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Costs of Nuclear Still Rising as INL Presses for NuScale Reactor and More

writes Tami Thatcher in an editorial printed in the Idaho Falls Post Register February 24, 2016. An extended version of the editorial is provided here.

From brilliant nuclear scientists there is an endless variety of proposed reactor designs from various small modular reactors, fast neutron reactors, molten salt reactors, to thorium reactors.

But from advanced light-water reactors to fast reactors, the construction prices never seem to come down.

From the Argonne National Laboratory – West, now part of the Idaho National Laboratory, came the sodium-cooled fast EBR-II reactor. [1] Advancement of its design by GE-Hitachi has yet to be built commercially. [2]

Fast reactor economic disappointments range from the *We Almost Lost Detroit* Fermi I reactor, [3] whose license to construct was denied by the reactor safety committee but overridden by the chairman in 1957 and suffered a partial meltdown before ever reaching full power — to Japan's costly problem-plagued Monju reactor — to France's Superphenix, at $9 billion, 6 times the original construction estimate. It generated electricity only an average 6 percent of the time. [4]

NRC licensing processes are costly, but bypassing thorough licensing reviews can also be costly. An existing design was changed during steam generator replacement at San Onofre, and despite modern computer codes and engineering wizardry, the change allowed the tubes to vibrate

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[1] Susan M. Stacy, *Proving the Principle – A History of The Idaho National Engineering and Environmental Laboratory 1949-1999*, Idaho Operations Office of the Department of Energy, DOE/ID-10799, 2000. p. 165 describes the EBR-II reactor but incorrectly overstates its electrical generation capacity as 62.5 megawatts. The EBR-II was a 62.6 megawatt (thermal) reactor with a 19 megawatt electrical generation capacity.

[2] GE Hitachi's PRISM reactor, see http://gehitachiprism.com/ GEH has created the PRISM design building from the EBR-II reactor, a sodium-cooled reactor first pioneered in 1951.

[3] John G. fuller, *We Almost Lost Detroit*, http://wsrl.org/pdfs/detroit.pdf This free online book is an informative history and an important look into the psychology of nuclear promoters.

[4] See wiki regarding France's Superphenix and Japan's Monju.

excessively causing tube cracking and failure very soon after being installed. The utility tried to argue safety was not compromised. [5]

Burning plutonium in fast reactors could shuffle the spent nuclear fuel problem a bit, but according to the Blue Ribbon Commission report from 2012, it doesn't solve the problem. It does not alleviate the need for long term disposal in a geologic repository. [6]

Plutonium-blended Mixed Oxide (MOX) fuel can be burned in conventional reactors, but the Department of Energy's South Carolina project can't even give its MOX fuel away. The MOX plant is so over budget that a panel has recommended just burying the excess plutonium at the struggling to re-open Waste Isolation Pilot Plant (WIPP) in New Mexico. But pork keeps rolling to the fizzling MOX project. [7]

Last year the NRC cancelled funding of what would have been the first meaningful epidemiology study of health near US nuclear facilities. They claimed it would cost too much (at $8 million) and take too long. [8]

The US NRC prefers reliance on the 1980s epidemiology study that mixed children and adults and populations near and far from nuclear plants and predictably found no harm. [9] The NRC actively ignores the irrefutable studies from Germany that found increased cancer and leukemia rates of children living near each of the plants. [10] [11] [12]

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[5] See Arnie Gunderson's Fairwinds.org about San Onofre's 2013 botched steam generator tube replacement or the NRC's lessons learned at http://pbadupws.nrc.gov/docs/ML1501/ML15015A419.pdf

[6] Blue Ribbon Commission of America's Nuclear Future. 2012. (It uses 2010 estimates for spent fuel quantities) www.brc.gov

[7] Department of Energy's South Carolina "Mixed Oxide (MOX) fuel plant is under construction to blend plutonium with uranium to use in conventional light water reactors and costs continue to spiral. See http://nukewatch.org/MOX.html and http://www.scientificamerican.com/article/mox-fuel-nuclear/ and CB&I Areva MOX http://www.moxproject.com/

[8] NRC (Nuclear Regulatory Commission) 2010. NRC Asks National Academy of Sciences to Study Cancer Risk in Populations Living near Nuclear Power Facilities. NRC News No. 10-060, 7 April 2010. Washington, DC: NRC. The framework for the study was reported in "Analysis of Cancer Risks in Populations Near Nuclear Facilities; Phase I (2012). See cancer risk study at nap.edu.

