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Small Nuclear Reactor Explosion in Russia Kills Seven People

News of the explosion of a small nuclear reactor in northern Russia that killed seven people continues to trickle out giving some clues about what happened. Near the city of Severodvinsk, radiation levels are said to have briefly spiked up to twenty times normal levels. [1] In early August, during retrieval efforts to retrieve a sunken nuclear-powered cruise missile, [2] the reactor apparently went prompt critical.

A prompt critical accident means that suddenly the reactor's neutron populations increased so rapidly that the heat generated caused the reactor fuel to melt. High power levels can be reached rapidly before displacement of the fuel shuts down the reaction. The reactor had remained subcritical while submerged in water, so introduction of water, a moderator, by in-leakage to the reactor, would not seem to be the cause. Rapid withdrawal of control rods or structural elements that absorb neutrons or **rapid movement of fuel inside the reactor** could be the cause. There may have been no way to assure the internal structural integrity of the reactor before lifting it.

Several radioactive isotopes that are short-lived indicate that the reactor went critical and generated fission products. Near the accident location, the Russian weather agency detected strontium-91 (half-life 9.3 hours), barium-139 (half-life 83 minutes), barium-140 (half-life 12.8 days), and lanthanum-140 (half-life 40 hours). [3] Probably many other radionuclides were released. Radioactive debris has washed up on the Dvinsk Bay shores and local residents have been warned to avoid the radioactive debris.

The Guardian reported that there are reports suggesting that doctors who treated victims of the explosion have tested positive for cesium-137. [4]

Perhaps more frightening that the accident and radiological release itself are the descriptions of the intended use of this nuclear-powered cruise missile. Concepts for such a nuclear-powered missile were explored by the U.S. in the 1950s and 60s. These cruise missiles would have longer

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[1] Kyle Mizokami, *Popular Mechanics*, "Why the U.S. Abandoned Nuclear-Powered Missiles More Than 50 Years Ago," August 13, 2019. https://www.popularmechanics.com/military/research/a28690053/russia-nuclear-powered-missile-skyfall/

[2] Mark Krutov et al., *Radio Free Europe*, "Did A Botched Bid To Recover A Sunken Missile Cause The Russian Radiation Blast?" August 30, 2019. https://www.rferl.org/a/russia-radiation-explosion-sunken-missile-investigation-nyonoksa/30138178.html

[3] Andrew E. Kramer, *The New York Times*, "Russia Confirms Radioactive Materials Were Involved in Deadly Blast," August 10, 2019. https://www.nytimes.com/2019/08/10/world/europe/russia-explosion-radiation.html?action=click&module=RelatedLinks&pgtype=Article

[4] Matthew Bodner, *The Guardian*, "Russia says radioactive isotopes releases by mystery blast," August 26, 2019. https://www.theguardian.com/world/2019/aug/26/russia-confirms-radiation-spike-after-weapons-test-blast

flying range than conventionally powered cruise missiles. The concept involves the ability to fly at supersonic speeds, the ability to fly at low altitudes, near 1,000 feet, to avoid radar detection, and the ability to drop several nuclear bombs on different targets.

Nuclear Reactor and Nuclear Waste Industries Fail to Adequately Address Hydrogen Explosion Hazard

It shouldn't surprise me that the Department of Energy is lax on understanding, preventing and mitigating hydrogen gas buildup in transuranic waste drums because the nuclear power industry also relies more on fiction than on adequate prevention measures for preventing hydrogen explosions at nuclear reactors.

Not only was there a hydrogen bubble in the reactor vessel, there was a hydrogen explosion at the Three Mile Island – II (TMI-2) accident in 1979 from melting zirconium cladding. [5] There were the hydrogen explosions — detonations — at the 2011 Fukushima Daiichi accident. [6]

A report written by Mark Leyse for the Natural Resources Defense Council describes the unresolved problems involving hydrogen generation at nuclear reactor plants, even the new AP1000 nuclear reactors being built in the U.S. [7]

The Department of Energy has methane and hydrogen gas buildup problems in its transuranic waste drums that it has failed to fully investigate or mitigate. A deflagration transition to detonation at a transuranic waste facility could involve worker fatalities and significant release of radionuclides to the environment. Yet, hazardous waste permits by States under RCRA hazardous waste laws don't even consider what hazards nor the environmental consequences of the facilities the States grant RCRA hazardous waste permits to. It's kind of a "don't ask, don't tell" arrangement on both the nuclear regulations and the hazardous waste regulations in regard to explosive hazards and potential consequences at the RCRA permitted facilities at the Idaho National Laboratory.

