpunished, including Idaho National Laboratory contractor Battelle Energy Alliance," in August 2017, "Understanding your lung count results," in January 2018, and others.

VIII. Protection of Radiation Victims

A. Empty Promises

The DOE promises to run its nuclear weapons production facilities safely. They promise that new projects planned for INL will not affect the health and safety of the general public and facility workers will be protected.

The truth of the matter is that the federal government established the Atomic Energy Act which exempts them from any liability due to injuries sustained by their nuclear weapons production and testing. The Price-Anderson Amendments Act of 1988 was signed into law to continue indemnification to DOE contractors. This legislation goes on to limit contractors working for DOE from liability even if injuries are caused by gross negligence or failure to follow safety regulations. The law "... subjects DOE contractors to potential civil penalties for violations of DOE rules, regulations, and compliance orders relating to nuclear safety requirements. Reduction of up to 50% of a base civil penalty may be given when a DOE contractor promptly identifies a violation and reports it to DOE. Additionally, the Enforcement Policy gives DOE discretion to not issue a Notice of Violation in certain cases." [Operating Experience] An example of how this system failed is when DOE tried to discipline Rocky Flats contractor Rockwell International for violations. Rockwell received a light slap on the wrist amounting to their bonus for the year because they could prove that DOE as the employer knew about the violations for decades.

Witness the 10th U.S. Circuit Court of Appeals decision to overturn US District Judge Bruce Jenkins' finding in 1984 that the government negligently failed to warn or educate downwind residents of radiation hazards from tests conducted by the Atomic Energy Commission at the Nevada Test Site from 1951 to 1962. Jenkins' earlier ruling came after a trial of 24 "bellwether" claims which represented nearly 1,200 plaintiffs suing the government for some 500 deaths and injuries. The U.S. Supreme Court subsequently refused to hear an appeal on the 10th Circuit Court decision because the Atomic Energy Act provides government-contractor exemption from liability. Congress has steadfastly refused to repeal the Atomic Energy Act; however, they recently awarded some limited compensation to Nevada Test Site Downwinders.

There was no question that the government was negligent in conducting the tests and that it gave false and misleading information at the trials. The legal bottom line is that Congress created laws that specifically exempt the government and any contractors who work for the government from liability.

Radiation victims from INL can find no compensation for their injuries. [Cawley] Not only can they not sue the government or the contractors for whom they worked, but Idaho law does not recognize long term radiation injuries. Typically, it takes 10-20 years for radiation related injuries to surface after exposure. Again, the legal bottom line exempts even the state Workman Compensation Commission from covering long term radiation injuries.

Sweetheart contracts between AEC/DOE and the state Workmen Compensation Commissions provided for: "Hiring of the state's claims administrator in the Tri-Cities [Hanford] was subject to approval by the Atomic Energy Commission (now DOE). That language is still in the current contract. From the beginning of the contract until today, state officials agreed to accept censored and deleted files on workers radiation injuries. The (Labor and Industries) Department will accept the Contractor's description of any accident, even though full details may not be given. This procedure is necessary in order to ensure against the possibility of disclosure of secret information." [Spokesman(e)]

"In 1984, the Ninth Circuit Court of Appeals in San Francisco ruled the workers could sue because the Nevada contract with DOE nullified the integrity of the state's industrial insurance system." [Ibid] The New York Times states, "The DOE has routinely awarded millions of dollars in performance bonuses over the last decade to contractors that run nuclear weapons factories racked by safety, health, and environmental deficiencies according to Government Accounting Office records." [Schneider] INL contractors were awarded $7.3 million in bonuses for 1993, $14.36 million in 1995. [AP(d),1/4/96]

Promises made by the Department of Energy must consequently be viewed as hollow promises. Individuals or communities have no legal standing in court. Safety would by definition have a low priority because there is no accountability.

The author interviewed Michael Cawley who worked at INL between 1955 and 1974 as a machinist. Mr. Cawley was diagnosed as having extensive pulmonary and pleural fibrotic disease that is an incurable and life threatening lung disease. Court documents support his allegation that he was exposed to radiation many times over the course of his eighteen years of employment at INL. This included unprotected exposure to beryllium. Dr. William R. Berry and Dr. Grady at the Boulder, Colorado Medical Center both substantiate Mr. Cawley's contention that his lung disease was caused by radiation exposure while working at INL. [Cawley, 1988] "In 1966 Cawley was exposed to a significant amount of radioactive material. Having passed through a storage area, he was informed by a health physicist that the area was contaminated. He was instructed to remove his clothing and take a shower. The health physicists discovered that Cawley had radioactive particles lodged in his nose, which the health physicist attempted to remove through the use of a small brush." [Cawley© @2] Cawley's notice of injury and claim for benefits was filed with the Idaho Industrial Commission [Workman's Compensation] June 29, 1979. The State Commission would not even give Cawley a hearing on the merits until 1990 when the Idaho Supreme Court ordered the State to respond and pay Cawley $983.23 for legal costs. [Ibid] The benefits the State tried to deny Cawley totaled $207,900.56. [Cawley(d)] Cawley's legal documents list the following exposures: 1) Fast Neutron beam exposed from the Materials Test Reactor Neutron Chopper in 1956; 2) Plugged pneumatic radioactive material (W.A.P.D. B.4 sample) transfer tube requiring MTR evacuation; 3) MTR July 1966 storage area exposure; 4) SL-I reactor explosion January 1961; 5) J.A.-10 Fuel element loading at the ETR canal. [Cawley(e)]

The author interviewed Richard Hansen who lives near Rupert, Idaho (Minidoka county) southwest of INL, in an area characterized as "Cancer Ridge" by the local residents and media. [AP(I), 2/18/89] Rupert residents are the first domestic users of the Snake River Aquifer down-gradient of INL. Hansen says that within the 36- square mile area around his home, there are 60 cancers. These diseases range from thyroid, pancreas, colon, leukemia, and female reproductive cancers. Hansen, a staff researcher in archaeology with the University of California at Los Angles and a Rupert farmer, is asking for scientific studies to determine whether the cancer rate is excessive. Hot-spot phenomenon is discussed Allan Benson's book "Hanford Radioactive Fallout". [Benson, p.28 & 36] In 1997, State health studies of cancer rates in Minidoka county found that there are elevated levels of seven types of cancers when the county incident rates (observed) were compared with the state as a whole (expected). This comparison likely understates the problem because the Idaho counties in the north have high cancer rates likely due to Hanford radioactivity. Also see Section V.A Independent health studies.

Cancers in Minidoka County

Cancer Site/Type	Observed	Expected
Parotid/Salivary	4	3.6
Stomach	37	22.09
Rectosigmoid/Rectum	48	43.82
Bone	4	2.79
Ovary	30	29.2
Brain/CNS	28	21.47
Liver	6	3.82

[IDH&W(d)]

As previously stated, Physicians for Social Responsibility's *Dead Reckoning* report, cites INL exposure records acknowledging 154 workers received greater than 5 rem/yr., and 562 received 4 rem to just under 5 rem between 1951 and 1989. This figure includes only prime contractors and does not include subcontractors, construction workers, security guards, or military personnel. [Dead Reckoning@41]

An example of non-monitored subcontract workers is Kenneth Grover who worked as a night security guard at INL between 1956 and 1959. The author interviewed Grover's daughter who clearly remembers that her father was irradiated during an accident at the site. As a result of his exposure and induced radiation sickness, he was forced to take a three month medical leave from work. Kenneth Grover died a few years later after suffering from cancer and heart disease. The Grover's lived in Monteview, Idaho, just east of the site. Three of Grover's children have thyroid dysfunction problems and one daughter has periodic hair loss, both are symptoms of radiation exposure. A partial listing of 100+ INL accidents and intentional radioactive releases between 1952 and 1995 is provided in attached Appendix.

Clair Burket moved his wife and four old daughter Mary to Idaho Falls in 1958 to work on the Aircraft Nuclear Propulsion Project (ANP) at INL's Test Area North. General Electric was the operating contractor for both the ANP as well as the SL-1 Reactor accident cleanup at the Auxiliary Reactor Area. When the SL-I blew up in 1961, Burket along with other ANP workers were called down to the SL-1 site to extract the three dead bodies and cleanup the contamination. Clair Burket died several years later of a massive brain hemorrhage at the age of 33 and his family believes his premature death was the result of exposure to radiation at the site. Mary attributes her thyroid problems to exposure as an infant to iodine-131 releases from the site. Mary's attempts through Freedom of Information Act requests to access her father's dosimetry records have thus far been denied on the grounds that DOE claims not to have any of Burket's exposure records. Even though the National Institute for Occupational Safety and Health is doing an INL worker mortality study, the agency is uncooperative in assisting in Mary's quest for her father's records.

The author interviewed Jean Dennis, the widow of James Dennis, who was a member of the SL-1 involuntary Army demolition crew brought in by General Electric under contract with AEC to dismantle the reactor after it blew up in January 1991. The 38 eight by ten photographs taken by the AEC and submitted as evidence in Dennis' litigation against General Electric, shows Dennis right beside the damaged reactor core placing the explosive charges on the support beams that held up the 80 ton concrete and lead operating room floor above the reactor vessel. The photos also show the two huge clouds of debris that went into the air when the two separate charges went off, covering Dennis, his partner Arthur Limeruk, and spreading the residual contaminates over a large area. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia (blood & bone marrow cancer), which his medical documents confirm, was caused by exposure to 50 rem/hr for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1,CAB] as grossly understated. Dennis claimed he received internal exposure because of the contamination in his nose. GE's health physics technicians however made no attempt to swab out his nose to remove the contamination or provide chelates to flush out the contaminates. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis ,p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. The US Justice Department defended General Electric John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Horan was also in charge of the Health Physics Department at the site and in charge of worker monitoring of the SL-1 cleanup workers. See Section I Accident History.

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"As a young boy in Jefferson county near the border of the INL he remembers an explosion in the late 1950's that lit up the night sky from his home in Dubois. He remembers smoke pouring from stacks at the then Atomic Energy Commission site, and government workers running frantically at a monitoring station a mile away from his family's farm."..."I've spent hours and hours going over my health history with doctors from the University of Utah and the Fred Hutchinson Cancer Institute," he said. "They say that I must have gotten a good-sized dose of radiation at one time or another. The first time they identified this kind of cancer was after Hiroshima and Nagasaki."..."I don't understand why the department is not looking at Jefferson County. It's closer to the site than any other", Walker told the committee. "If the doctors are right in telling me that the only place, I could have gotten this from is the site, what will the oversight committee do to make sure they don't get away with this again." [Id St Journal(b)]

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Other cases against DOE contractors operating the Nevada Test Site and the Fernald nuclear weapons plant in Ohio have been settled. Fernald residents received $73 million in compensation for environmental damage. It is unconscionable that the federal government has turned against its own people and sided with its big business contractors. The government simply does not own up to its responsibility to compensate people injured by its nuclear bomb factories. Instead of fighting the people and wasting collectively hundreds of millions on legal defense of the criminals, the responsible thing to do is use the money to help those injured.

"Inadequate oversight at the DOE allowed some of the nations' largest law firms to bill the government excessively, including steep photo copying fees in a Hanford case and expensive dinners in Seattle, investigators say. The lawyers, doing work defending DOE contractors against class-action suits, claimed $70 million in legal bills for six lawsuits since 1990, the DOE estimates. About $29 million of that was spent in a case involving the Hanford nuclear reservation in Richland, Wash., including $175,000 in copying fees at 20 to 25 cents a page. Investigators for the General Accounting Office told Congress on July 13, 1994 that DOE officials often did not receive copies of the bills and rarely reviewed the legal costs. 'This was the standard way for the DOE - turning an operation over to a contractor and just paying the bill.' Victor S. Rezendes of the GAO told the House Energy and Commerce subcommittee on oversight and investigation. 'The agency does not know the full costs associated with defending its contractors in litigation, does not have criteria setting forth what costs are allowable for legal services and does not have procedures requiring detailed contractor and DOE review of billed costs', he said." [AP(m)]

The Congressional Office of Technology Assessment (OTA) released a report in April 1993 that cites that DOE is unprepared to protect tens of thousands of workers who would soon embark on a 30-year cleanup of the DOE complex. OTA's 80-page report said that protection of workers in environmental restoration projects of any kind was often inadequate, but that the DOE, because of the way it is organized, might do worse than private polluters in cleanup. DOE and its contractors continue to operate under an organizational structure that presents serious obstacles to progress in safeguarding worker health and safety, the report said. [Times ©]

Between July 1961 and January 1966, 3,210 whole body counts of workers at INL's TRA, ICPP, SPERT, TAN, and CFA. Forty-six of these counts showed activity greater than 0.1 uCi (uCi = micro-curie or 10-6). Six of the more significant exposures are listed in the following table. [PTR-789 @5]

Case	Nuclides observed	Activity (uCi)	Remarks
A	I-131	0.20	Medical Experiment (count taken at termination)
B	Zr-95 Nb-95	0.10	Contamination on external surface of body
C	Hg-197	0.29	8.75 mrem to kidney, 7.3 mrem to gastrointestinal tract
D	Co-60	0.10	Radioactive contamination on external surfaces of body
E	Mn-54	0.15	Radioactive contamination on external surfaces of body
F	Co-60	1.50	93 mrem to lungs, 94 mrem to gastrointestinal tract, 3 mrem to whole body

Section VIII. B. Stories of Radiation Victims [1] [2] [3]

The Environmental Defense Institute (EDI) has over several decades collected interviews and news stories [4] about individuals who have been affected by radiation exposure at or near the Department of Energy's Idaho National Laboratory (INL) previously called the Idaho National Engineering and Environmental Laboratory (INEEL) located northwest of Idaho Falls, Idaho, the Hanford nuclear reservation in eastern Washington State, and the fallout from over a thousand nuclear weapon detonations at the Nevada Test Site (NTS). [5] EDI hopes that sharing this small sampling of stories of men and woman harmed by radiation exposure will help put a face on the thousands of INL workers and Nevada Test Site "downwinders," [6]

EDI considers all these people victims of America's nuclear legacy - regardless of whether the source was from current operations or fallout from previous INL, Hanford, NTS operations, or the exposure happened while they were employed by Department of Energy contractors. At this time it is not possible for the public to differentiate between INL, Hanford, and nuclear weapons fallout from the Nevada Test Site. The National Cancer Institute conducted a 1997 study that found that four of the five counties in the US that received the most radioactive iodine-131 from the Nevada Test Site (NTS) nuclear bomb fallout were in Idaho. [7] In this report, a special emphasis has been placed on Idahoans since their suffering is least reported. [8]

In 1990, the Radiation Exposure Compensation Act (RECA) was passed to provide monetary compensation of people, including atomic veterans who contracted cancer and a number of other specified diseases as a direct result of their exposure to atmospheric nuclear testing undertaken by the United States during the Cold War. States included Arizona, Utah, and Nevada. The 1990 act provided the following remunerations:

* $50,000 to individuals residing or working "downwind" of the Nevada Test Site
* $75,000 for workers participating in atmospheric nuclear weapons tests
* $100,000 for uranium miners, millers, and ore transporters [9]

Revisions to the act were passed in 2000 and in 2002. However, subsequent attempts to amend the act to include the downwind states of Colorado, Idaho, Montana, and New Mexico have been not been brought to a

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[1] Tami Thatcher, Idaho National Laboratory, Hanford, and Nevada Test Site Radiation Exposure Radiation Victim Stories Revision 28, Edited by Chuck Broscious And Tami Thatcher Updated December 2014 http://environmental-defense-institute.org/publications/RadCBC.pdf

[2] Tami Thatcher The Truth about the SL-1 Accident — Understanding the Reactor Excursion and Safety Problems at SL-1. remembered later by the spouse of the second *victim* about his concern that the reactor might blow up. Obscured History of Sticking Control. www.environmental-defense-institute.org/

[3] Tami Thatcher, Radiological and Chemical Exposures at the Idaho National Laboratory that Workers May Not Have Known About — How health is harmed by uranium, plutonium and other radiological and chemical exposures and possible nutritional support strategies Environmental Defense Institute Special Report By Tami Thatcher, April 2017 Radiological and Chemical Exposures at the Idaho National Laboratory That Workers May Not Have Known About - How Health is Harmed by Uranium, Plutonium and Other Radionuclides and Chemicals and Possible Nutritional Support Strategies, by Tami Thatcher, April 2017 www.environmental-defense-institute.org/publications

[4] J. Preston Truman, Jeremy Maxand, and Dr. Peter Rickards sent many of the news stories to EDI that are contained in this report.

[5] "DOE Facts, Declassification of Unannounced Nuclear Tests at the Nevada Test Site, Summary List of Previously Unannounced Tests," DOE Office of Public Affairs, Sam Grissle that states, "There were 925 [announced] nuclear tests at the Nevada Test Site in addition to 204 unannounced tests." The total number of tests would number 1,129.

[6] Tami Thatcher, Radiation Workers at the Idaho National Laboratory and Around the DOE Complex Need to Understand Blood Count Changes That Can Indicate a Significant Radiation Exposure, By Tami Thatcher, July 14, 2018 http://environmental-defense-institute.org/publications/RadCBC.pdf

[7] Specific radiation fallout deposition can sometimes be evaluated with sampling and chemical/radiological analysis to "differentiate" between different fallout depositions.

[8] See the National Cancer Institute mapping of Nevada Test Site fallout and the red hot spots in Idaho on this NCI webpage. http://cancer.gov/cancer_information/doc_img.aspx?viewid=556f5603-23e3-4171-aa5e-77f79d46b27c&docid=ed441687-03f6-4f2e-8eab-4296e8f44606

[9] http://environmental-defense-institute.org/radhealth.html

vote. (See H.R. 1645 113th Congress)

In 2000, another law was passed by congress providing monetary compensation to former Department of Energy workers who get illnesses, such as cancer and qualify for compensation due to their exposure at DOE facilities. The Energy worker compensation act (EEOICPA) law includes this statement: "studies indicate than 98 percent of radiation-induced cancers within the nuclear weapons complex have occurred at dose levels below existing maximum safe thresholds." [10] Even with a large percentage of claims denied, the law has paid out over 10 billion dollars paid in compensation to date.

Two award winning video documentaries "Idaho's Nuclear Dilemma" and "Voices of Victims" that document many of the above and many more victims, are available from Palouse Clearwater Environmental Institute, Moscow, Idaho, or the Environmental Defense Institute website;
http://environmental-defense-institute.org **;** edinst@tds.net

Ian Goddard Explains the Linear No-Threshold Model and Looks at Epidemiology Since the 2006 BEIR VII Report

Ian Goddard put together a video explaining the often debated "linear no-threshold" radiation health risk model. Nuclear proponents often argue that at doses below 10 rem there is no harm; they propose that there is a threshold below which radiation causes no harm. Other proponents argue that hormesis theory shows that radiation at low doses has a protective effect. Ian reviews human epidemiology studies that have been published since the National Academy of Sciences published its radiation health study in 2006. The BEIR VII study had concluded that the linear no-threshold model provided the best fit of the available human epidemiology. Ian's look supports that the BEIR VII study represents or underrepresents radiation health risk and that the linear no-threshold model is still appropriate. [11]
See National Academy of Sciences (2006). BEIR VII. http://www.nap.edu/read/11340

Ralph Stanton's "Nuclear Nightmare"—A "Must Read" for Radiation Workers and Their Families [12]

Tami Thatcher reports: "Ralph Stanton's life and his family's life were forever changed by the plutonium inhalation event on November 8, 2011 at the Idaho National Laboratory's Materials and Fuels Complex (MFC) during examination of fuel plates for the Zero Power Research Reactor (ZPPR). He has written a detailed narrative, titled Our Nuclear Nightmare describing his experience. You can find it on our website.1Idaho National Laboratory management directed Stanton to proceed with ZPPR fuel plate inspection, despite unclear warnings on the plates and despite previously warning, 17 times, by the Safety Oversight Chairman for MFC, that plate inspections in the facility were unsafe. 2Ralph describes numerous irregularities that occurred with regard to records pertaining to his dose and how his radiation dose was assessed. This is an important warning to all radiation workers for Department of Energy sites. Radiological dose estimated by Department of Energy contractors are used in determining eligibility of state Worker's Compensation and for determining eligibility for Energy Employee Occupational Illness Compensation. So, if the contractor underestimates your radiation exposure, you might not be eligible for compensation for illnesses arising from your exposure.