[9] NCI (National Cancer Institute) 1990. Cancer in Populations Living near Nuclear Facilities. 017-042-00276-1. Washington, DC: Superintendent of Documents, U.S. Government Printing Office.

[10] Kaatsch P, Kaletsch U, Meinert R, Michaelis J.. 1998. An extended study of childhood malignancies in the vicinity of German nuclear power plants. Cancer Causes Control 9(5):529–533.

[11] The study is known by its German acronym KiKK (Kinderkrebs in der Umgebung von Kernkraftwerken): Kaatsch P, Spix C, Schmiedel S, Schulze-Rath R, Mergenthaler A, Blettner M 2008b. Vorhaben StSch 4334: Epidemiologische Studie zu Kinderkrebs in der Umgebung von Kernkraftwerken (KiKK-Studie), Teil 2 (Fall-Kontroll-Studie mit Befragung). Salzgitter: Bundesamt für Strahlenschutz.

[12] Kaatsch P, Spix C, Schulze-Rath R, Schmiedel S, Blettner M.. 2008. . Leukemia in young children living in the vicinity of German nuclear power plants. Int J Cancer 122(4):721–726.

What are a few children's lives compared to the health of the nuclear industry anyway?

While accident risks threaten the public's health and economic future, and seven decades of unsolved and politically untenable nuclear waste issues continue, it is largely construction cost overruns for new US plants as well as internationally that have further dampened enthusiasm for nuclear energy. [13] [14] [15] [16]

Construction costs do not include the decommissioning and waste disposal costs, the cost of repairs, or the cost of early reactor retirement.

French taxpayers are paying billions for state-backed company AREVA's cost overruns on its fixed price promise to construct a reactor in Finland. Construction costs are three times the original estimate and 9 years behind schedule. [17] [18]

Who pays for construction cost overruns depends on the contract between the builder and the utility.

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[13] Interim Consolidated Storage Act of 2015, HR 3643. September 29, 2015, Congress.gov (This bill hasn't gone anywhere.)

[14] WISE Nuclear Monitor, "The past as prologue, the persistent upward spiral of nuclear reactor costs," August 25, 2009. http://www.wiseinternational.org/nuclear-monitor/692-693/past-prologue-persistent-upward-spiral-nuclear-reactor-costs

[15] *Top Utility News*, Herman K. Trabish, "Nuclear industry darkened by delay, cost overruns at Vogtle & Summer facilities," Aug 24, 2015. Four Westinghouse AP1000 nuclear reactors are under construction in the US: two in Georgia at Vogtle and two in South Carolina at V.C. Summer. See http://www.uti litydive.com/news/nuclear-industry-darkened-by-delays-cost-overruns-at-vogtle-summer-facil/404418/ The AP1000 modular design was supposed to streamline construction and reduce cost but that hasn't been the case. Four AP1000 reactors under construction in China are also over budget and behind schedule. VC Summer costs for both plants were to be $9.8 billion for both units and an additional $1.2 billion has been added, according to wiki.

[16] The Georgia utility is asking the state to certify $1.4 billion in Vogtle cost overruns and push the completion date back 18 months. The state Public Service Commission to decide who will pay for the overruns. See http://atlantaprogressivenews.com/2015/08/01/vogtle-nuclear-expansion-total-cost-is-65-billion-dollars-former-commissioner-says/ and http://www.power-eng.com/articles/2015/03/plant-vogtle-nuclear-reactors-expected-to-cost-7-5bn.html Vogtle construction costs originally $4.4 billion, now slated at $5.045 billion. And contractor's costs are currently the subject of litigation. (See Twelfth Semi-Annual Vogtle Construction Monitoring Report of February 2015 at www.georgiapower.com

[17] yle UUTISET, "French auditors slam Areva for Olkiluto nuclear project in Finland," July 15, 2014, http://yle.fi/uutiset/french_auditors_slam_areva_for_olkiluoto_nuclear_project_in_finland/7358244 "It is a bottomless pit of financial losses. . ."

[18] Jim Green and Oliver Tickell, *Ecologist*, "Finland cancels Oliluoto 4 nuclear reactor – is the EPR finished?, May 15, 2015, http://www.theecologist.org/News/news_analysis/2859924/finland_cancels_olkiluoto_4_nuclear_reactor_is_the_epr_finished.html Note that build of the Generation III European Pressurized Reactor (EPR) also called the "Evolutionary Power Reactor" at Olkiuoto 3 continues, but no fourth unit is planned.