The Revised July 2017 WIPP Enhanced Chemical Compatibility Requirements Apparently Ignored by Fluor Idaho and Department of Energy Idaho Operation Office

The Waste Isolation Pilot Plant (WIPP) issued new chemical compatibility requirements for transuranic waste in July 2017. [8] The new requirements were created because of an accident at

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[5] Prepared by the Nuclear Safety Analysis Center, Analysis of Three Mile Island - Unit 2 Accident, NSAC-80-1, NSAC-1 Revised, EPRI-NSAC—80-1, March 1980. https://inis.iaea.org/collection/NCLCollectionStore/_Public/13/677/13677904.pdf

[6] Taeko Shinongag et al., *Environmental Science & Technology*, "Airborne Plutonium and Non-Natural Uranium from the Fukushima DNPP Found at 120 km Distance a Few Days after Reactor Hydrogen Explosions," 2014. Dx.doi.org/10.1021/es404961w

[7] Mark Leyse, Natural Resources Defense Council (NRDC) Report, *Preventing Hydrogen Explosions in Severe Nuclear Accidents: Unresolved Safety Issues Involving Hydrogen Generation and Mitigation*, R:14-02-B, March 2014. https://www.nrdc.org/sites/default/files/hydrogen-generation-safety-report.pdf

WIPP in 2014 involving an uncontrolled exothermic reaction in a drum from organic kitty litter absorbent and nitrate salts. The report with these new requirements describes how the Advanced Mixed Waste Treatment Project at the Idaho National Laboratory is one of two programs that can certify waste for shipment to WIPP. The other program is managed from Carlsbad, New Mexico.

Despite the increased focus on transuranic waste drum chemical reactions, *four waste drums from the Advanced Mixed Waste Treatment Project*, that were to be sent either to WIPP or to the low-level radioactive waste disposal facility at Clive, Utah, rapidly overpressurized at the Idaho site's Accelerated Retrieval Project (ARP) V in April 2018. The four drums, one-by-one, breached their 55-gallon drum container, sent lids flying, smoldered at elevated temperatures, ejected most of the waste contents, created toxic airborne fumes and gases, created extremely high alpha airborne radiological contamination levels and reduced visibility due to the thick cloud of powdery materials. Personnel, fortunately, didn't happen to be in the facility at the time of the explosions. But, emergency responders to the first drum that overpressurized and ejected waste contents narrowly missed being in the room when additional drums overpressurized. Methane buildup resulting from heating up beryllium carbides in the waste by the oxidation of uranium metal was determined to be the cause of the rapid overpressurization of the drums that overcame the drum vents within hours of being newly repackaged. [9]

The July 2017 revised WIPP requirements state that chemical compatibility evaluation has been enhanced to require formal documentation and generation of a chemical compatibility evaluation memo for the waste stream, "as needed." The chemical compatibility evaluations are based on the method described in the 1980 EPA method EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Wastes." The evaluation begins with a list of all of the chemicals in the waste stream, based on the Accepted Knowledge Summary Report. The chemical compatibility evaluation is performed to determine if the chemicals in the waste stream are compatible. The quantity of the chemicals and materials for the waste stream are identified as being in quantities of (1) trace – less than 1 weight percent, (2) Minor – from 1 to 10 weight percent, or (3) Dominant – greater than10 weight percent.

According to the WIPP July 2017 report, "incompatible" refers to the materials/chemicals that, when mixed, can lead to consequences including:

- Generate extreme heat or pressure, fire or explosions, or violent reactions
- Produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human or environmental health

[8] Alison Moon et al., *U.S. Department of Energy Implementation of Chemical Evaluation Requirements for Transuranic Waste Disposal at the Waste Isolation Pilot Plant*, DOE-EM-4.21-01, July 2017. https://www.osti.gov/servlets/purl/1373361

[9] Idaho Cleanup Project Core, "Formal Cause Analysis for the ARP V (WFM-1617) Drum Event at the RWMC," October 2018. https://fluor-idaho.com/Portals/0/Documents/04_%20Community/8283498_RPT-1659.pdf

- Produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions [or]
- Damage the structural integrity of the device or facility, threaten human/environmental health in any other way.