"The assumption that past radiation worker exposures at INL were carefully monitored and recorded is changing as analysts in radiation dose reconstruction for the National Institute for Occupational Safety and Health (NIOSH) 3continue to investigate the ability to reconstruct radiation doses for worker illness compensation claims under the Energy Employee Occupational Illness Compensation Act. 4Recently, their investigations have led to

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[10] See 42 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended.)
[11] http://environmental-defense-institute.org/radhealth.html
[12] Tami Thatcher, Environmental Defense Institute Newsletter June 2019.

statement [13] [14] [15] that radiation monitoring may not have been conducted effectively for alpha contamination in the 1960 and 70s —but other decades remain to be investigated.

"While radiation dose reconstruction for Energy Employee compensation does not rely solely on DOE contractor dose estimates for inhalation of radiological materials, it relies on available records, including logbooks and other records documenting contamination levels as well as worker lung count and bioassay information. Without the information, reasonable dose reconstruction impossible—and illness compensation may be denied.

"Since 2011, the Environmental Defense Institute has provided many newsletter articles pertaining to the November 8, 2011 ZPPR plutonium accident, 5lung counts, dose estimation and the Energy Employee Occupational Illness Compensation Program.

After the ZPPR event, workers were not told of their radiation dose for almost 9 months. Ralph Stanton was told his lung counts indicated a very low intake. Yet, Ralph could not return to radiation work for months because of his elevated bioassay (urine and fecal) results because he was excreting elevated levels of radionuclides. Only after returning to radiation work would he later find out that his excretion rates had remained elevated and did not justify his return to radiation work.

Throughout the ordeal, he was being denied radiation dose estimate information from the company. Obtaining his radiation dose estimation documentation required a lengthy Freedom of Information Act request process. And once obtained, he was on his own to interpret the technical information. Instead of medical help that interfaced with dosimetry experts as policy would suggest, there was months of stonewalling and refusing to provide dose information to Ralph or in-house medical folks. An "expert" was hired who was told that their doses were low simply lectured the men contaminated in the ZPPR accident not to be concerned. Then the expert admitted not knowing that the men had positive bioassay results from excreting elevated levels of americium-241 and other radionuclides months after the accident.

Ralph wrote: "My years spent working at the Idaho National Laboratory showed me that there was the way it was supposed to be, and then there was the way it was." [16] [17]

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[13] Ralph Stanton, Our Nuclear Nightmare, 2019 at; http://www.environmental-defense-institute.org/publications/OURNUCLEARNIGHTMARE.pdf

[14] Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, "Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory" accident 11/8/11 at the Materials and Fuels Complex (MFC). http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor.

[15] NIOSH Radiation dose reconstruction for EEOICPA at http://www.cdc.gov/niosh/ocas/ and http://www.cdc.gov/niosh/ocas/ineel.html 442 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended and see the website for the Center for Disease Control, National Institute of Occupational Safety and Health, Division of Compensation Analysis and Support at http://www.cdc.gov/niosh/ocas/and U.S. Department of Labor, Office of Workers' Compensation Programs, EEIOCPA Program Statistics, http://www.dol.gov/owcp/energy/regs/compliance/weeklystats.htm

[16] Read his complete story, Our Nuclear Nightmare, 2019 at; http://www.environmental-defense-institute.org/publications/OURNUCLEARNIGHTMARE.pd

[17] Tami Thatcher, Environmental Defense Institute, newsletter articles for the ZPPR accident, search our website newsletters at http://www.environmental-defense-institute.org/edipubs.html and see, in particular, these articles: all articles in the October 2013 newsletter; "INL Managers Deny Any Responsibility for ZPPR Accident," and Boise Weekly Half-Life Article Debate, by Ralph Stanton," in May 2014; "Three events show that the Idaho National Laboratory still doesn't know how to monitor airborne alpha contamination," in May 2016; "Public Integrity reports that widespread bad behavior of Department of Energy contractors goes unpunished, including Idaho National Laboratory contractor Battelle Energy Alliance," in August 2017, "Understanding your lung count results," in January 2018, and others.

Section IX. A. Appendix Accidents

Partial Listing of INL Accidents/Unusual Occurrences (1952-2014) DOE Daily Operations Briefs (DOB) and Unusual Occurrences (UE)

1952

June 6; EBR-1 pyrophoric sodium coolant leaks from reactor causing **fire**;

1953

April 15; EBR-1 reactor **fuel element melts** down [ANL-5577];

***1954 ***

January; Materials Test Reactor (MTR) **fuel cladding melted** that released beta and gamma activity into the coolant process water in excess of 40,000 dps/ml [disintegrations per second/ milli-liter]. Workers were exposed to "activities as high as five to seven roentgens per hour inside the MTR tank where it is necessary to work in order to change a number of experiments." [Peaceful Uses of Atomic Energy, 8/55]

June; MTR reactor fuel rod plate **melting**;

July 22; BORAX-I reactor was intentionally put into an **"excursion**" which melted the fuel rods. An explosion resulted spreading fuel and contaminated coolant in a 350 ft. radius around the reactor building. The contaminated soil was just covered up with gravel. 720 Ci released in a cloud that was visible for 3 miles downwind before dissipating. The contaminated soil was covered up with gravel. [ERDA-1536 @ C-3] [DOE/ID-12119 @A187]

July; ICPP released 51 uCi (51 x 10^6 pCi) of long-lived fission product accidentally in one discharge 244,000 gal. to the waste injection well. [ERDA @C-3]

***1955 ***

January 10; ICPP emissions resulting in air contamination at INL;

June 18; Navel Reactor S1W was in **excursion** resulting in fuel melting and 310 Ci radioactivity released;

July 27; Accident - worker contaminated with radioactivity.

November 29; ERB-I reactor had an accidental "excursion" which melted 50% of the fuel rods and resulted in contamination of the building from released long-lived fission products. 10 grams of Pu and 52 kilograms of U-235 in fuel.

November 24; Electrician exposed to 450 mR/hr during ICPP RaLa Run No. 1 [PTR-185];

***1956 ***

February 22; Radioactive emissions from release of 46,134 Ci airborne radioactivity from IET nuclear engine test #3;

March 24; Transportation Accident - carload of uranium scrap derailed and scattered;

June ; IET Test #4(B&C) releases 1.9 million Ci;

July 23; Workers exposed to gamma rays at Materials Test Reactor;

August 1956, the ICPP accidentally released 1 Ci of long-lived fission products to the injection well discharging to the aquifer.

November; Electrician exposed to 450 mR/hr in ICPP centrifuge [PTR-185];

December 6; ICPP RaLa Run No.3 Shipping pot released air-borne activity into PM area

December ; IET Test #6 releases 8,953 Ci;

***1957 ***

March; Materials Test Reactor fuel element damaged during an excursion.

March 20; Fuel Element Burn Tests (A)(B) involved Reactor fuel rods being burned in open air pits releases 78.3 Ci;

September; IET test #8 releases 2,152 Ci;

***1958 ***

February 10; ICPP Workers exposed to C0-60 & I-131 during RaLa run accident releasing high levels radiation into building for 5 minutes and releasing one million pico curies of iodine-131;

February; IET test #10 releases 1.65 million Ci;

March 11-27; BORAX-IV was intentionally put into excursion - a meltdown, resulting in long-lived fission products leaking from the fuel and high radiation and building contamination. Cesium-138 was dominating release and a dose at 500 feet was 12 mR/hr.

March; Accidental release of 1 Curie of I-(131) to atmosphere at ICPP during waste transfer.

April; IET test # 11 releases 4,635 Ci;

May; IET test # 12 releases 29,070 Ci;

May 28; RaLa run at ICPP releases 49.5 curies iodine-131. Thirteen RaLa runs occurred in 1958.

June; OMRE reactor accident - coolant released to atmosphere.

July; Fission Products Field Release Tests (FPFRT) through September (9 tests) involved open air melting of reactor fuel to observe radiation dispersion. 1,334.36 Ci released;

July; Between July and August, ICPP released particulate fallout to the north-east. Maximum dose from a single particle was 25 mrads inhalation and 17 mrads ingestion using Ce-141 as the most hazardous isotope. Part of the release source was solvent process building near the ICPP stack that was venting directly to the atmosphere, however the major source could not be determined.

August; ICPP blower failure caused 10 uCi (10,000,000 pCi) long-lived fission product release to air.

September; ICPP Solvent Burner failure released .25 Ci of long-lived particulate fission product to atmosphere;

October 29; ICPP filter failure released 1,200 Ci long-lived fission particles to atmosphere from fuel element cutting facility resulting in contaminating 200 Acres around ICPP;

November 18; IET test #13 released 9,730 Ci green fission product contaminating 1500 acres south of IET. Ground contamination four hours after release was two micro curies per square foot (two million pico curies) at a distance of 2.5 miles. Primary activity was iodine-131.

November; ICPP pump leak spilled 1000 R/hr waste water (100 curies long-lived fission product) on floor of process building that was later moped up and dumped at RWMC;

December; ICPP waste collection tank released 1 Ci radioactive noble gas and Iodine to the atmosphere caused by a leaking flange;

December 9; ICPP liquid waste release (ten times allowable amount) of 29 Ci including 7 Ci Strontium-90;

***1959 ***

March 3; ICPP Accident - fission release to waste tank vault;

April; ICPP spill in fuel process building of 100 Ci;

May; IET test # 14 released 13,456 Ci;

June; IET test # 15A released 1,954.98 Ci;

June; IET test # 15B released 1,223.36 Ci;

July 9; ICPP released 105 mCi (.105 Ci) of plutonium to the atmosphere. The release was the result of burning plutonium contaminated waste solvent.

September; ICPP accidental leak in NaK heat exchanger;

October; ICPP high-level waste tank service line leaked;

October; Materials Test Reactor released of long-lived fission product gasses;

October; IET test # 16 released 294.42 Ci;

October 10; ICPP accidental release of SR-91 and Ba-139 to atmosphere;

October 16; Criticality accident at ICPP vessel WH-100 released 4E+19 fissions of U-235 (350,000 Curies) 21 workers exposed - some at 50 R/Hr [IDO-10035];

November 30; Engineering Test Reactor rupture of coolant impale tube in reactor;

November; IET test #17 released 6,402 Ci;

***1960 ***

February; IET test # 18 released 14,757 Ci;
February 9; Worker exposed while falling on "hot" equipment while cleaning at ICPP;
February 15; ICPP criticality Incident, [Ginkel];
February; IET test # 19 released 11,381 Ci;
June; IET test # 20 released 10,249 Ci;
August; IET test # 21 (FEET #1) released 3,752 Ci;
August; IET test # 22 (LIME) released 10,522.2 Ci;
October; IET test # 23 (FEET#2) released 2,890 Ci;
October; IET test # 24 (LIME-II) released 7,725.9 Ci;
November 16; OMRE solvent burning experiment .03 Ci;
November; IET test # 25 released 10,171.26 Ci;
December; Materials Test Reactor fuel assembly failure, apex-714;

1961

January; Materials Test Reactor fuel assembly failures;
January 3; SL-1 reactor explosion with fatalities Spec.5.C. John A. Byrnes, Spec.4.C. Richard L. McKinney ; Spec.1.C. Richard C. Legg, released 1,128 Ci January 3 -April; Workers exposed at INL during SL-1 cleanup;
January 7; 50 worker exposures to Si-110 at ETR reactor;
January 25; ICPP criticality accident in vessel H-110 released 5,200 Ci to environment 20 workers exposed [IDO-10036];
February; IET test # 26 released 10,090.66 Ci;
March 27; MTR spectrometer fire;
September 27; OMRE reactor coolant impurities loop fire;
December 12; Engineering Test Reactor fuel element meltdown due to coolant blockage;

***1962 ***

May 10; Fuel element flow blockage in the engineering test reactor [IDO-16780]
March; ML-1 reactor pressure vessel leak;
March; ICPP uncontrolled high-level waste leak in two tanks into vaults;
Jun-Aug; Overexposure of decontamination workers in SL-1 recovery;
August; EBR-II reactor corrosion in coolant seal plug;
August 24; Truck trailer accident load contamination I-129;
September; Worker exposure to 500 R/hr ICPP "E" Cell decontamination [IDO-14599]
November 5; SPERT-I test No. 1 intentional reactor meltdown caused 240,000 Ci released including 500 Ci Iodine.
November 13; MTR reactor fuel meltdown caused by coolant flow blockage. Accident required evacuation.
November 19; Worker exposed to Ir-192 during radiography;
November 25; MTR reactor debris in coolant;

***1963 ***

May 27; Controlled Environmental Radioiodine Test (CERT) May through December 1977 included 29 releases of 32 Ci of Iodine-131.
April-May; ERB-2 reactor coolant pump failure;
August 3; Container of radioactive material dropped and leaks at INL terminal;
October 19; Fuel failure-Borax -V reactor [Forum-Memo];
November; ICPP Accident resulting in plutonium contamination.
November 10; SPERT-I test No. 2 intentional reactor fuel melt down releasing 530 Ci.

***1964 ***

April 1; SNAPTRAN-3 test destruction of SNAPTRAN 2/10A-3 reactor in an open water tank. Radioactive cloud traveled 21 miles, released 24,000 Ci;
April 14; SPERT-I reactor destruct test No. 3 released 1900 Ci.;

May 10; ICPP tank released 5 Ci long-lived fission waste released to ground from leaking line coupling. Three acres inside and ten acres outside the ICPP fence were contaminated.
May 10; Accident causes spread of radioactive waste from Radioactive Waste Management Complex;
July 7; Borax-I excursion released 714 Ci;
July 10; ICPP explosion containing plutonium piercing worker's arm;
July 22; Worker exposed straightening "hot" wire;
Oct. 21 through July 21, 1965 released 32.72 during CERT experiments;

***1965 ***

January; EBR-II reactor fuel element failure [ANL-7010];
January; ATR reactor vibration leak in coolant system;
August; ML-1 reactor coolant leak and **shutdown;**
September.9-13; Leak of 10 curies of I-131 from airfreight shipment. 64 people receiving dispositions in thyroids.

1966

January 11; SNAPTRAN-2: SNAP 10A/2 Reactor intentionally destroyed in open air tests at Test Area North. Radiation readings of 2.7 R/hr from a remote detector. Radioactive plume traveled 30 Kilometers (off-site) released 600,000 Ci.;
September 8&9; Uncontrolled fire in RWMC waste in SDA;

Between July 1961 and January 1966, 3,210 whole body counts of workers at TRA, ICPP, SPERT, TAN, and CFA. Forty six of these counts showed activity greater than 0.1 uCi (uCi = micro-curie or 10-6). Six of the more significant exposures are listed in the following table. [PTR-789 @5]

Case	Nuclides observed	Activity (uCi)	Remarks
A	I-131	0.20	Medical Experiment (count taken at termination)
B	Zr-95 Nb-95	0.10	Contamination on external surface of body
C	Hg-197	0.29	8.75 mrem to kidney, 7.3 mrem to gastrointestinal tract
D	Co-60	0.10	Radioactive contamination on external surfaces of body
E	Mn-54	0.15	Radioactive contamination on external surfaces of body
F	Co-60	1.50	93 mrem to lungs, 94 mrem to gastrointestinal tract, 3 mrem to whole body

1967

February 20; Engineering Test Reactor fuel element melt down due to clogged coolant lines caused by duck tape left over reactor coolant lines. 7.398 g of fuel was lost
November 30; Relative Diffusion Tests (RDT) between November and October 1969 released 10.04 Ci. of radio-Iodine-131.

***1968 ***

February; EBR-II reactor sodium coolant release which immediately ignited the 80 gal radioactive Sodium-24. The sodium coolant is pyrophoric when it comes in contact with air. Boiler plant building and control room contaminated with 4 mCi (4 x 10 $^{-3}$Ci) Na-24. [ERDA-1536@C-5
May 3; Experimental Cloud Exposure Study (EXCES) between May and April 1970 released 987.6 Ci of radioactive Xe-133 and Na-24.

June 14; Contamination from the failure of a first-stage burner while burning enriched fuel elements RDT test;

***1969 ***

August; Tan Support Facility 10,000 gal high-level waste tank overflowed, contaminated soil had radiation readings of 5 Rad/hr at one foot;

August; Experimental Cloud Exposure Study (EXCES) test released 600 Ci;

September; ICPP accidental release 19 Ci long-lived fission product to injection well;

October; ANL-W released 413 mCi of zirconium-niobium-95, cesium-137, cerium-144, cobalt -60, antimony-124 were dumped in a ditch at the ANL-W in uncontrolled incident;

December; ICPP uncontrolled release 1.5 uCi (1.5×10^{6} pCi) in excess of the discharge limits of Sr-90 were dumped to the ICPP injection well

***1970 ***

April 7; Experimental Cloud Study (EXCES) tests released 352.6 Ci through May 25;

June 1; Uncontrolled fire in RWMC SDA waste;

July; Test Reactor Area tank failure released .578 Ci;

***1971 ***

January; ICPP ruthenium released 1 Ci;

February; TSF tank overflowed, 293 gal, .88 Ci long-lived fission waste product released;

March 3; Long-distance Diffusion Tests (LDDT) released between March and September 1000 Ci Kr-85, & 12.3 Ci Iodine-131;

May 5; Accident- contamination which caused evacuation of the ETR reactor building;

May 18; During attempt to remove the highly radioactive KAPL J-10 In-Pile tube from ETR core using the NR-2 transfer cask to ETR canal, the In-Pile tube fell out of the cask striking the shielding block on the top of the reactor. Twelve workers were exposed to over 25 rad/hr. Radiation Juno instruments could only read a maximum of 25 rad/hr. All 26 workers at the Test Reactor Area were evacuated to the main gate. [J-10]

September; Tan Support Facility liquid waste evaporator incident release 266 uCi cesium- 137 (266 million pCi),.0142 uCi Sr-90 (14,000 pCi), .0142 uCi Yttrium-90 (14,000 pCi);

***1972 ***

January; ICPP released 1 Ci. of radioactive Ruthenium-106 from the main stack;

May; ICPP accidental release 1 Ci Ruthenium-106 to environment;

May; Waste Calcine Facility accidental release 10 Ci long-lived fission waste product;

***1974 ***

April; ICPP waste line to high-level waste tank broke releasing 1,000 Ci of Cs-137, Cs-134, Sr-90, and Eu-154 to the soil.

October; ICPP tank line leak released 3,000 Ci Eu-154 with an additional 3,000 Ci contaminated soil left in ground;

***1975 ***

September; ICPP high-level waste line rupture was "discovered" releasing an estimated 14,000 gal of liquid waste containing 30,000 Ci. No accurate amount of release has been established indicating considerably more could have leaked out. To date, it has never been cleaned up.

***1976 ***

January 16; ICPP diversion valve leak, 12 gal. containing 500 mCi (.5 Ci) Sr-90, 500 mCi (.5 Ci) Ce-137, 130 mCi (.13 Ci) Ce-144;

September; ICPP waste line leak, 20,000 gal.60 mCi (.06 Ci) released;

October; ICPP's Waste Calcine Facility cyclone failure contaminated building with 230 mCi (.23 Ci) Sr-90, 40 mCi (.04 Ci) Ru-106, 230 mCi (.23 Ci) Cs-137. Contamination covered up not cleaned up.

***1977 ***

November 1; Accident - radioactive waste truck high-centering on railroad tracks;

***1978 ***

October 17; ICPP criticality accident occurred in first cycle uranium extraction system in CPP-601 building, lasting 20 minutes releasing a radioactive plume (including Iodine) which traveled beyond the boundary to the SW. 6,200 Ci release resulted in one month plant closure and evacuation;

***1981 ***

July 20; Accident - workers exposed to radioactive particles;

***1983 ***

November 17; cancer victim seeking $11 million from INL blast;

***1984 ***

March 12; Report on ducks carrying INL radiation off site;

October; CPP-603 spent fuel storage (IFSF) radiation Shield Door Rails fail. The cause is determined to be from movement of door and/or seismic events. [ID-WINC-ICPP-1990-9020]

***1985 ***

February 15; Accident - worker exposure;

July 9; LOFT Reactor core intentional melt down resulting in fission products leaking into reactor building released 8,800 Ci plus .09 Ci of Iodine, this was the last of eight test series between 1979 to 1985; [A-58]

***1986 ***

December 10; Accident - 2 workers contaminated at INL;

***1987 ***

March 1; Accident - welders exposed to radiation ;

***1988 ***

October 30; Radioactive Ruthenium gas release at ICPP stack Released .17 Ci; Explosion at ICPP resulting in one fatality.

1989

Feb. 27; ICPP employee bypasses radiation monitors and takes contamination home after work shift.

1990

May 9; ICPP-603 IFSF shield door rails inadequate to sustain seismic event. The door hinges had failed in 1984 and the plug had been removed. In 1990 unsuccessful attempts were made to replace the plug in preparation of Ft. St. Vrain fuel.