The NuScale small modular reactor, if built at the INL, may be obsolete before it is finished. It is not a bridge to advanced reactor design. It does not solve spent nuclear fuel disposal issues or spent fuel pool safety issues. [19]

With closed meetings being conducted by Idaho energy planners, [20] will the citizens who are the captive ratepayers and taxpayers and also bear the consequences of an accident be able to discuss lower cost, infinitely safer low carbon alternatives?

Fluor Wins "Cost Plus Fee" Contract for $1.4 Billion INL Cleanup

The U.S. Department of Energy (DOE) announced early in February 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. Two proposals were received in response to the solicitation.

Despite other bidders dropping out when more risk was being asked of them, ultimately the DOE gave Fluor a contract that is "primarily Cost-Plus-Incentive-Fee (CPIF)." [21]

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 (which is a tiny portion of the buried waste at the Radioactive Waste Management Complex); 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, RWMC and the Radioactive Scrap and Waste Facility (RSWF) facility infrastructure at the Material and Fuel

[19] NuScale Power Modular and Scalable Reactor Overview at https://www.iaea.org/NuclearPower/Downloadable/aris/2013/nuscale-2013-05-14.pdf and http://www.nuscalepower.com/

[20] Ken Miller, Snake River Alliance, "State and Utilities Start Talking About Idaho's Energy Future – Without the Public," September 4, 2015. The State's Office of Energy Resources houses the Idaho Strategic Energy Alliance (ISEA) charged with enabling advanced energy production. In 2015, they met in secret. They didn't provide notice of their meetings or meaningful minutes of what was said.

[21] Department of Energy website at http://www.energy.gov/em/articles/doe-awards-contract-idaho-clean-project-icp-core

Complex (MFC). Optional scope to be performed under this contract includes: Integrated Waste Treatment Unit (IWTU) operations. The IWTU option scope will be exercised at contract award.

Fluor and its partners, according to the Idaho Falls Post Register, will be working closely with the lab and the City of Idaho Falls through NuScale, a company developing small modular reactor technology in which Fluor holds a majority stake. [22]

IWTU Remains in Test and Fix Mode

The February 17 Idaho National Laboratory's Citizens Advisory Board meeting was given an update on the troubled Integrated Waste Treatment Unit. Now several years behind the 2012 Idaho Settlement agreement milestone, no radioactive sodium-bearing waste has been treated, but testing using a "simulant" has been conducted to exercise the new facility.

Each round of simulant runs has brought new surprises in the way of equipment problems. After the latest simulant run last November, while some problems were fixed several new problems were found including erosion and wear of fluidizer components, warping of a heat exchanger, and reduced but continuing "bark-like" scale formation. The leaders will tell you they are letting the plant tell them what it needs.

DOE is assuming that the approach of just fixing what obviously degrades within a few weeks of testing will be adequate to safety run the facility in the future with radioactive material. The reason for the multitude of inadequately designed components? If DOE knows, they aren't telling. Worker and public safety is at risk when and if equipment malfunctions during operation of IWTU with radioactive material.

A "Chemistry Summit" was held that week featuring experts from other national labs and industry. The facility continues to spend roughly $3 to $5 million per month on experts, staffing and repairs. The next simulant run is scheduled for next April and the DOE is not shifting to a new approach at this point.

The Department of Energy remains hopeful that they will iron out the problems and begin treating radioactive material by next fall as it committed to the Idaho Department of Environmental Quality after continuing to miss treatment schedules last year.

After the plant circulates radioactive material, acid flushing will be required to enable repair of equipment to reduce radiation levels of the contaminated systems. Air permit testing will be required initially to confirm air emissions estimates after the facility begins radioactive material treatment.

If the plant ran smoothly, it would only take a year or so to treat all of the liquid sodium-bearing waste. Then underground tank system closure could commence. The next phase of cleanup

[22] Roger Plothow, *Idaho Falls Post Register*, "Fluor a good choice for tough project," February 7, 2016.

would reuse the IWTU building to provide repackaging of calcine resulting from past nuclear fuel reprocessing at the Idaho Nuclear Technology and Engineering Center (INTEC) for shipping to a repository, if a repository existed.