These conditions are similar to the conditions in federal hazardous waste law 40 CFR 264.17. I presume that any of the above are a sign of incompatible materials, although the report does not explicitly state this and the overpressurization at the Idaho site in April 2018 could have created all of the above listed conditions. If the Department of Energy and Fluor Idaho had been trying to create all of the listed conditions in the July 2017 WIPP document, inside the ARP V fabric enclosure with no fire barriers or fire suppression systems, no operational airborne radiological contamination instruments, and no facility personnel qualified to use self-contained breathing apparatus, they could hardly have done a better job.

The Post Register reported that after the accident, 37 waste containers at the facility were processed by August 20, 2019. [10]

PCBs: Aroclor, What's It For?

When reviewing environmental contamination at Department of Energy and Department of Defense sites or weapons production-related wastes, often polychlorinated biphenyls (PCBs) are found. Production of PCBs was restricted in the 1970s but the PCBs are very chemically stable and persist in the environment from past use. Production of PCBs in the U.S. ended in 1997 because of environmental and health concerns. PCBs can accumulate in fatty biological tissue and pose human and ecological health risks. What are PCBs and why are they prevalent in these wastes that often contaminate soil?

PCBs had many uses including use in plasticizers, fluorescent lighting fixtures and electrical equipment such as capacitors. [11] A prevalent use for PCBs, less mentioned, is its use for chemical separation of radionuclides such as plutonium or americium.

A report about PCB contamination in sediments describes PCBs as a class of chlorinated organic compounds that have from one to ten chlorine atoms. [12] Although many possible patterns for how chlorines are substituted onto biphenyl rings are possible and about 100 to 150 are found in environmental samples. A few of them are termed Aroclors because of their trade name. Most Aroclors are PCBs.

Aroclors 1016, 1242, 1254, and 1260 comprised more than 90 percent of the PCBs that were produced in the U.S. Other names used for PCBs include Tri-chlorobiphenyl ($C_{12}H_7Cl_3$) and Penta-chlorobyphenyl ($C_{12}H_5Cl_5$) and other chlorobiphenyls.

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[10] Nathan Brown, *The Idaho Falls Post Register*, "Fluor says waste processing at ARP V done," August 21, 2019.

[11] Argonne National Laboratory in collaboration with U.S. Department of Energy, *Radiological and Chemical Fact Sheets to Support Health Risk Analyses for Contaminated Areas*, March 2007. https://www.remm.nlm.gov/ANL_ContaminantFactSheets_All_070418.pdf

[12] Naval Facilities Engineering Command, *Engineering and Expeditionary Warfare Center, A Handbook for Determining the Sources of PCB Contamination in Sediments*, Technical Report TR-NAVFAC EXWC-EV-1302, October 2012. https://clu-in.org/download/contaminantfocus/pcb/pcb_sediment_handbook.pdf

Other chlorinated chemicals commonly found at DOE and DOD sites include chlorinated hydrocarbons such as trichlorothylene, tetrachloroethylene and chloroform. PCBs are considered less common than (1) chlorinated hydrocarbons and (2) phthalates, that are a plasticizer, such as Bis-2-ethylhexylphthalate. [13] PCBs, chlorinated hydrocarbons, phthalates, and other contaminants such as fuel hydrocarbons such as benzene, toluene, xylenes, and polycyclic aromatic hydrocarbons, and complexing agents such as ethylenediamine tetraacetic acid (EDTA) and associated degradation products, and organic acids such as oxalic and citric are known to be found in contamination sites at the Idaho National Laboratory and other DOE laboratories, along with radionuclides and metals. The chemicals were often used for separating or purifying radionuclides from fuel and target materials. Despite this fact, other common uses of the chemicals are often emphasized in U.S. Geological Survey reports as well as Department of Energy reports that described the contamination in groundwater or soil, often years after the contamination had occurred by DOE disposal or operations.

PCB (Aroclor) chemical contamination is found at the Idaho National Laboratory facilities, generally near hot cell operations, including the Naval Reactors Facilities (Waste Area Group WAG 8), Auxiliary Reactor Area (Waste Area Group WAG 5) and the Test Reactor Area now known as the ATR Complex (Waste Area Group WAG 2). [14] [15] PCBs are also buried at the Radioactive Waste Management Complex (Waste Area Group 7) and are included in above ground storage of transuranic waste. [16] The barrels of above-ground transuranic waste are destined for the Waste Isolation Pilot Plant (WIPP) in New Mexico.

A Comparison of the Three Mile Island Unit 2 Fuel Release Fractions to the SL-1 Derived Release Fractions

A report of the 1979 Three Mile Island Unit 2 accident stated that an estimated 10 to 20 curies of radioactive iodine was released from the site relative to 2 to 10 million curies of radioactive gases. [17] The report also stated that the released iodine was in most cases not detectable even by sophisticated modern techniques.