Nov. 16; Contamination at 4,000 ppm beta-gamma spread outside a controlled area at ICPP-603

1991

Jan.29; NWCF stack monitor found out of calibration

Feb.11; ICPP fuel dissolver exploded, spraying three workers with highly enriched uranium and heated nitric acid; a forth worker was also exposed when he came to their aid. The facility remains closed because of explosion damage and high levels of contamination. Office of Nuclear Safety concluded that the initial contractor investigation & the corrective actions taken by the DOE/ID were inadequate. [Ryan @ 53]

May 2; Failure of EBR-II Fuel can carrier at cpp-603 allowed four cans of fuel to drop out of the can carrier and on top of the criticality control fixture which separates the two tiers of fuel in each storage pot. Faulty welding at ANL-W of the can was the fault.

May 20; Advanced Test Reactor fuel element fell from handling tool to water storage canal floor.

May 29; EBR-II reactor **shutdown** due to neutron detectors were not operative.

June 4; ATR reactor **scrammed** due to under voltage to coolant pump.

June 10; Idaho State files RCRA air/water quality violations and fines totaling $127,793.

June 11; Specific Manufacturing Capacity facility fire in exhaust filter caused by loss of coolant to deburring operations.

June 20; EBR-II **shutdown** due to no filtering and radiation monitoring on common stack violations.

June 21; Radiation contamination in material prepared for off-site shipment labeled "non-radioactive asbestos".

June 25; Operator's left hand is contaminated up to 100 mR beta gamma and 3,000 counts per minute beta gamma on his right hand at the NWCF while cleaning liquid sample cell
July 2; TRA Hot Cell worker contaminated with radium-192.
July 4; Denitrator Off-gas drain malfunction results in highly alpha contamination (Zone-III)
July 8; ICPP worker drained uranium concentrate into unauthorized container.
ICPP liquid radioactive leak into glove box violation.
July 9; Unplanned **shutdown** of the Fuel Storage Basin ICPP-603
July 11; WERF radioactive waste incinerator lost negative pressure in ash room caused by vent damper failure.
July 17; Argonne-W Hot Fuel Examination facility violates OSR for no annual electrical inspection on cooling blowers to fuel storage pits.
July 19; WERF incinerator **shutdown** due to pressure cell disconnected which detects differential between rooms.
July 25; NWCF activated rapid **shutdown** system due to off-gas compressor shutdown during power dip
July 29; Central Facility Area Laundry OSR diocty-1-phthalate violation.
Aug.6; Personal contamination to 500 cpm at ICPP-627 Radiological Materials Area
Aug.6; NWCF **shutdown** due to plugged filters however it took nearly three hours before operators shut down and no spare filter banks were available during that time.
Aug.9; Incineration violation when waste containing greater than 25 mrem/hr limit was incinerated.
Aug.13; ATR reactor **scrammed** due to loss of power to coolant pump.
Aug.13; Unplanned **shutdown** of the Fuel Storage Basin at CPP-603 after extensive corrosion of fuel hanger yokes were found.
Aug.; Unexplained personnel exposure at Test Reactor Area Hot Cell of up to 560 mRem and radiation beams up to 700 mRem/hr [Blush Report DOE Office of Nuclear Safety 4/2/93]
Sept.11; WERF incinerator emissions pre-filters and HEPA filters failure - filters were found completely breached.
Sept.13; NWCF failure of off-gas atmospheric protection system (APS) HEPA filters. The HEPA filters, F-OGF-100/101/102 failed a special requested DOP test after nine months of service. When the filters were changed out it was discovered the filter media had deteriorated. Two of the filters had the filter media missing or partially missing. The third filter's media was intact, but was discolored. Depending on when the filters failed, the APS could have operated for the entire nine months without HEPA filters. [ID-WINC-ICPP-1991-1058]
Oct.14; ATR reactor scrammed due to low coolant pressure caused by malfunctioning temperature control valve.
Oct.16; ATR reactor **scrammed** again due to low coolant pressure caused by another malfunctioning temperature control valve.
Oct.18; ICPP evacuated due to gamma radiation during Fort St. Vrain fuel handling. Fuel handling operation suspended. Radiation detection monitor shielded with lead to quiet alarm. Spent fuel radiation levels being investigated. A few days later an alarm went off in the Irradiated Fuels Storage Facility as a result of these emissions levels. DOE's response was to disconnect the alarm. [Ryan @ 54]
Oct.24; Radioactive Waste Management Complex safety envelope violations at SWEEP plant.
Nov.5; WERF incinerator **shut down** due to unapproved modifications to emissions HEPA filter; and non-approved drums used for shipment and disposal; and exceeding weight limits in incinerator.
Nov.7; ICPP steam generator dust explosion (Jan. 23)
Nov.27; ICPP high-level waste tank leak detection system failed...due in part to sensors and high radiation levels in the valve box greater than 21,500 cpm which repeatedly set off alarms.
Nov.28; ICPP evacuated after radiation alarms sound. [Times News (h)]
Dec. 3; Personal contamination at 1,000 cpm at ICPP-666 while unloading NRF fuel.

Dec.6; Contamination spread in an ICPP-666 Radioactive Materials Area while unloading NRF fuel canister contaminating two workers.
Dec. 22; ICPP-604 Process off-gas System HEPA filter monitors inoperable.

1992

Jan.6; Inspection found 9 alarms disconnected at the ICPP
Jan. 15; WINCO employee takes Cesium-137 contaminated section of pipe off site in his briefcase;
Jan.16; Advanced Test Reactor spilled 350 gallons of sulfuric acid into the "cold" waste pond;
Jan.19; ICPP Process Off-gas System blowers failed for two days while NWCF and other operations continued to operate
Jan.24 NWCF exceeded State limits on nitrogen oxide on five different occasions between 6/89 to 1/92
Feb.1; Fire in CPP-1605 which contains offices and equipment for engineering services
Feb.5; Personnel skin contamination to 100 cpm at the Remote Analytical Lab
Feb. 19; Radioactive contamination found outside controlled areas at Test Reactor Hot Cell Building - radiation readings ranged 1,500 to 28,000 DPM
Feb.1 Fire in CPP-1605
Mar. 4; Significant corrosion found in spent fuel storage racks at ICPP-603. Racks are supposed to prevent fuel rods from getting too close together - thus starting an uncontrolled reaction. DOE report acknowledges uncertainty regarding the facility condition following a major seismic event and the risks associated with such an event
Mar. 6; Container of Plutonium-239 found on the ground outside the ICPP-630 building;
Mar. 18; Radiation beam in the Test Reactor Area Hot Cell was left uncovered. Radiation levels of 20 rem/hr inside the cell and 2 rem/hr outside the cell wall were detected. 18,000 Ci. of Cobalt-60 were charged to the beam. Report calls the incident as a near miss in the sense that prompt fatalities could have resulted from the manner in which the facility was being operated. [Also see Ryan@52]
Mar.16; CPP-603 Middle basin spent fuel bucket yoke failed causing fuel to fall to pool floor
Mar.24; Personnel contamination to 1,000 cpm at the ICPP Flurorinel Dissolution Process Facility
Apr. 1; Unauthorized removal of criticality alarm system warblers at the ICPP.
Apr. 2; Employees forced to stay inside of ICPP due to unplanned radiation release from main stack containing 3 mrem/hr beta-gamma. [ID-WINC-ICPP-1992-0035] Contaminants spread beyond the ICPP boundary fence. Five to six acres had to be decontaminated. Ryan cities flakes the size of quarters falling on 40 acres around ICPP, and DOE sent notice of this incident to Idaho and the Fort Hall Reservation with a cover page erroneously stating; "This is a Drill". [Ryan @ 53][also see DOB 4/3/92], stating flakes 2 inches in diameter released] The released radionuclide composition was Cs-137, Sb-125, and Ru-106.
Apr. 7; Radionuclide release via excessed contaminated file cabinet. 10,000 cpm alpha (Radium-226)
Apr. 12; Advanced Test Reactor was scrammed when a diesel generator supply power failed;
April; High power scram at TREAT reactor caused by incorrectly calculating critical rod position by operator trainee [Blush Report]
May.2; Failure of an EBR-II fuel can carrier at ICPP-603 that caused the fuel to drop out of the can
May 11; Radioactive contamination found on roadway at Test Area North with readings of 700 mR/hr and a welding rod reading 70,000 dpm.
May 18; Unscheduled power outage at Advanced Test Reactor resulted from a malfunctioning rod becoming disconnected requiring the reactor to be **scrammed.**
May 22; CPP-603 lost commercial and standby power generator due to ICPP operator errors
May 26; Unscheduled power outage at ICPP resulted when operator attempting to shut off an alarm in Irradiated fissile Materials Storage and turned off the whole power supply that could not readily be turned on.

May 27; An error found in the irradiation of dosimeters for use in the DOE Laboratory Accreditation Program. Dosimeters for the past three years have been irradiated to higher levels than anticipated and incorrectly read as a result of the errors.
May 28; Idaho State inspection may result in notice of RCRA violations.
June 17; Radiation detected streaming from collimator port at Test Reactor Area Hot Cell # 1. Radiation readings of 700 mR/hr even with shielding. Additional shielding was not sufficient to stop the radiation. A similar incident happened on 3/18/92 Office of Nuclear Safety reviewed historical radiological survey records and discovered a surveillance report in August 1991 which revealed several unexplained employee exposures to dangerous levels of radiation. The Office of Nuclear Safety stated that the DOE/ID did not follow up on this surveillance report and line management failed to respond to the concerns until after the March 1992 incident. [Also see Ryan]
June 25; Personnel contamination to 3,000 cpm beta-gamma at the ICPP NWCF
July 1; NWCF HEPA filter failure due to rapid pressure rise and defective or failed filter material. This incident occurred while spare filter bank was undergoing filter change out and was not available for use. Three hours elapsed before the decision was made to **shut down** the Calciner
July 7; ICPP-603 BORAX-V fuel bucketed yoke failed causing fuel to fall to pool floor
July 18; ICPP NWCF unplanned **shutdown** due to clogged HEPA filters
July 25; NWCF activation of the rapid **shutdown** system due to compressor failure
Aug.2; Power failure at ICPP and 70 mph wind storm causes significant building damage;
Aug.7; Advanced Test Reactor **scrammed** due to loss of coolant and loss of backup diesel generator; restart delayed by malfunctioning control rod.
Aug.11; ICPP shipping cask had loose bolts on trunnion hold-down blocks
Aug.11; Personal Skin contamination in ICPP-640 Electrolytic Dissolution Area
Aug.12; Advanced Test Reactor remains **shut down** pending resolution of control rod problem.
Aug.19; Personal skin contamination at the ICPP New Waste Calcining Facility
Aug.21; Release of radioactivity from ICPP main stack - 25,000 counts per minute (cpm)
Aug.25; Unauthorized disconnection of alarms in ICPP-637
Aug.28; Personal contamination of 1,200 cpm at ICPP-666 Fuel Storage Area
Sept.1; Loss of stand-by power to evacuation sirens at the ICPP Remote Analytical Lab
Sept.12; Personnel contaminated to 20,000 dpm at the ICPP New Waste Calciner
Sept.17; Power outage at ICPP-604 Waste Treatment and loss of instrumentation and ventilation - these facilities operate the ICPP off-gas emission systems
Sept.18; Loss of contingencies against criticality accidents at ICPP-603 caused by side by side placement of highly reactive fuels;
Sept.21; Personnel contamination to 10,000 dpm in the ICPP-604 sample corridor
Sept.22; ICPP NWCF radiation detection instruments found out of tolerance
Sept.23; Three personnel contaminated to 1,500 cpm at NWCF
Sept.27; Sixteen radiation monitors found out of compliance at ICPP and instead of replacing the monitors managers chose to rescind the compliance order
Sept.22; Criticality infraction at ICPP Fuel Storage Basin (CPP-603) were 25 highly reactive fuel elements were stored adjacent to each other. Carbon steel fuel hanger failed allowing fuel to drop to bottom of basin. Violation of double contingency rule.
Sept.29; ANL-W female worker contaminated and left site to shop in Idaho Falls. Contamination not detected until return to the site.
Oct.13; Two workers in full bubble suits were decontaminating a tank floor, the air compressor supplying air to their suits stopped. 250 gal reserve tank provided air for exit.
Oct.20; Worker receives second degree burns while purging a nitric acid (13 Molar) line with compressed air.
Oct.21; Loss of control of radioactive material, building contamination to 50,000 dpm at ICPP-603
Oct.26; Improper fuel storage configuration at ICPP CPP-603. Two instances of expended fuel component configuration. violating criticality separation

Oct.29; Violation of ESA for radioisotope processing at INL. Preparations of isotope processing failed to properly align air sampling equipment to the hot cell - while irradiated targets were in the cell, but before processing began. Operators failed check list for valve alignment and provisions of Experimental Safety Analysis (ESA).

Nov.23; Improper fuel storage at ICPP building 603. Continuing investigation from 10/26 revealed north and middle basins have another improper fuel storage configuration and more corroded carbine steel support hangers. Ryan cites 25 highly radioactive fuel elements were stored adjacent to each other, and in the same area, corrosion caused a carbon steel hanger to fail which resulted in a bucket containing spent fuel to drop to the floor creating a potential criticality. [Ryan @ 54]

Nov.8; ERB-II reactor scrammed due to power perturbation caused by loss of the feed water pump and the secondary sodium loop. Scramming also caused loss of power to the ANL-W site.

Nov.15; Personnel contamination to 400 cpm at the ICPP NWCF

Nov.19; Personnel contamination to 10,000 cpm at the ICPP NWCF

Nov.28; ICPP evacuated because of radionuclide particulate releases at CPP-603

Dec.1; ICPP High-level waste tanks WM-101 and 102 vault sump level instrument probes (leak detection) were discovered to be connected to the transmitter in reverse

Dec.27; Kerosene fire in the Calciner Cell of the New Waste Calcining Facility. During cold operations of the NWCF kerosene fuel which had leaked from a Calciner fuel nozzle ignited resulting in a small fire in the Calciner vessel cell floor which burned for about 35 minutes. Nozzle connection was installed improperly (threads reversed).

1993

Jan.4; Advanced Test Reactor **scrammed.** During a lC-W loop experiment, a scram occurred due to loss of flow signal because of an operator error. The operator did not properly follow the procedure and a reset button was depressed which caused the loop pumps to turn off and the reactor scrammed.

Jan.4; Criticality Alarm System Warblers found Inoperable in CPP-651 and 603.

Jan.6; Unsafe entry into ICPP WL-101/102 Tank vaults by health physics technicians without proper protection.

Jan 9; New Waste Calciner forced to **shut down** due to plugged final off-gas filter plugging

Jan.25 Personal contamination by spray of 13 molar nitric acid at ICPP-601. Operator was not wearing the PPE specified by the HWP

Jan.28; New Waste Calciner again forced to **shut down** due to defective off-gas filters

Feb.2; State issues notice of violations based on May 18-22 1992 inspection. Notice cites, among other, things, a lack of training, and labeling and administrative deficiencies under the state hazardous waste management act.

Feb.26; ICPP-603 underwater fuel storage review found an additional five fuel canister failures.

Mar.4; ICPP-603 fuel canister yoke hook failed

Mar.9; NWCF worker contaminated to 12,000 Disintegrations per minute (dpm) and other areas of the mezzanine where the worker was were found to be contaminated to 100,000 dpm

Mar.13; Worker contamination to 800 dpm at CPP-604 tank farm

April 15; Contamination released from containers sent to ICPP from Pantex via commercial carrier

May 17; Personnel Skin contamination at Argonne-west. The contamination occurred at Fuel Cycle Facility Radioactive Liquid Waste System. Contaminated liquid (tritium and possibly strontium and cesium was sprayed on two individuals standing outside the radiation barrier when flexible tubing became disconnected from an adapter. The two individuals were no wearing protective clothing since they were outside the radiation control area. Individuals were decontaminated.

Sept. 8; A damaged C cell battery was found in the ATR reactor vessel outside of the core region and removed; a thorough inspection of the vessel revealed no other debris and the vessel was closed up.

Sept. 13; Crushed parts of a flashlight were found inside the ATR reactor vessel, but outside the core region and no debris was found on the fuel. Detailed inspections were conducted including the use of an underwater camera video system, but other missing flashlight parts were not found. Reactor operation was delayed for more than two days and in-vessel inspections will be performed following each nuclear re-qualification testing event.

Sept. 24; Approximately one and a half sticks of unexploded dynamite were uncovered during the excavation of an existing underground storage tank at INL Research Center. The site was immediately cleared and an explosive expert was called to the scene where it was determined that no other explosives existed. The dynamite, which appeared to be residue from initial construction was removed and safely detonated.

Oct 12; Approximately 1,540 gallons of diesel fuel leaked from the Central Facilities Area Tank Farm through an open drain valve on a fuel tank.

Dec 12; Two construction workers at the ICPP Tank Farm received whole body radiation doses of 770 mrem and 507 mrem and skin doses of 4,469 mrem and 2,040 mrem while completing work on a valve box.

"During calendar year 1993 at INL, there were 5,145 individuals monitored by whole body counting and 3,116 individuals monitored with urine/fecal analyses. Record summary data does not permit differentiation of how many who have whole body counts may have also had urine/fecal analyses. Of these individuals monitored, six had positive doses for plutonium and one had a positive dose for uranium. The 6 positive plutonium doses ranges from 14 mRem to 53 mRem committed effective dose equivalent. One uranium dosed was 11 mRem committed effective dose equivalent." [DOE Facts @ 2-87]

1994

Jan.21; A leak of unknown volume breached secondary containment at ICPP-604. [Boise Weekly]

April 4; During refueling of the Advanced Test Reactor, 19 workers received internal radiation exposure caused by underwater control rod cutting operations in preparations for disposal. Workers using a remote control saw were cutting through a control rod of hafnium and aluminum and either the saw arced or hit the hafnium which got into bubbles of hydrogen and rose to the surface of the pool. The highest dose was 2 mRem. Hafnium has a half life of 45 days. The facility was evacuated. OCAW union said exposure was 1.3 REM and internal uptake of 96 microcurie of hafnium-181.

April 15; A chlorine leak at ANL-W occurred when 40 pounds of chlorine gas leaked while changing out a tank at a water treatment facility. Of the 40 people exposed, one person was hospitalized for respiratory distress; and seventeen others were treated for respiratory distress. The 900 site personnel were evacuated for two hours. The leak continued for over 41 minutes until an ANL-W Haz-mat team closed the valve. [OE-95-21][DOE/EH-0527]

April 24; Test Reactor Area engineer violated safety procedures by not surveying his clothing before leaving the site. His cloths and shoes were contaminated with Cobalt-60 and Cesium-137 which he took home. The workers home then had to be checked and decontaminated.

1995

March 22; Unauthorized valve modification to Emergency Firewater Injection System is not corrected prior to reactor startup. [OE-95-13]

March 22; Concrete floor core drilling project at the Advanced Test Reactor dropped a 14 pound plug to the floor below were no safety barriers had been erected to prevent access and possible injury. [OE-95-13]

April 13; Decontamination manifold in the New Waste Calcine Facility and an air purge line had become internally contaminated with process fluid. The contact radiation level on the manifold was 3 R/hr. Personnel evacuated the immediate area.

April 13; Contaminated equipment used in an attempt to unplug a resin discharge line in the Test Reactor Area Warm Waste Treatment Facility (WWTF) was placed in the system engineer's office and in the uncontrolled tool crib.

June 30; An operator at the Test Reactor Area was exposed to acid fumes after 1,000 pounds (66 gal) of concentrated sulfuric acid was released while he was purging a tanker truck and fill line used to fill a site acid storage tank. Approximately 25 feet by 50 feet of ground was contaminated. The operator required medical treatment.

July 3; Several pipefitters working at the Advanced Test Reactor were exposed to 50,000 counts per minute by over a dozen isotopes because their anti-contamination (anti-c) clothing provided inadequate protection in the work environment. In another event, a DOE Environmental Health Representative was contaminated while conducting an inspection of the check valve work that was the subject of previous pipefitter contamination. In both cases the Pro-Tech 2000 anti-c clothing did not prevent the migration of graphite particles through the material or protect individuals during bending, kneeling, extreme temperatures, or presence of contaminated liquids.

July 6; A construction worker at the New Waste Calcine Facility was exposed to 383 millirem when he mistakenly worked in a different area with a higher dose rate and failed to hear an alarming dosimeter.

July 12; A construction worker received 383 millirem exposure when instructed to lay blotter paper over a high contamination area at the ICPP

Aug. 19; Misplacement of spent reactor fuel in ICPP-666 storage pool during re-racking operations caused radiation releases amounting to 200 mRem.

Aug. 24; The Advanced Test Reactor Emergency Fire Water Injection System would be rendered inoperable during a design basis earthquake. The purpose of the injection system is to pump water into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during an earthquake.