Department of Energy Issues INL

CERCLA Cleanup Five-Year Review

The Department of Energy's report summarizing a review of the mandated cleanup of the Idaho National Laboratory's chemically and radiologically contaminated areas was issued early this year. [23] The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) cleanup that began in the late 1980s continues today. The Five-year review admits that measures to lower chemical contamination in the aquifer at Test Area North (TAN) are not going well. Aside from that admission, the report fails to mention the numerous new added sites or the bungling of the date for ending institutional control of an area at the ATR Complex.

New information reported for the ATR Complex, formerly called the Test Reactor Area was reported last year. [24] In that new information notice, it was admitted that thousands of years need to be added to the previously date of 2310. DOE is still trying to figure out the actual number of years that need to be added. Based on the contaminant concentration of Americium-241 and the specified acceptable level of concentration, they need about 10 half-lives to decrease to regulatory soil contamination levels. While this contamination is under the surface by 10 ft or more, it can migrate to the aquifer. The measured soil contamination included elevated strontium-90, cesium-237, nickel-63, cobalt-60, and europium-152/154/155, all expected to decay to unrestricted use levels within 400 years. But the soil also contained high concentrations of plutonium-238, plutonium-239/240, and Americium-241. While the plutonium concentrations were double the unrestricted concentrations and needed a single half life to decay to unrestricted levels, the Am-241 concentration of 3210 pCi/g would require about 4 half lives to decay to the unrestricted concentration of 187 pCi/g. Am-241 has a 432 year half-year, but because Am-241 decays to Neptunium-237 which has a seriously long half-life of 2.14 million years, how DOE arrived at adding only an additional 24,000 years is a mystery.

The INL cleanup sites that will remain contaminated DOE summarizes in a "Long Term Stewardship Database." This database lists cleanup sites known as "operable units" that require institutional controls to restrict human use. The estimated duration of time that the sites require institutional control is specified either as a specific year such as "2310" or simply as "indefinite." By this rather word, "indefinite," the DOE hopes the public won't understand that what this actually means is "into perpetuity or forever.

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[23] 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.

[24] 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

Because these contaminated forever sites are a bummer, the DOE never seems to give a link to or full title of the actual institutional control database. However, I was able to find it on an Environmental Protection Agency website. [25] The database date for as of February, yet the error reported last fall regarding the ATR Complex date for removing institutional controls remained uncorrected. Ah, 2310 or an added 24,000 years or an several 5 million or so years: "Who cares?" they say, "we won't be here."

There are different groupings of contamination sites within operable units at each Waste Area Group. But roughly speaking, the INL's remediation is leaving Idaho with dozens of soil "forever contamination" areas that will require institutional controls "indefinitely" or forever. They have ingeniously left the date for removing aquifer restrictions as "unspecified."

In addition to the TAN, ATR Complex, and of course the Idaho Nuclear Engineering and Technology Center (INTEC) waste area groups with "forever contamination," there is the largest "forever contamination" area, the Radioactive Waste Management Complex (RWMC). The EPA fails to acknowledge or discuss the fact the it ignores radiological doses that rise and peak after 10,000 years and continue to remain above 30 mrem/yr forever, 100 mrem/yr if the soil cap is not maintained forever.

The DOE's report summarizing the "forever contamination" at RWMC was never disclosed to the public prior to EDI's freedom of information act request. [26] A figure from the DOE's report showing the rising radiation doses largely from migration of contaminants to the aquifer is shown figure below depicting the 100 mrem/yr case without credit for the soil cap slowing migration of contaminants to the aquifer.

In the short term, less than 1000 years, the ingestion dose from drinking water near RWMC due to migration of radionuclides buried at RWMC to the aquifer is primary due to carbon-14, chlorine-36, iodine-129, and technetium-99. In the longer term, americium-241 is the predominant contributor to dose as well as various uranium and plutonium isotopes. The figure does not show the chemical contamination at RWMC which already exceeds federal MCL drinking water standards.