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[13] R. G. Riley, J.M. Zachara (Pacific Northwest Laboratory) in collaboration with F.J. Wobber, *Chemical Contaminants on DOE Lands and Selection of Contaminant Mixtures for Subsurface Contaminant Research*, DOE/ER—0547T, April 1992. https://doesbr.org/documents/Riley-Zachara1992.pdf

[14] Administrative Record and Information Repository for the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at https://ar.icp.doe.gov

[15] Federal Facility Agreement and Consent Order (FFA/CO) New Site Identification (NSI) report for TRA [Test Reactor Area] Courtyard Area, NSI-26011, July 17, 2018. https://ar.icp.doe.gov/images/pdf/201501/2015012600971BRU.pdf

[16] U.S. Department of Energy, Office of Environmental Management, Idaho Cleanup Project (ICP) Core, Waste Management, https://www.emcbc.doe.gov/SEB/ICPCORE/Document%20Library.php (PCP treatment and other waste and regulatory documents, not necessarily up-to-date information.)

[17] Prepared by the Nuclear Safety Analysis Center, Analysis of Three Mile Island - Unit 2 Accident, NSAC-80-1, NSAC-1 Revised, EPRI-NSAC—80-1, March 1980. https://inis.iaea.org/collection/NCLCollectionStore/_Public/13/677/13677904.pdf

Table 1. Core Inventory Release Fractions to Primary Coolant and Auxiliary Building for Various Classes, Three Mile Island Unit 2 accident report.

Class	TMI Release Fraction Estimate (Values more typical but not necessarily conservative for TMI or SL-1)	SL-1 Release Fractions derived by Risk Assessment Corporation, based on the AEC's stated offsite releases
Noble Gases (Helium, Neon, Argon, Krypton, Xenon, Radon)	0.55	
Halogens (Fluorine, Chlorine, Bromine, Iodine, and Astatine)	0.1	0.0044, Iodine-131, derived release fraction
Mo, Y (Molybdenum, Yttrium)	0.01	
Cs, Rb (Cesium, Rubidium)	0.1	0.00017, Cesium-137, derived release fraction
Solubles *	0.01	0.000036, Strontium-90, derived release fraction
Insolubles **	0.001	

Table notes: The TMI-2 report does not specify which radionuclides are solubles or insolubles. Cladding and actinides such as uranium and plutonium may be considered insolubles.

The fuel release fractions from this TMI-2 report which are recognized to not necessarily be bounding provide a perspective on how oddly low the estimated release fractions are for the 1961 Stationary Low-Power Reactor (SL-1) accident. For the January 3, 1961 accident that vaporized a large portion of the aluminum clad, highly enriched nuclear fuel, the Atomic Energy Commission (AEC), now called the Department of Energy, stated that only iodine-131 was detected away from the immediate accident site and that of 84 curies of iodine-131 released.

The AEC claimed that no other fission products were detected other than 0.1 Curies of strontium-90 and 0.5 curies of cesium-137 within the perimeter fence of the SL-1. [18] The derived release fractions based on trying to fit the AEC claims to a release fraction show that the AEC claimed low curie amount releases are fiction. Never before or since has a reactor fuel had such

[18] Report by Risk Assessment Corporation for Centers for Disease Control and Prevention, Department of Health and Human Services, *Final Report Identification and Prioritization of Radionuclide Releases from the Idaho National Engineering and Environmental Laboratory*, RAC Report No. 3, CDC Task Order S-2000-Final, October 2002, pages 117, 118. https://www.cdc.gov/nceh/radiation/ineel/TO5FinalReport.pdf

low release fractions! The AEC not only left out many radionuclides, they underestimated the amount of the fission product releases from the accident by a factor of over 22 for iodine-131, 588 for Cs-137 and 277 for Sr-90. And even with the low-balled curie releases, the SL-1 accident was a serious accident.

Despite what Risk Assessment Corporation (RAC) writes about prevailing meteorological conditions at the time of the SL-1 accident being characteristic of the typical conditions at the time of year, the conditions were not typical. During the accident, the prevailing winds were from the north to northeast for 100 hours with an extremely strong inversion. Typical conditions are a prevailing wind in the opposite direction during the daytime, with wind reversals at night typical. The SL-1 radionuclide plume blew south toward American Falls and Rupert, Idaho.