Sept. 25; At the ICPP Tank Farm, a construction worker was contaminated by work tools when he helped to install radiation monitors on a valve box. The tools had 3 rem/hr beta/gamma contamination. They took a whole body count of the worker which revealed 4.6 nanocuries of internal contamination.

Dec 14; INL Mercury Retort Plant was shut-down and evacuated when propane tank truck attempted to refill a 10,000 gallon propane tank through the wrong port. Forty pounds of propane were released inside and outside the plant.

1996

Feb 8; Argonne-West Sodium Component maintenance Shop was evacuated when a highly reactive sodium potassium (NaK) when a transfer line overheated. Workers were attempting to treat 40 year old Experimental Breeder Reactor - I NaK coolant. NaK will burn if exposed to water or air.

Feb 20; Construction worker died in a fall off a stack of radioactive waste containers at the Radioactive Waste Management Complex.

Feb 22; Safety Analysis of the Advanced Test Reactor found breaks in the coolant piping and fuel damage to be “anticipated” events but that allowable exposure limits for workers would not likely be exceeded and that off-site exposures would also not likely be exceeded.

Mar 20; Criticality safety limits were exceeded when Uranium-235 spent fuel plates were found to be stored in twice the allowable limits of moderator. Moderators increase the hazard of accidental criticality of relatively low masses of fissionable material. The aging plastic moderator caused it to adhere to some of the fuel plates, which slowly oxidizing because the plate ends were cut off prior to shipment to INL.

Mar 21; Idaho Department of Health and Welfare send DOE/ID notice of 61 violations of State Hazardous Waste Management Act and levee penalties totaling $317,300,000.

Mar 28; A 25 year old crane at the Naval Reactor Facility failed, and dropped an 8,500 pound load of reactor refueling equipment. The 8 foot drop significantly damaged the equipment.

May 28; Pipe fitter was burned by sulfuric acid dripping from ceiling after a pipe failed while flushing bulk chemical storage tank at the Advanced Test Reactor. 25-30 ml of acid were ejected. The worker was only protected for a potential frontal spray not an overhead spray.

July 11; A site alert was declared when a range fire northeast of the ICPP perimeter fence. The fire occurred inside a controlled contamination area. Previous survey records show arsenic and cesium contamination that would become airborne as a result of the fire.

July 18; Uranium bearing storage bottles found improperly stored in ICPP violating criticality standards.

July 22; Five construction workers were contaminated during demolition of the ICPP Waste Calcine Facility. Whole body counts showed 500 mrem internal exposure to Cs-137, Sr-90, Pu-238, and Pu-239. The five workers were not wearing respirators yet were working in the immediate area where another group of workers were cutting and removing piping that contained contamination. LMITCO fined $25,000 by DOE for violations of nuclear safety regulations under the Price Anderson Amendments Act. [Star 3/11/97]

Nov. 25; ANL-W EBR-II ventilation monitors found to be inoperable for at least seven months during which time over 28 spent fuel assemblies had been processed

Nov 30; During a dismantling operation of a reactor spent fuel subassembly two fuel pins were dropped. One of the fuel pins fell below the machine and could not be retrieved with standard handling equipment.

Dec 3; ANL-W maintenance workers found that the emergency power diesel generator had been disconnected from the system for over a month.

Dec 25; Advanced Test Reactor while under full power scrammed by experimental loop 'watchdog' timer scram system. The experimental loop primary and secondary DPU operating systems failed triggering the **shutdown.**

1997

Jan 6; Mixed waste shipped from INL's Waste Reduction Operations to Envirocare disposal site was mislabeled and caused worker contamination with lead-227. Envirocare was shut down.

Jan 13; Two INL workers were contaminated during a HEPA filter change out when the second of two filters became disengaged from the lifting device and dropped 12 feet to the cell floor. The Radiological Control Technician (RTC) received 779 mrem and the Operator received 535 penetrating exposures from Cs-137. The RTC's shoe was contaminated with 6,000 dpm Cs-137. [DOB 1/16/97]

Feb.8; Nuclear Metals incorrectly shipped classified depleted uranium in boxes labeled as empty to INL SMC facility which violated Department of Transportation regulations.

Feb.13; A 6M drum of plutonium was shipped by air to Los Alamos without legal authorization and notification to the US Department of Transportation. All shipments were suspended pending an investigation.

Feb.17; Argonne-West Hot Fuel Examination Facility technician received an internal plutonium 239 dose of 143 mrem in addition to external exposure of 1600 dpm on his arm.

Feb.24; A Test Reactor Area Hot Cell operator was exposed to 3.15 rem on his right hand while moving an irradiated sample from a hot cell into a lead cask. Delays in the processing of extremity dosimetry created the potential for exceeding extremity dose limits.

Feb.24; Advanced Test Reactor accident resulted in 410 pounds of Freon when a scaffold fell on and broke a chiller unit line. Operators attempting to use self-contained breathing apparatus found five to be unusable. Freon, according to NIOSH is immediately dangerous to life or health in concentrations as low as 2 ppm.

Feb.27; DOE imposed $25,000 civil penalty on Lockheed Martin Idaho Technologies under the Price Anderson Act for multiple failures to maintain radiation exposures as low as reasonably achievable.

Mar.1; A Test Reactor Area Technician received a whole body neutron exposure of 1865 millirem the month of April and the source of the exposure could not be determined.

Mar.13; Two cesium-137 sources containing 27.5 mCi and 12 mCi with a potential dose rate of 111 mrem/hr were lost and a search was unable to determine their location.

March 20; State fines DOE $970,000 for missing RWMC Pit-9 cleanup milestone.

April 27; Advanced Test Reactor spent fuel element fell off handling device during transfer from reactor to storage pool

May 12; During a trial burn at the WERF incinerator, the chlorine emissions exceeded the administrative limit. Operators ignored monitoring instruments and proceeded with operations.

June 5; Worker exposed to 40,000 dpm of Gd-153, Eu-152, and Co-60 during decontamination of Hot Cell Facility despite wearing a double set of Personnel Protective Equipment. [6/9/97 DOB]

Aug 25; Five workers were exposed to nitrogen oxides while conducting a remote video inspection of underground ICPP Calciner valve box. NIOSH safety limits of 5 ppm were exceeded but the immediately dangerous to life limit of 20 ppm were not exceeded.

Aug 25; State of Idaho Division of Environmental Quality sent DOE/ID a Notice of Non-Compliance for 135 violations of Hazardous Waste Management Act and set penalties at $892,725.

Sept 8; Workers discover that liquid storage tanks (v-1,v-2, v-3, v-9, v-13, and v-14) at Special Nuclear Material Storage Facility contained fissile material in concentrations equal to 45% required for a critical mass. The tanks in question were not controlled as a Criticality Control Area.

Sept 17; Six workers at Test Reactor Area Hot Cell Facility were contaminated with europium resulting in evacuation. Facility contamination measured 260,000 dpm where the workers were located. Two of the six workers received uptakes of 10 to 30 mrem OVER 50 years committed effective dose equivalent and a maximum organ dose of 57 mrem committed dose equivalent to bone surfaces. Radiological surveys determined contamination escaped the Hot Cell. LMITCO claims the six worker exposures were at the 100 mrem level. [Star 9/23/97] This resulted in notices of violation under the Price-Anderson Amendments Act and LMITCO fines of $125,000.

Sept 19; DOE Office of Enforcement and Investigation issued Notice of Violation under the Price-Anderson Act to Lockheed Martin Idaho Technologies and INL Operations Office for six Severity Level III safety violations.

Oct 6; A lead shipment from INL contained contamination on the bed of the truck as high as 10,000 cpm. The trailer is owned by Tri-State Motor Transport.

Oct.7; Workers shirt contaminated during work in the basement buffer area in the manipulator repair glove box room.

Oct 25; Advanced Test Reactor operators discover five holes in gas-tight reactor confinement boundary (during operations) that subcontractors had left unfilled. This breached the reactor gas-tight confinement boundary. A similar event occurred on December 16, 1996 at the same location.

Nov 20; An unprotected Test Reactor Area worker was sprayed with 50 milliliters of sulfuric acid foam while disconnecting an air hose to an air sparge line.

Dec 3; An Argonne-West emergency power switch prevented the transfer of diesel generator power when outside power outage fails to reactor coolant and other process systems. The switch was left off a month earlier (November 9) during diesel maintenance. During that time there was no effective emergency backup power system.

Dec 8; ICPP New Waste Calcine facility maintenance fitter was contaminated after he removed his acid suit in a high contamination area. A radiological control technician measured 8,000 dpm beta/gamma on the fitter’s knees, 3,200 dpm beta/gamma on his stomach, and 39,000 dpm beta/gamma on his modesty clothing. The fitter had removed his acid suit during the job because of heat stress caused by inadequate breaks and excessive hours.

Dec 18; RWMC waste storage building WMF-634 radiation survey required by the state revealed seven Sandia transuranic waste boxes with surface americium-241 contamination levels at 2,500 disintegrations per minute (dpm) per 100 square centimeters. All personnel were evacuated from the building. Undated winter 1997-98; Managers reported fire caused when an engine overheated and caused a fire because the cooling water drain was plugged with ice which prevented circulation of cooling water through the engine coolant heat exchanger.

1998

Jan 6; Fire resulted from an overheated diesel powered water pump when the discharge line froze.

Jan 8; ICPP reactor fuel handlers dropped a container of uranium bearing material

Jan 12; The Advanced Test Reactor at the Test Reactor Area had an uncontrolled **shutdown** after a secondary coolant line system piping leaked.

Feb.3; Workers respirator air line failed due to the plunger being reversed in the quick disconnect line which could have been serious if the worker was in a contaminated are at the time of discovery.

Feb 26; Five lithium containers were found to be improperly stored in a nitrogen charged glove-box instead of the required argon charged glove-box. Lithium reacts with nitrogen and can result in a highly exothermic reactions when exposed to water or oxygen.

March 1; A liquid waste evaporator that was processing uranium oxide spilled 50 gallons of the waste on to the building floor when it lost steam used to heat the evaporator. No safety control systems were installed to shut the process down in the event of a malfunction.

March 11; WERF **chlorine emissions limit exceeded during incinerator operations** of 33 boxes of MLLW indicated HCL concentrations rose rapidly.

March 13; ANL-W Fuels Manufacturing Facility glove-box **fire** broke out when a technician was consolidating cans of passivated uranium hydride (uranium corrosion) in an air atmosphere glove-box and opened one can (1.7 kg) resulting in a spark that caused a fire in both cans. Despite putting Met-L-X designed to extinguish metal fires on the blaze, it took ten minutes before it was brought under control.

March 17; Test Reactor Area operator inadequately secured one end of a hose that went to a drain pit sump resulting in a spill of waste containing halogenated and non-halogenated solvents and hydrofluoric acid. Some of the 16 gallon spill went into the soil around the pad.

March 18; Worker found contamination on his right shoe during the decontamination of a seal rube bag-out ring at the manipulator maintenance.

March 19; Test Area North employee received an unexpected radiological exposure to neutron from an improperly stored americium-beryllium source which was stored on the top shelf in a room below the employee’s office for six years. Investigators believe other workers were also exposed.

March 19; Test Reactor Area TRA-605 waste water spill to environment while transferring spent filter resin to Resin Disposal Cask.

April 1; Test Reactor Area (TRA-777C) underground waste storage tank leak detection system non-functional and leaks possible and undetected.

April 3; Test Reactor Area underground waste storage tanks leak detection alarm was found to malfunctioning. Due to noncompliance with inventory control requirements, investigators were uncertain if a release had occurred.

April 8; Specific Manufacturing Capacity Facility at Test Area North found that they had been shipping contaminated resins off-site since March of 1997 resulting in loss of control of nuclear materials.

May 5; ATR operator inserted an experiment capsule into the wrong capsule irradiation position, and was lost. Because it was in the wrong position it was not discharged from the reactor and was over irradiated. [OES-98-19]

June 9; Test Reactor Area raw water tank found to contain PCB’s.

June 30; Three reactor operators exposed at Advanced Test Reactor with trimethylamine above the short-term (15 minutes) exposure limit while recharging anion exchange resin in a demineralized tank. The operators were exposed for less than 30 seconds and may have resulted in personnel injury.

July 21; Advanced Test Reactor Critical Facility emergency **shut down** when an unplanned power excersion resulted from control cylinder withdrawal failed to operate.

July 28; **One Test Reactor Area worker (Kerry Austin) killed and 14 other workers sustained life threatening injuries** when trapped in building 648 during preparation for electrical system preventive maintenance, a high-pressure CO2 fire suppression system unexpectedly activated when workers opened the last of several electrical circuit breakers. Workers did not have means to safely escape and were deprived of clear exit pathways, emergency breathing apparatus. No alarms sounded or evacuation warning alarms.

Aug.9; INTEC plant wide emergency communications and alarm system failed and the backup power system and battery backup also failed.

Aug.19; Eleven workers received external exposure at Fuel Conditioning Facility during a seal tube repair when a release of radioactive contamination to the operations corridor occurred. Of the eleven, four workers received an uptake, (determined by whole body count) with the highest reading being 23 nanocuries of cesium-137.

Oct.7; Fire Alarms found inoperable at INTEC.

Oct.15; Two workers at Waste Experimental Waste Reduction Facility (WERF) incinerator were exposed to 2.68 times the permissible OSHA levels for cadmium dust of 5 micrograms per m3, during cleaning the incinerator off-gas heat exchanger.

Oct.26; Fuel Storage Area found to not meet seismic code requirements because of a misapplied computer code for soil structure interaction used in seismic analysis.[98-43]

Sept.; DOE Office of Oversight Progress Report September 1998 found that "Workplace safety at INL has deteriorated since 1994" and that "corrective actions plan found that deficiencies were not resolved and that lessons learned from previous accidents were not being effectively applied. In environmental management and controls, data indicate weak regulatory compliance and inadequate, short-term, quick-fix solutions. Long term solutions are only in the conceptual stages, with no defined strategies, plans of action, or milestones." "Specifically, one-fifth of all INL occurrences in 1997 were related to radiation protection (personnel contamination) and environmental management occurrences have increased by one-third from 1994 through 1997."

Sept.1; INTEC radiation laboratory analysts received internal plutonium-239 exposure from inhalation that measured 0.1 mrem from unprotected work on plutonium-contaminated graphite molds. [Operational Experience Summary 98-47]

Sept.21; DOE fines LMITCO $55,000 for violation Price Anderson Act resulting from Advanced Test Reactor Critical Facility disabling of the seismic scram subsystem discovered in October 1997.

Sept. ; DOE Oversight Analysis Group issues Office of Oversight Progress Report covering INL's non-compliance with environmental regulations, poor implementation of worker safety and health programs and privatization issues. The report cited, "workplace safety performance has deteriorated," "recurring problems in work control and facility authorization basis, noncompliance with environmental regulations, and cost overruns associated with the Pit-9 project," "INL has not established an effective process to pro-actively track and prioritize corrective actions. Further, ES&H functions and activities are not always integrated into programs or work planning." "Worker competence and safety performance are also impacted by the reduction enforce at INL since the beginning of integrated management. The reductions have affected the experience level of workers and reduced morale. Since 1994, INL has experienced to workplace fatalities, a serious electrical shock, and many unplanned exposures and near misses involving workplace hazards." "Significant weaknesses are also noted in INL's environmental management program as shown by the site's having received four Notices of Violation from the State of Idaho for environmental non compliance since 1994, as well as 4 of the 26 DOE Enforcement Actions issued by DOE through

June 1998." "In recent years, weakness in work planning and controls have resulted in two Type A accidents as well as many near misses involving workplace hazards. The identified programmatic deficiencies include insufficient worker training, lack of hazard identification and control, and inadequate supervision of work."

Sept. 28; On 9/27/98 the Region VI (Idaho) Radiological Assistance team was deployed to Idaho Falls to investigate two cooler-type containers bearing cesium transport index 5 labels. The containers were discovered in a residential home's garage. The team determined that the containers held sealed radioactive sources, on cesium-137 and one amercium-241." [DOE Daily Filed Management Report, September 28, 1998]

Nov.4; Waste Experimental Waste Reduction Facility (WERF) incinerator worker seriously injured when thrown against an air receiver and into a concrete wall from the concussion following a catastrophic air compressor **explosion**. Compressor parts, debris, and oil were propelled into the south end of the compressor room, and immediately filling it with atomized lubricating oil and smoke.

Nov.25; RWMC fire alarm notification to other facilities was found to be "non-functioning" for over three weeks.[Operational Experience Summary 98-48

Dec. 14; Advanced Test Reactor forced into unscheduled **shutdown**.

Dec.17; Two workers at Argonne-West 752 analytical Laboratory and two workers at Fuel Conditioning Facility received carbon monoxide exposure when a fork lift truck was left running next to the intake for two breathing air compressors. The four workers showed signs of CO exposure and were transferred to INL Dispensary.

Dec.22; Six workers contaminated at the New Waste Calcine Facility incinerator during waste transfer operations. Additionally, two pickup trucks, some road surfaces, and hallway carpets in another INTEC were contaminated when workers left the NWCF.

Undated; INTEC (ICPP) Fuel Element Cutting Facility (CPP-603) HEPA filter failure resulted in outside ground contamination of 131,302 square feet. [Waste Area Group 3, RI/FS page 2-129]

1999

Jan.3; Fire at Argonne-West Sodium Process Facility resulted when a sodium leak (four ounce) in the reaction vessel sodium injection lines. The process was **shut down** and the facility evacuated.

Jan.6; At Test Reactor Area, an Iridium-192 pellet was unknowingly removed from a cell charging port at the TRA Hot Cell Facility and resulted a radiation filed of approximately 800 rem/hr on contact. Three workers were exposed to 2 rem/hr and one worker received 14 rem/hr exposure.

Jan 7; INTEC NWCF and CPP-665 & 679 fire detection system found inoperable due to degradation, down for two weeks for being corrected. Operator attempted to cover up by destroying printout. [ID-LITCO-Landlord Occurrence Reports 9901]

Jan. 11; New Waste Calciner Facility **fire** erupted while bringing the NWCF into operation, a flexible, braided stainless steel oxygen hose for the calciner vessel #4 fuel nozzle failed. This failure resulted in a spray of kerosene mist, which ignited in the cell.

Jan. 11; Butte County High School student was contaminated during tour of Advanced Test Reactor Canal Area. Cobalt-60 contamination measuring 23,500 disintegrations per minute (dps) was found on the students shoes.

Jan.15; New Waste Calciner Facility incinerator **fire** in the oxygen/kerosene fuel loop was caused by missing seals. It is believed that absence of these seals allowed oxygen and kerosene to leak, mix and catch fire at calciner operating temperatures.

Jan.19; INTEC a maintenance electrician at CPP-601 and 640 received contamination (12,000 cpm) beta-gamma, the gamma scan showed Cs-137 at 6,000 dpm. [ID-LITCO-Landlord Occurrence Reports 1998-0002]

Feb.3; ICPP, Two of four air compressors crucial to radiological material transport between systems failed.

Feb. 4; Waste Experimental Reduction Facility (WERF) incinerator worker exposed to contamination when he entered a mixed-waste incinerator chamber to remove hardened hearth ash from an ash hopper. A stand down order was issued

Feb.12; INTEC standby power generator starting float mechanism disconnected preventing startup. [ID-LITCO-Landlord Occurrence Reports]

Feb. 17; INTEC nitric acid leak contaminated employee's head and arm. [ID-LITCO-Landlord Occurrence Reports]

Feb. 17; Advanced Test Reactor operators found that a flux trap target capsule holder assembly had been rotated 90 degrees from its intended position since 1994. Miss orientation of the targets could have caused a variation of the neutron flux peaking within the flux trap resulting in operating the advanced test reactor outside its safety authorization basis.

Feb. 19; INTEC high-level waste transfer error from VES-WH-101 Tank Farm containing 1976 gallons went to VES-WL-133 and 1325 gallons went to VES-WM-100 for a total of 3,301 gallons. [ID-LITCO-Landlord Occurrence Reports]

Feb. 23; Test Area North radiological control technician worker was contaminated with 2,000 dpm cesium-137 when he walked through water that had become contaminated when it leaked from the roof onto the facility duct-work.. Fan room floor contamination measured 23,900 dpm gamma.

March 8; INTEC diesel driven fire water pump batteries exploded during test startup. [DOE Operational Experience Summary 99-12]

March 9; INTEC Fuel Storage Area operators failed to store a fuel assembly in the storage port that was specified on a fuel receipt record which could have resulted in a criticality but luckily was stored with compatible fuel assemblies.

March 10; INTEC power failure at CPP-603 and CPP-1758. [ID-LITCO Landlord Occurrence Reports.]