[25] INL Waste Area Group Institutional Controls Report. Dated February 16, 2016. https://cleanup.icp.doe.gov/ics/ic_report.pdf from the EPA page: https://cleanup.icp.doe.gov/ics/

[26] 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. See https://www.inl.gov/about-inl/general-information/doe-public-reading-room/

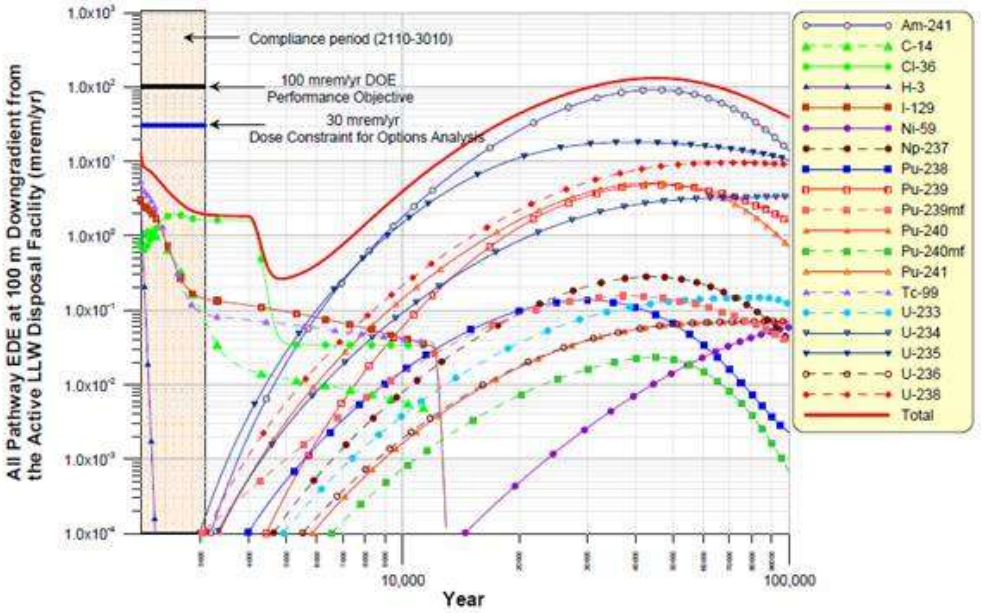

Figure 4-2. All-pathways effective dose equivalent 100 m downgradient from the Radioactive Waste Management Complex boundary from year 2110 to year 100,000 with cover infiltration rate equal to 1 cm/year.

Department of Energy Issues Preliminary Notice of Violation to Contractors Involved in the WIPP Accidents But Does Not Levy Fines

While the Department of Energy's Waste Isolation Pilot Plant (WIPP) is progressing with a new safety analysis, a plan for installing a temporary ventilation system, and scheduled operations readiness reviews, the DOE is not stating when shipments of transuranic waste from Idaho to WIPP are expected to resume. They are also expecting that when WIPP does begin accepting shipments, that they may only be accepting shipments at a slow pace sometime after 2016.[27]

The U.S. Department of Energy (DOE) recently issued a Preliminary Notice of Violation (PNOV) to Nuclear Waste Partnership, LLC (NWP) for violations of DOE worker safety and health and nuclear safety requirements. [28] [29] Concurrently, DOE's National Nuclear Security

[27] See Idaho National Laboratory Citizen's Advisory Board February 17, 2016 "Progress at WIPP" presentation at www.inlcab.energy.gov

[28] Department of Energy website: http://energy.gov/articles/department-energy-cites-nuclear-waste-partnership-llc-and-los-alamos-national-security-llc

[29] http://sputniknews.com/us/20160219/1035057063/us-nuclear-waste-contactors.html

Administration (NNSA) issued a PNOV to Los Alamos National Security, LLC (LANS) for violations of DOE's nuclear safety requirements. Issuance of these PNOVs marks the completion of DOE's investigations and enforcement process regarding two events in February 2014 at DOE's WIPP.

NWP is the management and operating contractor for WIPP, located in Carlsbad, New Mexico. LANS is the management and operating contractor for NNSA's Los Alamos National Laboratory (LANL), located in Los Alamos, New Mexico. Worker safety and health and nuclear safety are priorities for the Department, and DOE's enforcement program, implemented by the Office of Enterprise Assessments' Office of Enforcement on behalf of the Secretary of Energy, supports these priorities by holding contractors accountable for meeting regulatory requirements and maintaining a safe and healthy workplace.

Due to significant adverse contract and fee actions taken against NWP and LANS, DOE is proposing no civil penalties for the violations cited in the two PNOVs.

DOE's Office of Enforcement states it role is to promote overall improvement in the Department's safety and security programs through management and implementation of the DOE enforcement programs for safety and classified information security, authorized by the Atomic Energy Act.