March 16; INTEC NWCF individual (with Science Applications) was exposed doing NWCF off gas sampling. [ID-LITCO-Landlord Occurrence Reports]

March 21; Waste Experimental Reduction Facility (WERF) incinerator operator was radiologically exposed to europium and the waste sizing room was also contaminated. The cause of the accident was inaccurate isotopic data from the site waste-tracking database. Contamination levels were greater than one-million dpm beta-gamma and 17,500 dpm alpha.

March 22; Advanced Test Reactor crane dropped a 400 pound irradiated inpile tube assembly being lifted from the reactor core and narrowly missed hitting a worker. The uncontrolled fall damaged the storage well and docking plate.

April 1; INTEC NWCF individuals received exposure to methylene chloride and toluene during off-gas sampling over two months. The exposure data indicated values that exceed twice the value of the limits established for a 40 hour workweek of methylene chloride of 105 ppm; toluene at 166 ppm. Samples at the base on INTEC main stack exceeded OSHA limit of 25 ppm. [ID-LITCO-Landlord Occurrence Reports 1999-006]

April 7; INTEC NWCF high radiation area (exceeded 1 rem/hr) found unattended when it should have been in a secured locked box. [ID-LITCO-Landlord Occurrence Reports]

May 5; INTEC bacterial contamination found in potable water supply. [ID-LITCO-Landlord Occurrence Reports]

June 13; INTEC emergency alarm and personnel emergency paging system was found non-functional when managers attempted activate the facility incident response team to respond to a personnel injury. The system has a history of intermittent failures.

June 21; ANL-W West Fuel Conditioning Facility special nuclear materials security handling requirements were violated causing a general **shut down** of the facility.

June 30; ANL-W employee performing an oil vapor test on a breathing air system was burned by concentrated sulfuric acid expelled from a drager [sic] tube. The employee received burns to the right side of the neck, the right forearm, and the little finger of the left hand.

July 12; INTEC (ICPP) fire in a power beaker resulted in loss of power, communication, and ventilation system failure. The New Waste Calcine Facility (high-level waste incinerator) at INTEC was evacuated when backup generators, and battery backups failed. Three radiologically contaminated areas within facility radiological buffer areas were found and the cause was due to ventilation failure. Fuel Receiving and Storage Facility and Irradiated Fuel Storage Facility at

INTEC were also evacuated because backup generator power failed to be automatically routed into the system. A similar power failure occurred at ANL-W in 1997.

July 15; INTEC NWCF shift supervisor certification expired two months earlier in violation of operating rules. [ID-LITCO-Landlord Occurrence Reports]

July 20; RWMC Pit-9 waste characterization program shut-down due to sonic drilling into the pit could cause the mixture of potassium and sodium nitrates and organic chemicals in the waste to explode or ignite.[Star 7/22/99 pg 4]

July 27; ANL-W rigger injured in construction accident

August 23; INTEC, three of four air compressors fails and the fourth was unable to maintain plant air demand. [ID-LITCO-Landlord Occurrence Reports]

August 24; INTEC New Waste Calcine Facility operators failed to refuel a diesel powered portable air compressor causing it to **shut down** and resulting in a loss of plant air. The facility manager ordered an evacuation because the air compressor shutdown reduced the plant air supply and caused the ventilation system intake dampers to close. Failure to maintain the minimum air supply resulted in a facility evacuation and could have resulted in additional facility evacuations or the spread of contamination. Investigators determined that the portable air compressor was being used as a backup supply because three of the four permanently installed air compressors were out of service.

August 25; Operator suffered heat stroke while working in high-temperature area. Worker was wearing three sets of personal protection equipment and a full face mask respirator. He worked one hour when the maximum safe limit is 15 minutes. Management fails to provide refrigerated air lines for workers because of expense

Sept.15; INTEC air quality check on portable breathing air compressor expired but still in use. [ID-LITCO-Landlord Occurrence Reports]

Sept. 17; Specific Manufacturing Capability Facility operator incorrectly opened the main flush valve to the evaporator process resulting in a spill of 20 gallons of uranium process liquid on the floor of the plant.

Sept. 20; INTEC radiation worker contaminate on his arms at INTEC Tank Farm 20,000 dpm/ 50 mrem whole body that went through protective clothing. [ID-LITCO-Landlord Occurrence Reports 1999-0011]

Sept.23; Hydrogen gas and a spark produced a quick fire at the Advanced Test Reactor destroying the HEPA filters

Oct.24; INTEC Calciner air compressor shutdown because it ran out of fuel. “This resulted in a shortage of plant air impacting operating facilities when pressure dropped below the limits required to sustain operations.” NWCF was evacuated. [1999-0011 Final Report]

Nov. 6; A leaky valve in the primary coolant system caused an unscheduled **shut down** of the Advanced Test Reactor (ATR. The ATR lost 55 hours of operation. An internal report concluded that a lack of preventive maintenance contributed to the problem. This forced shut down “cost $392,000 because preventive maintenance was not performed. A nearly identical failure occurred in 1996. [DOE/IG 3/01]

2000

Jan. 24; An over-pressurization condition in a furnace caused an explosion that led to an exhaust stack falling to the floor. Although no one was injured, this was the second failure of this furnace. A report on the incident cited improper maintenance as the problem. Incident reports identified other furnace problems, all related to inadequate maintenance. DOE/IG audit states “We further noted that, as of April 2000, the backlog of preventive maintenance was approximately 311,000 hours.” [DOE/IG 3/01]

March 17; Test Area North Hot Shop Special Equipment Service Room had two radiation penetration areas without shielding. The Hot Shop also had “several additional straight through radiation penetrations.” [Operational Experience Summary 98-47]

August 5; The Test Reactor Area potable water supply was contaminated after the area’s chlorination system failed. A report linked the problem to maintenance that was neglected. Auditors found that $362,700 (just for IFSF operation) was transferred out of the maintenance budget and into current operating budget. [DOE/IG 3/01]

2002

Nov. 20; Four workers at ATR received radioactive contamination on Nov. 20, when a shipping cask loaded with Cobalt-60 failed to depressurize properly after a routine cask pressure check. The incident occurred at the Advanced Test Reactor. The four workers – a heavy equipment operator, and engineer, a mechanic and a pipe fitter – were wearing the proper protective clothing and were quickly decontaminated. Three of the four tested positive for nasal contamination and were further tested for internal contamination. None of the three was found to be internal contaminated. [DOE/ID Press Release November 25, 2002]

2003

August 14; AMWTP at RWMC fire during venting of a 55 gallon waste drum containing a sludge mixture of plutonium contaminated solvents mixed with concrete. The drum was part of a retrieval of buried mixed waste at the INL RWMC burial ground. About 20 drums were found to be "bulging from built-up pressure, such as hydrogen gas.[Times-News August 14, 2003] [also see the Albuquerque Journal (8/14/03) that states "the drum contained radioactive sludge from the Rocky Flats nuclear weapons plant in Colorado. In the 1970s, drums from Rocky Flats were sent to Idaho for long-term storage until a permanent waste dump could be built. In this case, however, flames leapt from the drum as soon as it was vented."

2004

July 26; INTEC vapor leak that first started June 24 involving a gas cylinder that contains anhydrous (containing no water) hydrofluoric gas. Employees were instructed to remain indoors. This is an active work area were old cylinders are being recovered from an existing burial pit. The 40-year-old cylinders are being retrieved and stored.[DOE News Release 7/26/04]

2005

Nov. 8; RWMC propane leak caused the **evacuation** of 650 employees in the vicinity of RWMC and the AMWTP. Initial reports indicated the propane was leaking from an overfill line on a 1,000-gallon propane tank. Further reports indicated the leak is coming from a failed line or valve leading to a pair of 1,000 gallon propane tanks connected in series as part of the a heating system at the RWMC's Accelerated Retrieval Project Facility. [DOE/ID News Release 11/8/05] Other reports indicate that propane leaks occurred twice during the summer of 2005.

DOE order O 232.1A Effective Date 8/012/97 closed public access to DOE's Occurrence Reporting and Processing of Operations Information.

2006

June 22: During a Safety Analysis Report (SAR) review, Advanced Test Reactor personnel identified a Potentially Inadequate Safety Analysis (PISA) condition regarding Primary Coolant System (PCS) overpressure protection in relation to a complete loss of heat sink (LOHS). Upon a LOHS condition, the PCS water will heat up, expand, and cause a pressure increase. Additional flow from the gland seal water (GSW) pump was not considered in the analysis. However, combining the GSW flow of 68 gallons per minute (gpm) with the LOHS transient flow (maximum of 622 gpm) would result in a total flow of 690 gpm. This would exceed the capacity of the SAR minimum required relief valve flow. The currently installed PCS relief valves have a combined certified relief capacity of 700 gpm, which would provide adequate protection for this transient. Appropriate notifications were made and an Unreviewed Safety Question evaluation was initiated. There were no restrictions or interim controls associated with this PISA conditions. (NE-ID--BEA-ATR-2006-0007)

June 22: During a Safety Analysis Report review, Advanced Test Reactor personnel identified a Potentially Inadequate Safety Analysis condition regarding an extreme over-speed of the diesel-powered standby pressurizing pump. The analysis assumed that only the pressurizing pump would be affected by the diesel over-speed, and did not take into account the flow increase from the diesel-powered gland seal water pump. Appropriate notifications were made and an Unreviewed Safety Question evaluation was initiated. (NE-ID--BEA-ATR-2006-0008)

May 22: During routine plant observations, it was noted that an unused Advanced Test Reactor (ATR) fuel element storage position was moving laterally approximately 1/2 inch. Movement was most likely induced by the flow from the canal recycle system. At the time, no other storage positions were noted to be moving and this condition was treated as a material deficiency. An extent of conditions review was performed and two additional storage positions were found to move greater than the design dimensional tolerance (1/32 inch). Initial assessment indicates that due to the large amount of conservatism built into the criticality safety evaluation for the fuel storage grid, this small amount of lateral movement poses no threat to criticality safety and no interim controls are required. ATR management has removed the three storage locations from service until a new detailed criticality analysis of the grid is completed. (NE-ID--BEA-ATR-2006-0005)

June 7: The Design Basis Reconstitution (DBR) team discovered a minor calculation error in the high pressure set point of the Advanced Test Reactor plant protection system. When primary coolant system pressure increased to a pre-determined value, the ATR core and several pumps are shutdown automatically. Due to the inaccuracy, the automatic shutdown may have been slightly delayed. The miscalculation was of such small magnitude, it was determined that no additional controls or limits were required for the continued operation of the ATR. The DBR is an effort to search for and correct errors and inconsistencies in the design of the ATR. Similar DBRs have been conducted on numerous commercial nuclear reactors. (NE-ID--BEA-ATR-2006-0006)

June 26: During post-maintenance testing at the Advanced Test Reactor Critical (normal shutdown/ outage period), the #3 safety rod failed to drop into the reactor core, as required. A spare actuator controller was installed in the #3 position and the test repeated. The #3 safety rod again failed to drop into the reactor core, indicating performance degradation associated with the actuator controllers and their circuitry. Plant and Nuclear Safety Engineering commenced an evaluation of the problem for indication of a possible original design deficiency and a reasonability determination of the existence of a potential inadequacy in the safety analysis (PISA). There was no safety impact since the discovery was during facility shut down. Currently, there are no programmatic impacts. There is potential for future impacts, if further evaluation reveals the need for component redesign. (NE-ID--BEA-ATR-2006-0009)

July 26: A review of the powdered uranium inventory stored at the Nuclear Materials Inspection and Storage Facility (NMIS) was conducted to determine if it was within the safety basis to repackage and permanently remove the material from the facility. The quantity of material in some of the individual packages was large enough to raise a question about whether the current safety documentation was sufficient, resulting in an unreviewed safety question finding. Interim controls were established for the movement of uranium powders from these approved storage areas. (NE-ID--BEA-ATR-2006-0010)

Aug 2: Operations personnel were routing tubing through the Advanced Test Reactor Loop 2B transmitter cabinet when the tubing came in contact with a conduit. The radiological controls technician noted a spark coming from the end of the conduit upon contact. Work was immediately stopped, management was notified and boundaries were established to restrict access to the area. The source of the spark was determined and power to the energized wiring was tagged out. The wiring was placed in an electrically safe configuration by insulating the exposed ends of the wiring and then power was restored. (NE-ID--BEA-ATR-2006-0011)

Aug. 7: Battelle Energy Alliance has a zero defect policy for administration of the lockout/tag out (LO/TO) process. Recently two events fell short of the zero defect expectation and caused the contractor to stop work and a critique and safety stand downs were conducted. Subcontractors were then trained on the LO/TO requirements and the contractor’s expectations. In neither case was work performed without hazard mitigations in place. (NE-ID--BEA-ATR-2006-0012)

Aug. 21: During non-routine maintenance on several Advanced Test Reactor switchgear and motor control centers, the systems control panel was placed under Lockout/Tag-out (LO/TO). During a control panel recheck an energized power source was found. Work was immediately stopped. A critique was held and the cause was identified prior to work restarting. (NE-ID--BEA-ATR-2006-0013)

Aug. 22: Neutron Radiography Reactor operations were being performed when an automatic reactor **shutdown** occurred. No observable failure was identified. The reactor was restarted by reactor operations personnel following verification that the high voltage power supply spurious alarm was clear and operational checks of the reactor protective circuits were completed satisfactorily. Reactor operations personnel did not notify management immediately and did not obtain permission for continued operation. As a result, the reactor has been **shut down** and cannot be restarted without line management authority. A critique is being performed. (NE-ID--BEA-NRAD-2006-0001)

Aug. 23: It was discovered that the Advanced Test Reactor's Safety Analysis Report did not fully analyze the bounding of accidents for reflector aging. A Potentially Inadequate Safety Analysis was identified after this discovery. Compensatory measures were taken, appropriate notifications were made, and an Unreviewed Safety Question Determination was initiated. (NE-ID--BEA-ATR-2006-0014)

Aug. 28: Part of the ongoing Advanced Test Reactor Design Basis Reconstitution Program includes review of the Safety Analysis Report (SAR) and supporting calculations. This review has resulted in a Potential Inadequacy in the Safety Analysis in Section 15.6, "Decrease in Primary Coolant Inventory." One of the supporting calculations had several deficiencies. The calculations will be corrected and changes made. Interim controls have been established to assure secondary coolant system activity remains within the controlled limits. (NE-ID--BEA-ATR-2006-0015)

Oct. 2: During a standard review, it was determined that a more detailed analysis was needed for a maximum potential accident scenario at the Advanced Test Reactor spent fuel storage canal. No compensatory measures were required because requirements are already in place to prevent the movement of loads over irradiated fuel in the canal. Appropriate management notifications were made, and a more detailed safety review was initiated. (NE-ID--BEA-ATR-2006-0023)

Oct. 2: A condition was identified at the Advanced Test Reactor regarding inconsistencies in a maximum hypothetical accident analysis associated with radiological consequence analysis. Appropriate interim measures were taken, management notifications were made, and a more detailed safety review was initiated. (NE-ID--BEA-ATR-2006-0024)

2007

July 31: While working on the Advanced Test Reactor Critical, operators noted that an instrument light for an amplifier was indicating erratically. The instrument was declared out of service, the failed amplifier was replaced, and required post-maintenance testing completed. (NE-ID-BEA-ATR-2007-0016).

Aug. 9: During a maintenance outage of the Advanced Test Reactor, a discrepancy was identified in the safety documentation of the reactor. A review of the concern is under way while the reactor is in maintenance shut down, and no interim controls are required. (NE-ID-BEA-ATR-2007-0017).

Sept. 19: Electricians working at the Advanced Test Reactor discovered electrical energy in an area that was supposed to be de-energized to allow for maintenance. Work was stopped and an investigation undertaken to determine the source of the energy. (NE-ID-BEA-ATR-2007-0018).

Oct. 3: Equipment required for the safe operation of the Advanced Test Reactor (ATR) is identified using a rigorous analysis process and documented in the ATR Safety Analysis Report (SAR). Operation, maintenance, and modification of the ATR are accomplished only after careful review of the SAR for impacts to this safety analysis. When the SAR was upgraded in the late 1990s, a discrete list of this safety-related equipment was developed. Contrary to DOE administrative requirements, there is currently no procedure for maintaining this safety-related equipment list. This is not a safety issue because the list is not used for safety-related decision making – the source analysis documents are. (NE-ID- BEA-ATR-2007-0019)

Oct. 4: During a review of historical ATR documents, it was discovered that a fuel storage requirement had been inappropriately removed from operating procedures. Past operating procedures required that fuel used in the reactor not be placed within 12 inches of the wall of the fuel storage canal during the first 17 days of its storage. The heating of structural materials caused by their absorption of radiation may adversely affect the structural performance of those materials. The 12 inches of separation allows the canal water to shield the walls from the more intense radiation emitted by the fuel during the first 17 days of storage. This requirement was based on extremely conservative assumptions regarding ATR operations which yielded far higher wall radiation exposures than actual operations do. The requirement has been reincorporated into facility procedures. (NE-ID-BEA-ATR-2007-0020)

Oct. 18: A total power outage occurred at INL when a phase conductor on a power pole fell to the ground and tripped the breakers at both ends of the power line. The power pole and cross arm were burned, but the conductor was not damaged. The power pole was repaired and the line was re-energized. (NE-ID-BEA-CFA-2007-0007).

Oct. 24: During startup of the Advanced Test Reactor Critical, the reactor operator reported that instrumentation was showing abnormal readings. He stopped the start-up procedure and ordered the **<u>reactor shut</u>** down pending review**.** (NE-ID-BEA-ATR-2007-0021).

Oct. 29: At the Advanced Test Reactor, “dampers” are used to prevent the release of radioactive material from the facility in the event of an incident. Several years ago, backup dampers were upgraded to provide the same kind of protection as primary dampers. While both the backup and primary dampers would close in the event of a release at ATR, current safety documentation only requires that one or the other is in service during reactor operations. This is inconsistent with a higher-level safety requirement, and is under review. (NE-ID-BEA-ATR-2007-0023).

Oct. 29: As part of an ongoing evaluation process to ensure that safety documentation at the Advanced Test Reactor is consistent, three issues were identified. These deal with how much pressure the reactor confinement system can withstand; an improper evaluation of the heating, ventilation and air conditioning system performance during a radiation release; and improper evaluation of the effect of negative air pressure on the confinement system. Both the ATR contractor and DOE have evaluated these issues and found there is no impact to the safe operation of ATR. An evaluation of the issues and how to correct them is ongoing. (NE-ID-BEA-ATR-2007-0022).

Nov. 5: Proper procedures were not followed when workers could not get a large sliding door to open at the Advanced Test Reactor building. A worker complained of shoulder pain resulting from manual efforts to force open the stuck door, was examined and released back to work with restrictions. An investigation into the failure to follow proper procedures is underway and corrective actions will be put in place. (NE-ID-BEA-ATR-2007-0024).

Nov. 15: During a planned power outage at the Reactor Technology Complex, power was unexpectedly lost to another building in the area. Work in progress, including crane operations and containment work requiring filtered air movers, was impacted. Upon discovery of the unexpected power loss, a decision was made to complete the work in order to restore power quickly to the affected building. A critique was held to determine the cause of the incident and to identify lessons learned. (NE-ID-BEA-ATR-2007-0025).

Dec. 3, 2007: DOE Cites Battelle Energy Alliance, LLC for Price-Anderson Violations

The U.S. Department of Energy (DOE) today notified Battelle Energy Alliance, LLC (BEA) that it will fine the company $123,750 for violations of the Department's nuclear safety requirements. BEA is the DOE Idaho Operations Office prime contractor for the operation of the Neutron Radiography (NRAD) reactor. The Neutron Radiography Reactor is used to non-destructively examine irradiated materials; the imaging technique utilizes thermal neutrons and is used for quality control purposes in industries which require precision machining.

The Preliminary Notice of Violation (PNOV) issued today cited a series of violations that occurred on August 20, 2006 during the restart and subsequent automatic unplanned shutdown of the NRAD reactor. Violations include failures to adhere to technical safety requirements and reactor operating instructions, inadequacies in the reactor operating instructions, failure to correct known problems with a reactor component, and failure to adequately conduct management assessments in reactor operations.

The proposed civil penalty of $123,750 is based on the significance of the violations yet reflects substantial mitigation granted by DOE for BEA's identification of the issues and corrective actions they have taken to prevent recurrence of the identified deficiencies. While the deficiencies in NRAD reactor operations did not compromise reactor safety systems, they did represent a significant departure from what the Department expects in the operation of its reactors. BEA will have 30 days to respond with any objections to the notice.

The Price-Anderson Amendments Act of 1988 authorizes the Energy Department to undertake regulatory actions against contractors for violations of its nuclear safety requirements. The enforcement program encourages departmental contractors to identify and correct nuclear safety deficiencies at an early stage, before they contribute to or result in more serious events.

2008

Feb. 11: A leak was discovered in the non-radioactive system that supplies sealing and cooling water to the shaft seal on the primary coolant pump at the Advanced Test Reactor during recent perations**.** The reactor was **<u>shut down</u>** to allow a switch to a different primary coolant pump with a non-leaking seal system, and the reactor was restarted. (NE-ID-BEA-ATR-2008-0003).

March 4: It was determined there is a discrepancy between a computer model's projections for how quickly safety rods can be inserted at the Advanced Test Reactor, and the response time predicted in current safety documentation. Interim safety controls will be implemented while the issue is further analyzed. (NE-ID-BEA-ATR-2008-0005).

May 6: During start-up of the Advanced Test Reactor, it was determined that a system that indicates power levels in the reactor lobes was not functioning properly, even though it was not required at lower power levels. **Limits were placed on reactor operations** as a precaution until the system is restored. (NE-ID-BEA-ATR-2008-0007).

May 13: The Advanced Test Reactor was inadvertently **<u>shut down</u>** when an operator hit the wrong computer command. Normal reactor shutdown procedures were followed. The test and debug computer displays will be password protected in the future to prevent a similar inadvertent shutdown. (NE-ID-BEA-ATR-2008-0009)

June 5: The Advanced Test Reactor experienced an unplanned **<u>shutdown</u>** due to an electrical malfunction. The reactor went into an unplanned outage to allow for troubleshooting and repair of the problem. (NE-ID-BEA-ATR-2008-0010)

June 26: While inspecting the Advanced Test Reactor during a planned outage, a flow restrictor component was found out of its installed experiment position in the vessel tank. A review of the reactor loading records showed the flow restrictor was installed as part of the vessel closeout process. The closeout process will be revised to include performance of the final visual inventory and inspections after all in-vessel operations are complete and all long-handled tools are removed from the vessel. (NE-ID-BEA-ATR-2008-0013).

July 10: During operation of the Advanced Test Reactor on July 5, operators observed an intermittent reactor vessel low differential pressure alarm. Follow-up investigation revealed electrical interference between the cables of a regulating rod and the differential pressure instrument, causing fluctuations in the differential pressure. Spacers were placed between the cables to limit the interference. Testing was performed and validated that the electrical interference was eliminated. (NE-ID-BEA-ATR-2008-0015).

July 15: A systems engineer determined that an electrical breaker installed in the switchgear cubicle of a pump at the Advanced Test Reactor was not the breaker that was expected to be installed. It was then determined that a required response check of the system was not conducted as prescribed. The pump was placed out of service until the required check could be performed. The pump was not operating at the time the discrepancy was found. (NE-ID-BEA-ATR-2008-0016 and 0017).

July 29: It has been determined that there is an error in the computer code used as part of accident analysis at the Advanced Test Reactor and the Advanced Test Reactor-Critical. After an analysis of the error was conducted, it was determined the error would not significantly change the conclusions of the safety analysis done for the reactors, and no interim restrictions or requirements on reactor operation were necessary. (NE-ID-BEA-ATR-2008-0018).

Aug. 7: Operators noticed unusual noises caused by vibration from a coolant pump at the Advanced Test Reactor. The pump was removed from service and the reactor was **shut down.** A technical evaluation was performed on the remaining coolant pumps and reactor operations resumed. (NE-ID-BEA-ATR-2008-0019).

Aug. 7: While exiting the storage canal area at the Advanced Test Reactor, an employee set off a personnel contamination monitor alarm when contamination was discovered on the operator's shoe. The contamination was removed and analyzed. Detailed surveys were performed in the canal area and additional controls were implemented for entry in that area. (NE-ID-BEA-ATR-2008-0020).

Aug. 11: An alarm went off while a primary coolant pump was being restarted at the Advanced Test Reactor. Operators noted that a stand-by pump was running inadvertently. Both pumps were **shut down** and management notified. (NE-ID—BEA-ATR-2008-0021).

Sept. 22: It was discovered that the engine block heater thermostat on a diesel firewater pump failed at the Advanced Test Reactor Complex. The reactor was in shutdown condition and defueled, and the pump is not required to be operable when the reactor is defueled. The pump was declared inoperable and will be repaired. (NE-ID-BEA-ATR-2008-0027).

Sept. 11: While removing an experiment from the Advanced Test Reactor, it was discovered that configuration of the lift equipment was not in compliance with the drawing in the operating procedure. However, evaluation by the engineering staff determined that the configuration used was an acceptable and safe method for the lift. Management was notified of the non-compliance and an incident critique was held. (NE-ID-BEA-ATR-2008-0024).

Sept. 15: During inspection of a circuit breaker at the Advanced Test Reactor, suspect bolting material was discovered. A non-conformance report was placed into the tracking system for resolution. (NE-ID-BEA-ATR-2008-0025).

Nov. 3: The Advanced Test Reactor was **shut down** and a review undertaken after an investigation identified potential seismic concerns with a cinder block wall in the facility. Compensatory actions were taken to ensure the wall would not damage required utility systems in a seismic event, and the reactor was restarted. (NE-ID-BEA-ATR-2008-0028).

2009

March 10: During startup of the Advanced Test Reactor on March 8, it was determined that a primary coolant check valve was not seating properly. Startup preparations were stopped **[shutdown],** the primary coolant system was depressurized and the reactor was defueled so the check valve could be replaced. (NE-ID-BEA-ATR-2009-0003).

March 19: An operator at the Advanced Test Reactor discovered that an inflatable seal on the canal bulkhead at a fuel storage facility was no longer maintaining required pressure because of an air leak. Spent fuel cask movements in the canal area affected by the failed seal were prohibited until the failed seal is repaired or modifications completed. (NE-ID-BEA-ATR-2009-0004).

March 26: It was determined that an existing safety analysis of the Advanced Test Reactor does not fully address the possibility that emergency cooling pumps at the reactor could be submerged before they are able to fulfill their safety function following a reactor shutdown in a particular accident scenario. No compensatory action was taken because subsequent calculations showed that the emergency cooling pumps would remain operational for the required time. (NE-ID-BEA-ATR-2009-0005).

March 30: During a routine safety walk down of the Advanced Test Reactor, a facility representative discovered a slightly open door on a 480-volt electrical panel. The open door provided a small opening where a person could contact energized wires. The electrical panel with the open door was roped off for further investigation. (NE-ID-BEA-ATR-2009-0006).

June 9: An operator at the Advanced Test Reactor noted power variations in one of the reactor's experimental lobes. After consulting with ATR engineering and verifying the indications were from a failure of the instrumentation system, the ATR shift supervisor declared the instrumentation system inoperable, and initiated **limiting conditions on reactor operations**. The indication problem was corrected and the limiting condition on reactor operations was removed the same day. (NE-ID-BEA-ATR-2009-0013).

June 29: An equipment operator noted the improper assembly of wire rope components on a mobile crane during a daily pre-use inspection at the Advanced Test Reactor Complex. Other suspect/counterfeit wire clamps were also noted. This crane was tagged out of service and further mobile crane inspections discovered suspect/counterfeit components. These cranes were also tagged out of service. (EM-ID-CWI-BIC-2009-0002).

Aug. 24: A review was initiated to look at the Advanced Test Reactor primary coolant system chemistry. In the course of the review, it was noted that the technical safety requirements limits for pH of the ATR primary coolant system water allow a low range (pH 4.7) that could possibly cause damage to the thin boehmite oxidation layer that is on the fuel. Interim controls after the discovery have been put into place that do not allow the pH of the primary coolant system to get below 5.0. A review of chemistry logs has been performed to ensure that none of the fuel in the canal has been exposed to a pH less than 5.0. (NE-ID—BEA-ATR-2009-0020).

Sept. 16: It has been determined that evacuation sirens located at the Advanced Test Reactor Complex are mounted within office buildings that are not designed to withstand significant seismic events. A review of the safety analysis at the facility is underway. (NE-ID—BEA-ATR-2009-0021).

Sept. 30: An automatic **shutdown** of the Advanced Test Reactor occurred when a circuit breaker on a diesel bus tripped open on a ground fault indication. An investigation was initiated into the cause of the ground fault trip. The reactor remained in a safe condition and was restarted following review of the shutdown. (NE-ID—BEA-ATR-2009-0022).

Oct. 12: An automatic **shutdown** of the Advanced Test Reactor occurred as the result of an error by an experiment operator who failed to follow proper procedures**.** The reactor remained in a safe condition; a critique was conducted and corrective actions taken. (NE-ID—BEA-ATR-2009-0023).

Nov. 17: While connecting a battery charger to a battery bank at the TRA-604 Battery Room, an electrician was burned on both hands by an electrical arc. The injured electrician was treated at the Central Facility Area medical dispensary and then driven home. The doctor found first and second degree burns over 5 percent of the electrician's hands. Electrical work was stopped and access to the battery room secured pending a critique of the incident. (NE-ID—BEA-RTC-2009-0002).
Fuel Burnup Record: Idaho National Laboratory scientists have set a new world record for fuel burnup with a reactor fuel for next generation high temperature gas reactors. As part of a nearly three-year experiment, about 19 percent of the fuel's low-enriched uranium has been consumed in the INL's Advanced Test Reactor – more than double the previous record set by German researchers. Better reactor fuels mean more efficient heat and power production and less waste when the fuel is spent.

Nov. 24: Start-up of the Advanced Test Reactor was interrupted by an instrument problem. The problem was diagnosed and corrected and reactor **start-up** resumed. (NE-ID-BEA-ATR-2009-0024).

Dec. 2: The Advanced Test Reactor was **shut down** when a calculation error was discovered in the assurance package for that particular reactor operating cycle. The reactor remained in shutdown until the error was corrected and a re-calculation performed. (NE-ID—BEA-ATR-2009-0025).

2010

Jan. 12: The shift supervisor at the Advanced Test Reactor entered into a **limiting condition shut-down** for operation of the reactor when two instrument systems used to calculate water flow in the reactor were declared out of service. Limiting conditions for operation are a Department of Energy approved method to ensure safety of nuclear facilities while system performance is evaluated. The shift supervisor used other data systems to verify the safety of reactor operations while the systems were repaired and returned to operation. (NE-ID—BEA-ATR-2010-0001).
Nuclear Research: The INL's Advanced Graphite Capsule project will test over 2,000 different samples of graphite in the INL's Advanced Test Reactor over a 10-year period. The tests are part of work to certify the graphite that is used in many parts of advanced nuclear reactor designs.

Feb. 11: An air leak was detected from two pressurized seals on the bulkhead at the head of a nuclear fuel storage canal. Cask handling was prohibited in the canal until the seal was repaired. (NE-ID—BEA-ATR-2010-0003).

March 9: An electrician violated a lock out/tag out when he mistakenly disconnected the electrical system for the wrong pump motor at the Advanced Test Reactor. The motor was not energized at the time, and there were no injuries or damage to equipment. A lock out/tag out was applied and a critique of the incident was scheduled. (NE-ID—BEA-ATR-2010-0004).

April 8: An operator at the Advanced Test Reactor noted that the distribution breaker for the Plant Protective System channel C battery charger had tripped open. An attempt was made to reset the breaker, but it immediately tripped open again. The system is not required to be operable while the reactor is shut down, and it was taken off-line. (NE-ID—BEA-ATR-2010-0006).

April 26: Two subcontractors violated posted radiological control area entry instructions while delivering waste boxes to a storage pad at the Advanced Test Reactor Complex. Because of the low radiological fields present in the area, the two workers did not receive significant exposures. A radiation engineer will complete a radiological exposure questionnaire to document any dose received. (NE-ID—BEA-RTC-2010-0001).

May 5: Several instances of suspect/counterfeit bolts were discovered during a recent outage at the Advanced Test Reactor. Some of the suspect bolts were determined to be non-load bearing and acceptable for use. They will be replaced when future maintenance activities require disassembly of the components. All other suspect bolts were removed pending determination for disposal or destruction. (NE-ID—BEA-ATR-2010-0008).

June 7, 2010 INL.gov website Information Update; "On May 30, 2010, Idaho National Laboratory voluntarily interrupted **[shutdown]** routine testing at the Advanced Test Reactor because operators detected momentary, higher-than-normal radioactivity levels in the reactor's primary coolant and building exhaust systems." "The radioactivity levels detected were too low to trigger any routine reporting criteria, but warranted interruption of testing at the ATR to allow for experiment analysis and removal of the source. No measurable exposure to workers or the public occurred. "One of the ATR's functions as a test reactor is to test how new nuclear fuel designs perform. During this testing, experiments may release minor quantities of radioactivity into the reactor's primary coolant system. INL's continuous monitoring of ATR systems quickly detects such release conditions, should they occur." "ATR staff has now determined that the experiment which released fission products into the reactor coolant is one of several testing new types of low-enriched fuel that could be used in research reactors that currently run on highly-enriched uranium. Testing at the ATR will resume after the experiment causing the increased radioactivity is removed and normal scheduled maintenance work is completed."

June 15: A need for further safety analysis was determined at the Advanced Test Reactor. As part of ongoing review of the safety documentation at the reactor, it was determined the existing analysis does not look at what would happen in the unlikely event that all five experiment loops in the reactor **failed during an earthquake.** The preliminary analysis showed that this accident is already enveloped by other accidents in the unlikely category and it does not have any effect on safe reactor operation (NE-ID—BEA-ATR-2010-0009).

July 8: A laborer, working at the Advanced Test Reactor Complex, cut the index finger and thumb on his left hand while trying to cut a plastic sprinkler pipe. The employee was evaluated by a doctor, who referred the employee to an off-site specialist. A review of the event and critique were performed. (NE-ID—BEA-RTC-2010-0002).

July 14: An engineer at the Advanced Test Reactor reported that the lubricating oil viscosity for a diesel firewater pump was out of specification. The pump was declared out of service, operations were limited according to procedure, and a service request to change the lubricating oil and filter on the firewater pump was submitted and approved. (NE-ID—BEA-ATR-2010-0010).

July 20: An operator injured his elbow while moving a grating at the Advanced Test Reactor canal. The injury occurred in June, but was not fully diagnosed for a few weeks. The operator eventually had outpatient surgery. An accident investigation was initiated and a critique scheduled. (NE-ID—BEA-ATR-2010-0011).

July 22: Management at the Advanced Test Reactor (ATR) noted data anomalies from the Wide Range Neutron Level ion chamber. Specifically, the measured current from the ion chamber was expected to level out at high voltage, but did not. A critique was held and ATR engineering was asked to perform a technical evaluation of the chamber. (NE-ID—BEA-ATR-2010-0012).

July 25; The Advanced Test Reactor was forced into a **limited power mode**.
INL Initial Not. Rpt. FOIA Doc., 26 July 2010, Reduced power 25 July 2010.

July 27: The Advanced Test Reactor was **shut down** following discovery of low oil pressure in one of the two primary coolant pumps. The pump was secured at temperatures well below acceptable levels and there was no equipment damage. (NE-ID—BEA-ATR-2010-0013).

Aug. 9: The safety analysis for the Advanced Test Reactor is continually reviewed. In a recent review, it was determined that a more conservative or safer approach would be to adjust the interim operating controls for the ATR surge tank, which affects the initiation time of the Emergency Firewater Injection System (EFIS). This was due to review of the ATR surge tank volume. The new controls were slightly more stringent. However, the actual EFIS as tested will operate much faster than the safety analysis requires. (NE-ID—BEA-ATR-2010-0015).

Summary of Advanced Test Reactor Shutdowns
1973 Through September 20, 2012 [1]

Year	Shutdown/ Scrams Dates	Power Restricted Dates	Total Shutdowns Power Restrictions	Comments DOE Document Citation
1973	Feb. 2			Foot Note (FN) [2]
1974	Jan. 15			FN [3] + FN 6
	June 5			FN 3 + FN 6
	Sept. 12			FN 3 + FN 6
1977	Feb. 9			FN [4] + FN 6
1991	June 4			FN [5]
	Oct. 16			FN 5
	Aug. 13			FN 5
1992	May 18			FN 5
	Aug. 7			FN 5
	Aug 12			FN 5
1993	Jan. 4			FN 5
1996	Dec. 25			FN 5
1998	Jan. 21			FN 5
	July 21			FN 5
	Dec. 14			FN 5
1999	Nov. 6			FN 5
2000-	Jan. 2			DOE/IG 3/01
	Jan. 11			NE-ID-BBWI-ATR-2000-0003+
2001	Feb. 1			-0004 +-0020 +
2002	Sept. 27			Internal Office Memo 11/18/02
	Feb. 6			NE-ID-BBWI-ATR-2002-0008 + FN 6
2003	Nov. 1			NE-ID-BBWI-ATR-2003-0012
2004	Aug. 21			NE-ID-BBWI-ATR-2004-0007
2006	July 10			NE-ID-BEA-ATR-2005-0004
	Aug. 22			NE-ID-BEA-ATR-2006-0019
2007	October 24			NE-ID-BEA-ATR-2007-0013
				NE-ID-BEA-ATR-2007-0014 + FN 6
				NE-ID-BEA-ATR-2007-0021

[1] DOE Occurrence Reports database (https://orpspublic.hhs.doe.gov/orps/)
[2] Incident Report, Aerojet Nuclear Co., ANC-73-11, ATR, 2/2/73; "A scram was received …for run startup. **A second scram** received at 0906 hours, Feb. 2, 1973."
[3] Incident Reports, Aerojet Nuclear Co., ANC-73-11, 2/2/73; ANC-74-5 (ATR-74-1) 1/15/74. Aerojet Nuclear Co,, Unusual Occurrence Reports (UCR), ANC-74-60 (ATR-74-27), 6/5/74. UCR, Aerojet Nuclear Co., ANC-74-64, (ATR-74-31), 9/10/74.
[4] Unusual Occurrence Reports (UCR), EG&G-77-26 (ATR-77-19), 3/9/77.
[5] DOE Freedom of Information documents provided to EDI.

2008	Feb. 11 May 13 June 5 Aug 7 Aug. 11 Nov. 3	 May 6		NE-ID-BEA-ATR-2008-0003 NE-ID-BEA-ATR-2008-0007 NE-ID-BEA-ATR-2008-0009 NE-ID-BEA-ATR-2008-0010 NE-ID-BEA-ATR-2008-0019 NE-ID-BEA-ATR-2008-0021 NE-ID-BEA-ATR-2008-0028
2009	Mar. 10 Mar 26 May 31 June 9 Sept. 30 Oct. 8 Oct. 12 Oct. 14 Nov. 6 Dec. 2	 Mar. 17 Nov. 22		NE-ID-ATR-2009-0003 NE-ID-BEA-ATR-2009-0003+FN 6 FN 7 + ATR-CR-5-31-09 NE-ID-BEA-ATR-2009-0013 FN 7 + NE-BEA-ATR-2009-0022 FN 7 + 6+ NE-ID-ATR-2009-0023 NE-ID—BEA-ATR-2009-0023 FN [6] FN [7] FN [8] NE-ID-BEA-ATR-2009-0024 NE-ID-BEA-ATR-2009-0025 NE-ID-BEA-ATR-2009-0025
2010	 Feb. 14 May 27-30 June 7 July 23 July 26 Oct.12 Oct. 26 Nov. 17	Jan. 12 July 13 July 25		NE-ID- BEA-ATR-2010-0001 FN 7+ FN [9] (Channel A vent failure) FN 7+FN [10] (Increase Rad. PCS/Stack) FN 7 (quad IV flow inst. Failure) + INL Initial Not. Rpt. 14/7/10 FN 7 (M-6 PC pump lub. Failure) + NE-ID-BEA-ATR-2010-0013 FN [11] + FN 7 FN [12] (low coolant flow) FN [13]+ NE-ID-BEA-ATR-2010-0019 FN [14] + FN 6 + INR 26 Oct. 2010 FN [15] INL 11/17/10

[6] INL Initial Notification Report. FOIA Doc.# 9, 13 October 2009, Shutdown 10/12/09. Critique Rpt. ATR-CR-10-13-2009

[7] INL Initial Notification Report. FOIA Doc, 15 October 2009, Scram, 14 October 2009.

[8] INL Initial Notification Report. FOIA Doc.#10, Shutdown, 6 November 2009.

[9] INL Initial Notification Report (INR). FOIA Doc.#14, 15 February 2010, Shutdown 2/14/2010. DOE/ATR Unplanned Shutdowns Slow Setbacks Reductions in Power FY-09-2010 (FOIA)

[10] INL Initial Not. Rpt. FOIA Doc.D-3-#15, 30 May 2010, Shutdown 5/27/10. DOE/ATR Unplanned Shutdowns Slow Setbacks Reductions in Power FY-09-2010 (FOIA). ATR stack effluent 105 Ci/day.