The reality is that the Department of Energy claims to have in place adequate regulations defining how processes are to be implemented and DOE not only has oversight functions daily at these facilities, the DOE is required to review and approve the documented safety analyses and to audit deficiencies at these facilities. The things the contractors are being slammed for were well known to WIPP Department of Energy employees.

WIPP's original safety basis had been extensively reviewed, more than any other DOE facility. Reviews by the Environmental Protection Agency and by the Defense Nuclear Facility Safety Board had been conducted. But subsequent changes to the WIPP safety basis, approved by DOE had reduced safety significantly. They made the assumption that a roof fall would never occur in an open panel and had no accident analysis for this. WIPP experienced a roof fall within a couple months of not bolting the ceiling in the underground mine. The accident investigation report also discovered that far more plutonium/americium was released from a single drum in the February 12, 2014 event than the safety analysis predicted was possible. [30]

[30] Department of Energy Office of Environmental Management, Accident Investigation Report, "Phase 2 Radiological Releases Event at the Waste Isolation Pilot Plant February 14,2014," April 2015. http://wipp.energy.gov/Special/AIB_WIPP%20Rad_Event%20Report_Phase%20II.pdf See Sections 7.1 and 7.2. The release was found to have been from a single drum with stated inventory in plutonium-239 equivalent curies of 2.84 PE-Ci. But based on contamination on filters at Station A of 0.1 curies PE-ci far from the exploded drum in Panel 7, using conventional safety analysis assumptions the expected amount of material released to Panel 7 would not have exceeded 2.84E-4 PE-Ci — far less than what was measured downstream at Station A. The inventory in the drum appears to have been much higher than stated for WIPP drum and the release fractions may also be incorrect. This discrepancy in the transuranic inventory of the drum is in addition to the fact that forbidden inorganic "kitty litter" absorbent was placed in the drum which allowed an explosive combination of nitrates and organics. In my view, the extent to which the stated transuranic inventory was

Tracking the INTEC Disposal Well Waste Water in the Snake River Plain Aquifer

Understanding past contamination levels of groundwater near the Idaho National Laboratory requires a careful look at data collected by the US Geological Survey in various wells south of the INL. [31] [32]The most recent INL CERCLA cleanup report states "By the early 1990s, low but detectable concentrations below [maximum contaminant levels] MCLs of tritium, Cl-36, Tc-99, and I-129 derived from the injection well had reached the southern INL Site boundary some 8 mi south of INTEC." [33] But the reality is that INTEC waste water contaminants had already reached several miles south of the southern INL site boundary by the 1970s.

The USGS study of radioactive Chlorine-36 discusses waste water reaching USGS 14 "at least by 1984." [34] But a more detailed report on this topic concludes that analysis of archived samples for Cl-36 showed the waste water had reached USGS 14 by the 1970s. [35]

I note that well monitoring shows a large spike in sodium and chloride in wells south of INL by the late 1950s from the INTEC injection well that was in use by 1952.

Did INTEC waste water reach as far east as Atomic City, located on the southern border of INL?

Tritium levels at Atomic City in 1965 was monitored by the USGS as 11,000 pCi/L and the levels still come in sometimes at 100 pCi/L. While the USGS has tended to inflate what they refer to "background" levels of tritium at INL, wells outside of the INTEC plume and not near other radioactive disposal sites have basically no detectable tritium these days. While this is

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understated and actually not known does not appear to be adequately addressed by corrective actions recommended in the report. Alpha is difficult to monitor and easily shielded: DOE does not want you to know the degree that they say is in the drums may not conservatively bound what is actually in the drums.

[31] US Geological Survey website link: http://id.water.usgs.gov/projects/INL and INL bibliography at http://id.water.usgs.gov/INL/Pubs/INL_Bibliography.pdf

[32] The USGS mapper is at http://maps.waterdata.usgs.gov/mapper/index.html

[33] 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. See p. 6-6.