[11] INL Initial Not. Rpt. FOIA Doc., 26 July 2010, Reduced power 25 July 2010.

[12] INL Initial Not. Rpt. FOIA Doc., October 2010

[13] INL Initial Not. Rpt. FOIA Doc. E-1 13 October 2010, Scram 12 October 2010.

[14] INL Initial Not. Rpt. FOIA Doc. #18 , 26 Oct 2010

[15] INL Initial Not. Rpt. FOIA Doc. 17 November 2010, Shutdown 17 November 2010.

2012	 Mar. 22 Mar. 27	Mar. 6-26 May 9 June 5		NE-ID-BEA-ATR-2012-0007 + 0008 +0010+0014 NE-ID-BEA-ATR-2012-0013 NE-ID-BEA-ATR-2010-0015 NE-ID-BEA-ATR-2012-0017 (fire water pump failure) NE-ID-BEA-ATR-2012-0021 (fire water pump failure)
2013	April 15	 Dec. 12		NE-ID--BEA-ATR-2013-0012 NE-ID--BEA-ATR-2013-0042
2014 *	 Jan. 16 [1]	Jan. 3		NE-ID--BEA-ATR-2014-0001 NE-ID--BEA-ATR-2014-0004
Totals 1973 to 2014	Total 55*	Total 9	Total 64	

Additional References:
a. Advanced Test Reactor Outage Risk Assessment, July 9, 1998, INEEL/Con-97-0463; Conf-980616
b. INL Reactor Outage, 2/5/08, DOP-7-7.2.7, Rev.24.
c. References (i.e., NE-ID--BEA-ATR-2014-0001) refer to Occurrence Reports in its data base of Office of Health, Safety and Security (HSS) in the Department of Energy's (DOE) central organization responsible for health, safety, environment, and security.
d. Advanced Test Reactor Outage Risk Assessment, July 9, 1998, INEEL/Con-97-0463; Conf-980616
e. INL Reactor Outage, 2/5/08, DOP-7-7.2.7, Rev.24.
f. Advanced Test Reactor Critical Facility is an identical reactor beside the ATR used for trial runs and using the same safety systems as the ATR, and had 3 shut downs in 2013 (Jan. 15, 17and 23). The Advanced Test Reactor Critical is not included here even though they are co-located with the ATR; operate under the same contractor (Battelle Energy Alliance/management structure and share safety systems). It is reasonable to assume that safety system failures at ATRC reflects on the ATR.

***Dates from 1973 through September 20, 2012 (ATR startup date was ~ 1960 so seven early years are not included plus six years since 2012). Due to 14 years not included and limited access to information on the Advanced Test Reactor plus what information that is available is widely dispersed, EDI cannot conclude that the above table even closely or completely represents all of the reactor shut-downs nor all the power limiting events. Neither DOE nor the Navy likes to admit reactor shut-downs because it represents poor management and aging equipment - thus the information restrictions.**

Also see; Unacceptable Risk at the Idaho National Laboratory Advanced Test Reactor, The Case for Closure Volume I, By David McCoy, J.D. and Chuck Broscious, Updated January2013. http://www.environmental-defense-institute.org/publications/ATR.Risk.Rpt.Rev.6-03.wPics.pdf

Section IX. Appendix B

Listing of INL Reactors & Facilities by Area; See Section Reactors at INL List

Facility Area	Acronym
Materials and Fuels Complex	**MFC**
(formerly Argonne National Laboratory-West)	ANL-W
Operating or Operable Reactors	
Experimental Breeder Reactor-II	ERB-II
Integral Fast Reactor	IFR
Neutron Radiography Reactor	NRAD
Transient Reactor Test Facility	TREAT
Zero Power Physics Reactor	ZPPR
Safety Test Reactor Facility	STF
Sodium Loop Safety Facility Reactor	SLSF
TRIGA Research Reactor	TRIGA
MFC--Non-Operating-Reactors	
Experimental Breeder Reactor-I	ERB-II
Zero Power Physics Reactor No 2	ZPPR-II
Zero Power Physics Reactor No 3	ZPPR-III
Argonne Fast Source Reactor	AFSR
Experimental Organic Cooled Reactor	
Fast Spectrum Refractory Metals Reactor	
Gas Cooled Reactor Experiment	
Coupled Fast Reactivity Measurement Facility	
Natural Circulation Reactor	
Thermal Reactor Idaho Test Station	
Materials and Fuels Complex Facilities	
Hot Fuel Examination Facility/North	HFEF/N
Hot Fuel Examination Facility/South	HFEF/S
(Fuel Cycle Facility)	FCF
Laboratory and Office Building	L&OB
Fuel Manufacturing Facility	FMC
Spent Fuel Pool	NRSD
ZPPR Dry Fuel Storage	ZPPR
TREAT Dry Fuel Storage	TREAT
MFC Waste Discharge Sites	
Radioactive Scrap and Waste Facility	RSWF
Injection Well between T-1 & ZIPPR	ANL-10
Waste Pond	ANL-01
Three Ditches	
Injection Well at Building 768	ANL-15
Two Injection Wells at Building 759	ANL-16
Injection Well at Building 720	ANL-17
TREAT Leach Field	ANL-21

Radioactive Waste Management Complex	**RWMC**
Subsurface Disposal Area	SDA
Transuranic Disposal Area	TDA
Transuranic Storage Area	TSA
Compactor Building	
Stored Waste Experimental Pilot Plant	SWEEP
LCCDA Chemical Seepage Pits	
Intermediate Level TRU Storage Facility	ILTSF
Advanced Mixed Waste Treatment Plant	AMWTP
Naval Reactors Facility Reactors (operating or operable)	**NRF**
Large Ship Reactor "A"	AIWA
Large Ship Reactor "B"	AIWB
Natural Circulation Reactor	S5G
Submarine Thermal Reactor	S1W(STR)
High Temp. Marine Propulsion Reactor	630-A
NRF Operating Facilities	
Supporting Naval Spent Nuclear Fuel Handling Facility	
Expended Core Facility	ECF
Spent Fuel Water Basins	
Dry Cell Fuel Cutting	
Naval Nuclear Propulsion Program	NNPP
Idaho Nuclear Technology Center	INTEC
formerly Idaho Chemical Processing Plant	ICPP
Fluorinel Dissolution and Fuel Storage (Zirconium fuel reprocessing)	FAST(CPP-666)
Denitration Facility	CPP-602
Remote Analytical Laboratory (Pilot Plant fuel reprocessing)	RAL(CPP-627)
Headend Process Plant	CPP-640
Fuel Receiving and Storage Building	
Irradiated Fuel Storage Facility	IFSF (CPP-603)
Fuel Element cutting Facility	FECF (CPP-603)
Waste Treatment Building (Three 18,000 gal. waste tanks) (Process Evaporator Waste)	CPP-604
Calcine Waste Storage Bins (underground)	
High-Level Waste Tank Farm (underground) (Eleven 300,000 gal. Tanks)	
Underground Fuel Storage Facility	CPP-749
Aluminum Fuel Reprocess Building	CPP-601
Fuels Processing Facility	FPF (CPP-631)
Process Improvement Facility	CPP-637
CPP Percolation Ponds #1 & #2	CPP-67

Non-operating INTEC	
CPP Waste Injection Well (Sealed Off)	CPP-23
USGS Waste Injection Well	USGS-50
Waste Calcine Facility	WCF
New Waste Calcine Facility	NWCF(CPP-659,694)
Underwater Fuel Storage Facility	FSF (CPP-603)
Auxiliary Reactor Area	ARA
Auxiliary Reactor Area - I (dismantled)	ARA-I
Army Reactor Program Support Building	
Mobil Power Plant Reactor No 1	ML-1
Nuclear Effects Reactor	FRAN
Fast Spectrum Refractory Metals Reactor	710
Hot Critical Experiment	HOTCE
Chemical Evaporation Pond	
Critical Experiment Tank	
Experimental Organic Cooled Reactor	
Shield Test Pool Facility	
Spherical Cavity Reactor	
Auxiliary Reactor Area - II	ARA-II
Stationary Low Power Reactor - I (dismantled)	SL-1
Auxiliary Reactor Area - III (dismantled)	ARA-III
Army Gas Cooled Reactor Experiment	GCRE
Auxiliary Reactor Area - IV	ARA-IV
Power Burst Reactor Facility	PBF
Evaporation Pond	PBF-10
Warm Waste Injection Well	PBF-05
Corrosive Waste Injection Well	PBF-15
Chemical Waste Evaporation Pond	PBF-16
ARA SPERT Area	SPERT
Dismantled Facilities	
Waste Experimental Reduction Facility	WERF
Special Power Excursion Reactor Test - I	SPERT-I
Special Power Excursion Reactor Test - II	SPERT-II
Special Power Excursion Reactor Test-III	SPERT-III
Special Power Excursion Reactor Test-IV	SPERT-IV
SPERT Leach Pond	
Reactivity Measurement Facility	
Transient Reactor Test Facility	
Test Area North	**TAN**
Non-Operating or Dismantled Reactors	
Experimental Beryllium Oxide Reactor No. I and II	EBOR
Aircraft Nuclear Propulsion	ANP
Initial Engine Test	IET
Loss-of-Fluid Test	LOFT
Split Table Reactor	STR
Spherical Cavity Reactor Critical Exp.	SCREC
SNAP-10A Transient Reactor No 1	SNAPTRAN-1
SNAP-10A Transient Reactor No 2	SNAPTRAN-2

SNAP-10A Transient Reactor No 3	SNAPTRAN–3
Water Reactor Research Test Facility	WRRTF
Heat Transfer Reactor Experiment. No 1	HTRE-I
Heat Transfer Reactor Experiment. No 2	HTRE-II
Heat Transfer Reactor Experiment. No 3	HTRE-III
Process Experimental Pilot Plant	PREPP
Organic Moderated Reactor Experiment	
TAN Operating or Operable Facilities	
Water Reactor Research Test Facility	WRRTF
Technical Support Facility	TSF
Decontamination Facility Hot Shop	TAN-607
Fuel Storage Pool	TAN-607
Fuel Cask Storage Pad	TAN-SFCTSP
Containment Test Facility	CTF
Radioactive Materials Laboratory	TAN-RML
Radioactive Liquid Waste Storage	RLWSF (TAN-666)
Radioactive Materials Storage Pool	
Warm Shop	
Specific Manufacturing Capacity Facility	SMC/CT
Aircraft Nuclear Propulsion Hanger	
Initial Engine Test Control Bunker	
Operating Waste Discharge Sites	
WRRTF Evaporation Pond at TAN-762	WRRTF-03
WRRTF Two-Phase Pond at TAN-763	WRRTF-02
LOFT Disposal Pond	LOFT-02
TSF Disposal Pond	TSF-07
TSF Intermediate-Level Rad. Disposal	TSF-09
Central Facilities Area	**CFA**
Radiological/Environmental Sciences Lab.	RESL
Hazardous Waste Storage Facility	HWSF
Laundry & Decontamination Facility	CF-617
Maintenance Shops & Cafeteria	
Waste Drain Field	CFA-08
Motor Pool Pond	
Standards Calibration Laboratory	CF-698
Willow Creek Building (document archive)	WCB
Naval Ordinance Disposal Area	NODA
Navy Unexploded Ordinance Burial Ground	
Experimental Breeder Reactor Area	ERB-1
Advanced Test Reactor Complex	**ATRC**
formerly Reactor Technology Center	RTC
Operating or Operable Reactors	
Advanced Reactivity Measurements Fac.1	
Advanced Reactivity Measurements Fac.2	
ARMF-1(TRA-660)	
Advanced Test Reactor	ATR (TRA-670)
Advanced Test Reactor Critical	ATRC

ATRC/TRA-Continued	
Coupled Fast Reactivity Measurements	CFRMF
Dismantled/Decontaminated Reactors	
Engineering Test Reactor	ETR
ETR Critical Facility Reactor	ETRC
Material Test Reactor	MTR
ATRC-TRA Operating Facilities	
Hot Cell Facility	TRA-632
Alpha-Wing Laboratory	TRA-661
TRA Operating Waste Sites	
TRA Hot Waste Tanks #2,#3,#4	TRA-613 & TRA-15
TRA Warm Waste Retention Basin	TRA-04
TRA Brine Tank at TRA-631	TRA-20
TRA Cold Waste Disposal Pond	TRA-08
New ATR Warm Waste Pond	
MTR Fuel Canal	TRA-603
ARMF Fuel Canal	TRA-660
ATR Fuel Canal	TRA-670
TRA Non-Operating Waste Sites	
TRA Chemical Waste Disposal Pond	TRA-06
TRA Warm Waste Pond	TRA-03
TRA Non-Operating Facilities	
Cavity Critical Reactor	CREC
Critical Experimental Tank	CET
Reactivity Measurement Reactor Facility	RMF
Shield Test Pool Facility Reactor	SUSIE
Waste Injection Well	TSF-05
Waste Injection Well	USGS-53
BORAX Area	
Dismantled Reactors	
Boiling Water Reactor Experiment No 1	BORAX-I
Boiling Water Reactor Experiment No 2	BORAX-II
Boiling Water Reactor Experiment No 3	BORAX-III
Boiling Water Reactor Experiment No 4	BORAX-IV
Boiling Water Reactor Experiment No 5	BORAX-V
Army Reentry Vehicle Facility Area	ARVFS
Defense Nuclear Testing Ground	
Test Range Area	
EOCR/OMRE Area (decommissioned)	
Organic Moderated Reactor Experiment	OMRE
Experimental Organic Cooled Reactor	EOCR

IX. Appendix C

Glossary of Terms

Actinide: Any of a series of chemically similar, mostly man-made radioactive elements with atomic numbers ranging from actinium (89) through lawrencium (103). [ROD@9-1]

Alpha - relatively large slow moving particles (positive charge consisting of 2 protons and 2 neutrons) that will not penetrate clothing, a sheet of paper or the outer layers of skin. Serious cell damage can result if inhaled or ingested. Alpha sources may be associated with spent nuclear fuel. In addition to many other heavy radioactive elements, alpha particle emitters include uranium, americium, radium, thorium, and plutonium-238.

Background Radiation: The amount of ionizing radiation to which a person is exposed from natural sources, such as terrestrial radiation due to naturally occurring radionuclides in the soil, cosmic radiation originating in outer space, and naturally occurring radionuclides deposited in the body. [NRC@125] Heated debate continues between the public and government definitions of background. The federal government insists that background include man-made radiation from "global fallout as it exists in the environment (such as from the testing of nuclear explosive devices." [DOE/EIS-0218F@9-1] By including man-made fallout, the government is able to trivialize the impact of any given nuclear plant.

Beta - small particles (usually electrons) that, depending on energy, may penetrate several layers of skin causing serious skin damage especially to the lens of the eye. May be shielded with materials such as aluminum, glass or plastic. Found in reactor, hot cell and radioactive waste storage areas. Beta particle emitters include strontium-90, Cesium-134/137, Krypton-85, (high energy) and tritium (low energy).

Biological Half-life: The average time it takes for the body to eliminate on half the amount of a radionuclide (as measured in radioactivity) starting at the time that the radionuclide was ingested. {Connor@61]

Calciner: This incineration process takes liquid high-level waste (HLLW) generated during the chemical reprocessing of spent reactor fuel and burns off the combustible liquid portions of the waste and then mixes the residual ash with a granular calcine for easier handling and storage. The calcine process as applied to HLLW is unique to INL and consequently, the site does not have near the massive inventory of HLLW that Hanford or Savannah River have.

Characterization: The determination of waste or spent nuclear fuel composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done to determine appropriate storage, treatment, handling, transportation, and disposal requirements. [ROD@9-2]

Cladding: In this context, cladding refers to the metal covering around the fissile portion of reactor fuel. The cladding acts as an initial containment for mixed fission products that are produced during the operation of a reactor. There is a wide range of cladding materials some of which include zirconium, aluminum, stainless steel, and graphite. Failed fuel refers to nuclear fuel whose external cladding has cracked, pitted, corroded, or potentially allows the leakage of radioactive gases.

Criticality: The conditions in which a system is capable of sustaining a nuclear chain reaction such as in a nuclear reactor. If a reactor loses its coolant system or if the fuel rod cladding fails, a meltdown can result. Uncontrolled criticality can occur for instance in a spent fuel reprocessing plant were sufficient fissile material collects in a geometrically unstable situation that results in spontaneous criticality. If adequate spacing between fuel rods in a fuel storage facility, spontaneous criticality can also occur.

Curie (Ci) - is a measure of radioactivity of a substance equaling 37 billion disintegrations per second. (DPS) Curies are also used to quantify the total radioactive energy concentration in a given quantity of material - such as Pico curies per liter (pCi/L), or Pico curies per gram (pCi/gram). EPA Maximum Contaminate Level (MCL) standard for cesium-137 is 10 pCi/gram, or 200 pCi/L. Due to the extreme biological affects of radionuclides, these exposure standards are expressed in Pico curies, or one part per trillion.

Pico Curie (pCi) - is equal to 1,000,000,000,000 th of one Curie; or 10^{-12} Ci
Nano Curie (nCi) - is equal to 1,000,000,000 th of one Curie; or 10^{-9} Ci
Micro Curie (uCi) - is equal to 1,000,000 th of one Curie; or 10^{-6} Ci
Mill Curie (mCi) - is equal to 1,000 th of one Curie; or 10^{-3} Ci

Decay (radioactive): The spontaneous disintegration of the nucleus of an unstable atom resulting in the emission of particles and energy.

Decay Products: A new isotope created as a result of the disintegration of a radioactive, parent atom. As the parent atom gives up particles and energy in an attempt to stabilize its nucleus, it transforms itself into new isotopes and elements whose characteristics and radioactive properties can be quite different from the parent radionuclide

For example, as an atom of uranium-238 undergoes natural decay, it transforms itself into several so-called “daughter” products such as radium-226 and polonium-210, which are considerably more biologically harmful than the original parent atom. [Connor@60]

Dosimetry: A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed effective dose equivalent, or total effective dose equivalent. Also see REM

Fissile Material: Any material fissionable by thermal (slow) neutrons; the two primary fissile isotopes are uranium-235 and plutonium-239 which are also the primary material in nuclear reactor fuel.

Fission: The splitting or breaking of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Fission Products: The nuclei (i.e. cesium-137) produced by fission of heavy elements (i.e. uranium-235), and their radioactive decay products.

Fuel Elements: Nuclear reactor fuel including both the fissile and the structural material serves as cladding.

Gamma: highly penetrating photon radiation(similar to x-rays but higher energy); energetic gamma may pass through the body while others are absorbed, more by bone than soft tissue. May be shielded by very dense material such as lead, concrete or large quantities of water. Found in reactor, hot cell and radioactive waste storage areas. Gamma ray emitters include cobalt-60, chromium-51, and Iodides.

Neutron - May be highly penetrating. Human tissue damage results from energy imparted to hydrogen atoms as they are struck in the body. May be shielded by materials containing large amounts of hydrogen atoms such as paraffin, polyethylene and water. Found in operating reactor areas. Neutron particle emitters include uranium-235 and plutonium-239 when they undergo fission reactions.

Nobel Gases: This is a category of radioactive gases that are generally short-lived (a day or less) . They are sometimes referred to as chemically inert gases because they do not readily interact in the environment. They are, however by no means harmless because they are readily dispersed in the environment and resist becoming absorbed by plants, animals and humans.

Half-life - is the amount of time it takes for a substance's radioactivity to be reduced by half. The half-life determines how long a substance will remain radioactive. For example, cesium-137 has a half-life of about 30 years. That means that if a liter of water has 500 pCi/L concentration of Cs-137, that water will have a concentration of 250 pCi/L in 30 years; 125 pCi/L in 60 years; and 62.5 pCi/L in 90 years. The whole life of a radioactive substance is approximately its half-life times twenty years.

High-level Waste: Spent nuclear reactor fuel, and the highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High level waste may include the highly radioactive material the Nuclear Regulatory Commission consistent with existing law, determines by rule requires permanent isolation.

Ionizing Radiation: Radiation that is sufficiently energetic to dislodge electrons from an atom. Ionizing radiation includes x and gamma radiation, beta particles, alpha particles and heavier charged atomic nuclei. Neutron radiation, a product of nuclear fission in reactors and during nuclear detonations also ionized indirectly by colliding with atomic nuclei. Conversely, non-ionizing radiation is all other radiation including microwave and other electro-magnetic forms of radiation that involves the transfer of energy through space but is not sufficiently energetic to dislodge electrons in the atoms it interacts with. [Connor@58]

Low-level Waste: A catchall term for any radioactive waste that is not spent fuel, high-level, or transuranic waste. There are four categories of LLW - Class A, Class B, Class C, and greater than Class C (GTCC). Low-level does not mean low-risk.

Maximum Contaminate Level (MCL): The maximum permissible levels of a contaminate in water which is delivered to the free flowing outlet of the ultimate user of a public water system. This is a Environmental Protection Agency promulgated standard.

National Environmental Policy Act (NEPA): A Federal law, enacted in 1970, that requires the Federal government to consider the environmental impacts of, and alternatives to, major proposed actions in its decision-making processes.

Off-gas: This generally refers to the radioactive/chemical releases to the atmosphere from a nuclear plant.

Radionuclide: Atoms that emit ionizing radioactivity in the process of trying to stabilize an energized and unstable atomic nucleus. A radionuclide is identified by element and by an isotopic number which represents its atomic weight. [Connor@58]

Rad (R) (radiation absorbed dose) is a unit of dose equal to the deposition of 100 ergs of energy per gram of material being irradiated. A Roentgen is basically equal to one Rad.[IEER] The rad measures the amount of radiation absorbed by the exposed material. This number must be related to other factors in determining the effective dose to a human. [PSR]

Rem - (Roentgen Equivalent Man) measures the damage to a human from radiation exposure. It is determined by multiplying the number of rads by a number reflecting the potential damage caused by that particular type of radiation. [PSR] The Rem is a unit of dose that takes into account the relative biological damage due to various kinds of radiation energy (i.e.. Beta, Gamma, Alpha) absorbed by tissue. In general, the larger the amount of energy deposited per unit length of tissue, the greater the radiation damage per unit of absorbed radiation energy; that is, the greater the ratio of rems to rads. A rem is equal to 1000 millirem (mRem). Idaho's State exposure standard for gross beta is 4 mRem/yr (.004 rem).[Oversight 1991 @25] EPA radiation dose equivalent standards for the public were lowered in 1990 to 10 mRem/yr. DOE and NRC standards for workers are 5 rem/yr which have not changed for 35 years. British standard for workers is 1.5 rem/yr.

"Because of the particle mass and change, 1 rad deposited in tissue by alpha particles creates a more concentrated biological damage than 1 rad of gamma rays. To compensate for this difference in damage and subsequent effect, a new unit was created - the rem. This is called the dose equivalent. The absorbed dose is measured in rads and the dose equivalent is measured in rems. The rad and rem are related by a quality factor as follows: Number of rems = Q times the number of rads; where Q is the quality factor that has been assigned the following value: Q = 1 for beta particles and all gamma rays; Q = 10 for neutrons from spontaneous fission and for protons; Q = 20 for alpha particles and fission fragments. The quality factor is meant to approximately account for the relative harm caused by various types of radiation." [Federal Register, Vol. 56, No 138, 1991]

RaLa: The term RaLa is an abbreviation for radioactive lanthanum-140 which is a decay product of barium-140. RaLa as used here refers to all phases of barium-140 production and development to actual production facility operation. Barium-140 was produced at INL for military nuclear programs.

Raffinate: When spent reactor fuel is processed, initially, it is dissolved into a solution using acids and solvents and the liquid is called supernate. After multiple uranium/plutonium extraction processes (PUREX), the residual liquid waste is called raffinate and is sent to underground high-level waste tanks prior to being sent to the calciner for solidification.

Source Term: The amount of radioactive materials or chemicals released from a site, facility or point source of emissions to the environment over a given period of time. The source term is commonly used in dose reconstruction and for radio nuclides, is expressed in terms of particular radio nuclides and measured in curies. [Connor@60]

Throughput: This is a term used in relation to feed stock for a processing plant. For instance, the throughput for the Idaho Chemical Processing Plant would be the type and characteristics of the spent reactor fuel reprocessed at the plant. For an incinerator, it would be the type of waste run through the burner.

Transuranic Element: The 13 known atomic elements with higher atomic numbers (as determined by the number of protons in the atomic nucleus) than uranium, which has an atomic number of 92. The presence of transuranics in nuclear emissions and nuclear wastes has particular importance for public and worker health because most transuranics emit alpha radiation and many like plutonium-239 have very long radioactive half-lives. [Connor@60]

Transuranic Waste: Waste containing more than 100 nanocuries per gram of waste of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, except for (a) high-level radioactive waste; (b) waste that the DOE and EPA has determined does not need the degree of isolation required by 40 CFR 191; or (c) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. [HLW/EIS @D-34] The sum total of individual TRU isotopes curie concentration in a given waste unit must be more than 100 nCi/g. The TRU standard prior to 1984 was 10 nano curies per gram. Currently this category of waste between 10 and 100 nano curies per gram is called alpha-low-level. Pursuant to the Federal Court enforced agreement between Idaho and DOE, alpha-low-level waste will continue to be managed as TRU waste. [ROD@45]

Vitrification: The process of immobilizing waste that produces a glass-like or ceramic-like solid that permanently captures the radioactive materials and complies with waste acceptance criteria in deep geological high-level waste repository.

IX. Appendix D Units

Conversion Factors and Converting Unites of Measure

Volume

Units	Equivalence
milliliter (ml)................	0.001 L [cubic centimeter (cc)]
liter (L)....................	1,000 cc or 1,000 ml
cubic meter (cu m)......	1,000 liters; 35.3 cubic feet (cu ft.)
cubic meter.................	264 gallons (gal)
gallon (gal)..................	3.79 liters (l)(L)
cubic foot (cu ft.)..........	7.48 gal; 28.3 liters
acre-foot (ac ft.)...........	43,560 cu ft.; 1 acre 1 ft. deep

Mass

gram (gm) …………..	1 cc or ml of water
kilogram (kg)..............	1,000 grams (gm); 2.205 lb
metric ton...................	1,000 kg; 2,205 lb.
pound.........................	454 gm
ounce (oz)..................	28.4 gram (gm)
short ton ……………	2,000 lbs.; 0.91 metric tons ; normal U.S. ton

Scientific Notation [1]

1,000,000,000	$= 10^{9}$	E+09	giga	billion
1,000,000	$= 10^{6}$	E+06	mega	million
100,000	$= 10^{5}$	E+05		
10,000	$= 10^{4}$	E+04		
1,000	$= 10^{3}$	E+03	kilo	thousand
100	$= 10^{2}$	E+02	hecto	hundred
10	$= 10^{1}$	E+01	deca	ten
1	$= 10^{0}$	E+00		
0.1	$= 10^{-1}$	E -01	deci	tenth
0.01	$= 10^{-2}$	E -02	centi	hundredth
0.001	$= 10^{-3}$	E -03	milli (m)	thousandth
0.0001	$= 10^{-4}$	E -04		
0.00001	$= 10^{-5}$	E -05		
0.000001	$= 10^{-6}$	E -06	micro (u)	millionth
0.000000001	$= 10^{-9}$	E -09	nano (n)	billionth
0.000000000001	$= 10^{-12}$	E -12	pico (p)	trillionth

[1] "Scientific Notation is a convenient way of writing very large and very small numbers. For example, 635,000 is written as 6.35×10^{5} in scientific notation. This number is read as follows: '6 point 35 times ten raised to five.'" Institute for Energy and Environmental Research (IEER); "The Yellow Pages." IEER.org offers excellent "technical reference guides for activists, citizens and policy makers on nuclear waste and cleanup issues."

Greek, prefix & abbreviation	Value	Shorthand exponential notation	Description
mill—m	1/1,000	10^{-3}	One part per thousand.
micro—Greek m	1/1,000,000	10^{-6}	One part per million.
nano—n	1,1,000,000,000	10^{-9}	One part per billion.
pico—p	1/1,000,000,000,000	10^{-12}	
femto—f	1/1,000,000,000,000,000	10^{-15}	
atto—a	1/1,000,000,000,000,000,000	10^{-18}	

Thus 1 picocurie is a millionth millionth of a curie and is abbreviated 1 pCi. Also 1 millirad (1 mrad) is one thousandth of a rad.

Because of the particle mass and charge, 1 rad deposited in tissue by alpha particles creates a more concentrated biological damage than 1 rad of gamma rays. To compensate for this difference in damage and subsequent effect, a new unit was created—the rem. This is called the dose equivalent. The absorbed dose is measured in rads and the dose equivalent is measured in rems.

The rad and rem are related by a quality factor as follows:

Number of rems=Q times the number of rads

Where Q is the quality factor which has been assigned the following value:

Q=1 for beta particles and all electromagnetic radiations (gamma rays and x-rays)

Q=10 for neutrons from spontaneous fission and for protons

Q=20 for alpha particles and fission fragments

The quality factor is meant to approximately account for the relative harm caused by various types of radiation. The International System (SI) unit corresponding to the rem is the Sievert (Sv). One Sievert equals 100 rem.

Appendix B—Beta Particle and Photon Emitters

Nuclide	Ch (pCi/liter)
H-3	6.09E+04
BE-7	4.35E+04
N-13	1.52E+05
C-11	9.92E+04
C-14	3.20E+03
C-15	6.69E+06
O-15	4.95E+05
F-18	3.95E+04
NA-22	4.66E+02
NA-24	3.35E+03
SI-31	1.02E+04
P-32	6.41E+02
P-33	1.87E+03
S-35	1.29E+04
CL-36	1.85E+03
CL-38	2.12E+04
K-42	3.90E+03
CA-45	1.73E+03
CA-47	8.46E+02
SC-46	8.63E+02
SC-47	2.44E+03
SC-48	7.66E+02
V-48	6.44E+02
CR-51	3.80E+04
MN-52	7.33E+02
MN-54	2.01E+03
MN-56	5.64E+03
FE-55	9.25E+03

Appendix B—Beta Particle and Photon Emitters—Continued

Nuclide	Ch (pCi/liter)
FE-59	8.44E+02
CO-57	4.87E+03
CO-58	1.59E+03
CO-58M	6.49E+04
CO-60	2.18E+02
NI-59	2.70E+04
NI-63	9.91E+03
NI-65	8.81E+03
CU-64	1.19E+04
ZN-65	3.96E+02
ZN-69	6.31E+04
ZN-69M	4.22E+03
GA-67	7.02E+03
GA-72	1.19E+03
GE-71	4.36E+05
AS-73	7.85E+03
AS-74	1.41E+03
AS-76	1.06E+03
AS-77	4.33E+03
SE-75	5.74E+02
BR-82	3.15E+03
RB-82	4.36E+05
RB-86	4.85E+02
RB-87	5.01E+02
RB-88	2.91E+04
RB-89	5.27E+04
SR-82	2.41E+02
SR-85	2.83E+03
SR-85M	2.37E+05
SR-89	5.99E+02
SR-90	4.20E+01
SR-91	2.16E+03
SR-92	3.10E+03
Y-90	5.10E+02
Y-91	5.76E+02
Y-91M	1.32E+05
Y-92	2.87E+03
Y-93	1.20E+03
ZR-93	5.09E+03
ZR-95	1.46E+03
ZR-97	6.50E+02
NB-93M	1.05E+04
NB-94	7.07E+02
NB-95	2.15E+03
NB-95M	2.39E+03
NB-97	2.35E+04
NB-97M	1.37E+06
MO-99	1.83E+03
TC-95	6.97E+04
TC-95M	3.12E+03
TC-96	2.05E+03
TC-96M	1.76E+05
TC-97	3.25E+04
TC-97M	4.45E+03
TC-99	3.79E+03
TC-99M	8.96E+04
RU-97	7.96E+03
RU-103	1.81E+03
RU-105	4.99E+03
RU-106	2.03E+02
RH-103M	4.71E+05
RH-105	3.72E+03
RH-105M	5.51E+06

Appendix B—Beta Particle and Photon Emitters—Continued

Nuclide	Ch (pCi/liter)
RH-106	1.24E+06
PD-100	1.30E+03
PD-101	1.34E+04
PD-103	6.94E+03
PD-107	3.66E+04
PD-109	2.12E+03
AG-105	2.70E+03
AG-108	6.26E+05
AG-108M	7.23E+02
AG-109M	1.67E+07
AG-110	1.84E+06
AG-110M	5.12E+02
AG-111	1.08E+03
CD-109	2.27E+02
CD-115	9.58E+02
CD-115M	3.39E+02
IN-113M	5.24E+04
IN-114	9.76E+05
IN-114M	3.23E+02
IN-115	3.51E+01
IN-115M	1.64E+04
SN-113	1.74E+03
SN-121	6.06E+03
SN-121M	2.26E+03
SN-125	4.46E+02
SN-126	2.93E+02
SB-122	8.10E+02
SB-124	5.63E+02
SB-125	1.94E+03
SB-126	5.44E+02
SB-126M	5.85E+04
SB-127	8.18E+02
SB-129	3.09E+03
TE-125M	1.49E+03
TE-127	7.92E+03
TE-127M	6.63E+02
TE-129	2.72E+04
TE-129M	5.24E+02
TE-131	2.68E+04
TE-131M	9.71E+02
TE-132	5.80E+02
I-122	2.11E+05
I-123	1.07E+04
I-125	1.51E+02
I-126	8.10E+01
I-129	2.10E+01
I-130	1.19E+03
I-131	1.08E+02
I-132	8.19E+03
I-133	5.49E+02
I-134	2.14E+04
I-135	2.34E+03
CS-131	2.28E+04
CS-134	8.13E+01
CS-134M	1.01E+05
CS-135	7.94E+02
CS-136	5.18E+02
CS-137	1.19E+02
CS-138	2.56E+04
BA-131	2.95E+03
BA-133	1.52E+03
BA-133M	2.62E+03
BA-137M	2.15E+06

APPENDIX B—BETA PARTICLE AND PHOTON EMITTERS—Continued

Nuclide	Ch (pCi/liter)
BA-139	1.38E+04
BA-140	5.82E+02
LA-140	6.52E+02
CE-141	1.89E+03
CE-143	1.21E+03
CE-144	2.61E+02
PR-142	1.04E+03
PR-143	1.17E+03
PR-144	4.70E+04
PR-144M	1.12E+05
ND-147	1.25E+03
ND-149	1.17E+04
PM-147	5.24E+03
PM-148	5.05E+02
PM-148M	5.75E+02
PM-149	1.38E+03
SM-151	1.41E+04
SM-153	1.83E+03
EU-152	8.41E+02
EU-154	5.73E+02
EU-155	3.59E+03
EU-156	6.00E+02
GD-153	4.68E+03
GD-159	2.76E+03
TB-158	1.25E+03
TB-160	8.15E+02
DY-165	1.51E+04
DY-166	8.30E+02
HO-166	9.81E+02
ER-169	3.64E+03
ER-171	3.80E+03
TM-170	1.03E+03
TM-171	1.27E+04
YB-169	1.83E+03
YB-175	3.11E+03
LU-177	2.55E+03
HF-181	1.17E+03
TA-182	8.42E+02
W-181	1.90E+04
W-185	3.44E+03
W-187	2.66E+03
RE-183	5.40E+03
RE-186	1.88E+03
RE-187	5.82E+05
RE-188	1.79E+03
OS-185	2.46E+03
OS-191	2.38E+03
OS-191M	1.43E+04
OS-193	1.69E+03
IR-190	1.01E+03
IR-192	9.57E+02
IR-194	1.04E+03
PT-191	3.81E+03
PT-193	4.61E+04
PT-193M	3.02E+03
PT-197	3.40E+03
PT-197M	1.75E+04
AU-196	3.66E+03
AU-198	1.31E+03
HG-197	5.76E+03
HG-203	2.39E+03
TL-202	3.84E+03
TL-204	1.68E+03
TL-207	4.00E+05
TL-208	2.83E+05
TL-209	3.58E+05
PB-203	5.06E+03
PB-209	2.53E+04
PB-210	1.01E+00
PB-211	1.28E+04
PB-212	1.23E+02
PB-214	1.18E+04
BI-206	6.56E+02
BI-207	1.01E+03
BI-212	5.20E+03
BI-213	1.50E+04
BI-214	1.89E+04
FR-223	3.41E+03

APPENDIX B—BETA PARTICLE AND PHOTON EMITTERS—Continued

Nuclide	Ch (pCi/liter)
RA-225	9.14E+00
RA-228	7.85E+00
AC-227	1.27E+00
AC-228	3.27E+03
TH-231	4.07E+03
TH-234	4.01E+02
PA-233	1.51E+03
PA-234	2.56E+03
PA-234M	9.30E+05
U-237	1.78E+03
U-240	1.54E+03
NP-236	5.96E+03
NP-238	1.39E+03
NP-239	1.68E+03
NP-240	2.31E+04
NP-240M	1.74E+05
PU-241	6.26E+01
PU-243	1.64E+04
AM-242M	1.27E+00

Ch=Concentration in water for 4 mrem ede/y, assuming 2 liters daily intake.

APPENDIX C—ALPHA EMITTERS

NUCLIDE	Cm (pCi/liter)	Ci (pCi/liter)
SM-147	1.06E+02	1.04E+02
BI-210	1.94E+03	1.01E+03
BI-211	2.05E+05	1.56E+05
PO-210	1.40E+01	7.46E+00
PO-212	1.15E+14	8.78E+13
PO-213	8.03E+12	6.06E+12
PO-214	2.43E+11	1.86E+11
PO-215	9.17E+09	6.84E+09
PO-216	7.38E+07	5.30E+07
PO-218	9.50E+04	6.91E+04
AT-217	5.74E+08	4.27E+08
FR-221	4.50E+04	3.26E+04
RA-223	3.21E+01	2.41E+01
RA-224	5.46E+01	4.06E+01
RA-226	2.07E+01	1.57E+01
AC-225	1.85E+02	1.13E+02
TH-227	6.62E+02	4.03E+02
TH-228	1.53E+02	1.25E+02
TH-229	5.15E+01	4.93E+01
TH-230	8.27E+01	7.92E+01
TH-232	9.18E+01	8.80E+01
PA-231	1.02E+01	1.02E+01
U-232	1.02E+01	5.72E+00
U-233	2.56E+01	1.38E+01
U-234	2.59E+01	1.39E+01
U-235	2.65E+01	1.45E+01
U-236	2.74E+01	1.47E+01
U-238	2.62E+01	1.46E+01
NP-237	7.19E+00	7.06E+00
PU-236	3.33E+01	3.23E+01
PU-238	7.15E+00	7.02E+00
PU-239	6.49E+01	6.21E+01
PU-240	6.49E+01	6.22E+01
PU-242	6.83E+01	6.54E+01
PU-244	7.02E+00	6.87E+00
AM-241	6.45E+00	6.34E+00
AM-242	8.66E+03	5.34E+03
AM-243	6.49E+00	6.37E+00
CM-242	1.45E+02	1.33E+02
CM-243	8.47E+00	8.30E+00
CM-244	1.00E+01	9.84E+00
CM-245	6.35E+00	6.23E+00
CM-246	6.38E+00	6.27E+00
CM-247	6.93E+00	6.79E+00
CM-248	1.71E+00	1.67E+00
CF-252	1.70E+01	1.62E+01

Cm=Concentration in water for lifetime mortality risk=1×10^{-4}

Ci=Concentration in water for lifetime incidence risk=1×10^{-4}

Both assume 2 liters daily intake of water.

List of Subjects in 40 CFR Parts 141 and 142

Chemicals, Reporting and record keeping requirements, Water supply, Administrative practice and procedure.

Dated: June 17, 1991.

William K. Reilly,

Administrator, Environmental Protection Agency.

For the reasons set forth in the preamble, title 40 of the Code of Federal Regulations is proposed to be amended as follows:

PART 141—NATIONAL PRIMARY DRINKING WATER REGULATIONS

1. The authority citation for part 141 continues to read as follows:

Authority: 42 U.S.C. 300f, 300g–1, 300g–2, 300g–3, 300g–4, 300g–5, 300g–6, 300j–4 and 300j–9.

2. Section 141.2 is amended by adding, in alphabetical order, a definition for "adjusted gross alpha" as follows:

§ 141.2 Definitions

* * * * *

Adjusted gross alpha: Adjusted gross alpha is defined as the result of a gross alpha measurement, less radium-226 and less uranium. Radon is not included in adjusted gross alpha.

* * * * *

3. Section 141.15 is amended by revising the introductory text to read as follows:

§ 141.15 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems.

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity, which shall remain effective until [insert date 18 months after publication of the final rule in the **Federal Register**];

* * * * *

4. Section 141.16 is proposed to be amended by adding introductory text to read as follows:

§ 141.16 Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems.

The following maximum contaminant levels shall remain effective until [insert date 18 months after publication of the final rule in the **Federal Register**];

* * * * *

5. Section 141.25 is amended by revising the section to read as follows:

X . References

A few references in this Citizens Guide are in both foot notes and here. Most references are in [brockets] and are listed below in alphabetical order.

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