[34] U.S. Geological Survey, "Evaluation of archived water samples using chlorine isotopic data, Idaho National Engineering and Environmental Laboratory, Idaho 1966-93," DOE/ID-22147, Report 98-4008, 1998. http://pubs.er.usgs.gov/usgspubs/wri/wri984008

[35] L. DeWayne Cecil, "Origin of Chlorine-36 in the Eastern Snake River Plain Aquifer, Idaho: Implications for Describing Ground Water Contamination Near a Nuclear Facility. A thesis presented to the University of Waterloo in fulfillment of the thesis requirement for the degree of Doctor of Philosophy In Earth Sciences Waterloo, Ontario, Canada, 2000. http://www.collectionscanada.gc.ca/obj/s4/f2/dsk3/ftp04/NQ60526.pdf

below the federal maximum drinking water standard for tritium of 20,000 pCi/L, the federal MCL is ridiculously high.

The Atomic City USGS data showed a similar historical big up-tic in sodium and chloride levels that is shared by other wells down-aquifer from INTEC. The USGS monitoring of various contaminants is very spotty: they would sample a contaminant once and even if found above background, they might not resample it in future years.

Atomic City did receive fallout from INL including the 1961 SL-1 reactor accident. High levels of Cesium-137 may be fallout or INTEC plume. But the Atomic City well shows a spike in sodium and chloride, and continuing elevated levels of tritium. It appears to me that Atomic City did receive the INTEC radioactive waste water plume. Elevated levels of chromium suggest that the Test Reactor Area (now ATR Complex) plume with high hexavalent chromium that co-mingled with the INTEC plume was also received by Atomic City wells.

The rate of water pumping and reinjection at INL affect local aquifer flow and where the contaminants go. The water stream from an injection well will wind its way through the underground lava flows in unique ways that are variable because of the solid rock formations in some areas and basically flow tubes in other areas. The aquifer is a big porous rock sponge that is highly non-uniform. If water usage at Atomic City was high, it would tend to bring more INTEC contamination toward the heavily used wells. Note also that seasonal changes in well water level are normal and these changes act to dilute or concentrate contaminants. The farther downstream from the source of contamination, the deeper the depth in the aquifer the contaminants may be at. Thus mixing of well water from different depths will tend to dilute the sample. So, there are a lot of reasons for monitored results to bounce around when you are fortunate enough to have data for a particular contaminant for multiple years. The USGS data monitoring is publically available but often a contaminant of interest is not monitored more than once or twice even when the value is significantly above background.

What does this mean for other wells south of INL? Unfortunately, much of the reporting of down-aquifer wells seemed to avoid discussion that these wells were known to have received INTEC plume waste water (such as USGS 14, also known as MV-61.

It was important for the DOE and USGS to keep public perception that contamination had not migrated off the INL site for as long as they could, a tradition that continues today as DOE tends to discuss contamination not going off-site before the 1990s when their own reports know the contamination went off-site decades earlier but often their own reports don't mention this fact. [36] The verbal now tends to emphasize that levels exceeding federal maximum contaminant levels

[36] U.S. Geological Survey, *Historical Development of the U.S. Geological Survey Hydrologic Monitoring and Investigative Programs at the Idaho Engineering and Environment Laboratory, Idaho, 1949 to 2001*, Report 2005-1223 (DOE/ID-22195), 2005. See listing of reports for contamination from the southern boundary of INL to Hagerman, Idaho, not all are available online.

were not exceeded.[37] Yet, the ability to monitor accurately the plume during the 1960s and 1970s was limited by analytical capability.

In report published by the USGS in 2000 specifically about aquifer contamination south of the INL, there is no mention of the wells proven to have been affected by INTEC waste water discharge published in 1998 despite this concern being a reason for the 2000 report. [38] [39]

Articles by Tami Thatcher, for March 2016.

[37] Chuck Broscious, Environmental Defense Institute, *Citizens Guide*, 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. . . .In 1997, State health studies of cancer rates in Minidoka county found that there is 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.

[38] U.S. Geological Survey, *Radiochemical and Chemical Constituents in Water from Selected Wells and Springs from the Southern Boundary of the Idaho National Engineering and Environmental Laboratory to the Hagerman Area, Idaho, 1999,* Report 00-399, 2000. This report fails to acknowledge the Chlorine-36 analysis proving INTEC contamination based on archived samples. Other indicators such as sodium and chloride data are not given.

[39] U.S. Geological Survey, "Evaluation of archived water samples using chlorine isotopic data, Idaho National Engineering and Environmental Laboratory, Idaho 1966-93," DOE/ID-22147, Report 98-4008, 1998. http://pubs.er.usgs.gov/usgspubs/wri/wri984008 This report states that USGS 14, also known as MV-61, was affected by INTEC waste water.