The SL-1 reactor fission product inventory consisted of radionuclides produced during the excursion and also radionuclides the had built up in the fuel during previous reactor operations. The operating history of the reactor consisted of 11,000 hours for a total of 932 MW-days. The reactor accident resulted in a total energy release of 133 MW-seconds. Roughly 30 percent of the core's fuel inventory was missing from the vessel, when examined after the accident. [19] [20] [21]

Risk Assessment Corporation used the computer code RSAC to calculated a fission product inventory based on operation of the reactor at a power level of 2.03 MW (mega-watts) for 458 days, followed by a shutdown period of 11 days and the excursion power level of 88,700 MW for a period of 0.015 seconds. The Center for Disease Control did not call out what were obvious discrepancies and which meant that the SL-1 radiological consequences have been grossly understated.

Sage brush samples were collected and according to the AEC, the "gamma spectra of representative samples indicated that the activity was due to iodine-131. (IDO-12021, p. 131)

It was customary for the AEC to monitor jack rabbit thyroids and the iodine-131 levels before the SL-1 accident, for jack rabbit thyroids were typically 100 picocuries per gram. After the SL-1 accident, the levels were as high as 750,000 picocuries per gram at the SL-1, 180,000 picocuries/gram at nearby Atomic City, located south of the SL-1, and 50,000 picocuries per gram at Tabor, a farming community southeast of SL-1 and west of Blackfoot, and 11,200 picocuries at Springfield. These rabbit thyroid results reveal much higher rabbit thyroid iodine-131 levels than produced by the other large episodic and routine releases from the Idaho National Laboratory during the 1950s and 1960s. [22] [23] [24] [25]

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[19] Department of Energy, Idaho National Engineering Laboratory Historical Dose Evaluation, DOE/ID-12119, August 1991. See https://inldigitallibrary.inl.gov

[20] Atomic Energy Commission, "Final Report of the SL-1 Recovery Operation," IDO-19311, June 27, 1962. See p. III-77 regarding fuel damage. https://inldigitallibrary.inl.gov/PRR/163644.pdf

[21] Atomic Energy Commission, "Additional Analysis of the SL-1 Excursion Final Report of Progress July through October 1962," IDO-19313, November 21, 1962. See p. 27 Table I-VIII. https://inldigitallibrary.inl.gov/PRR/163644.pdf

[22] Atomic Energy Commission, "1958 Health and Safety Division Annual Report, IDO-12012, See p. 72, 73 for iodine-131 in sage brush and rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/112697.pdf

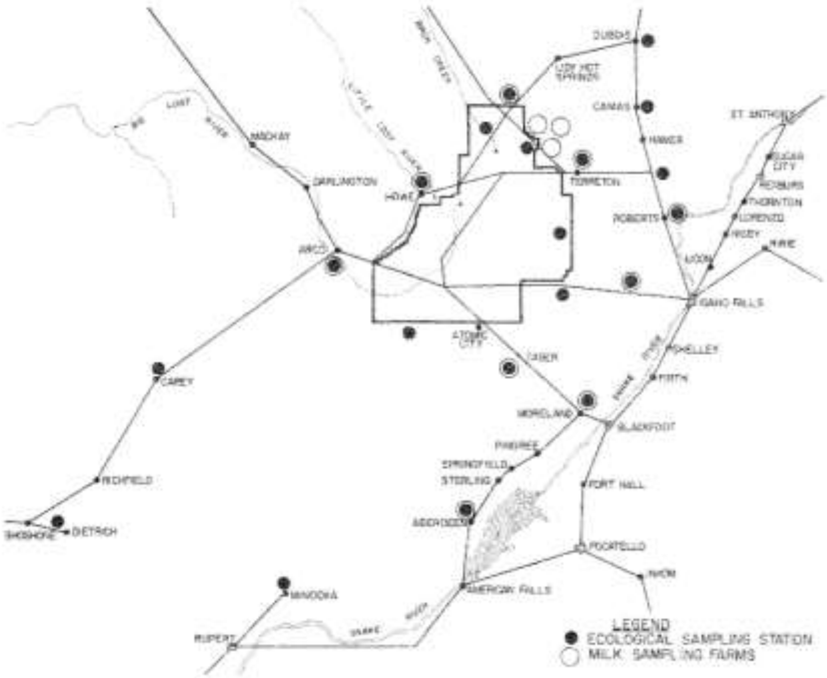

Fig. 51 Perimeter and off-site biological monitoring stations.

Figure 51 on this page and Figure 52 on the next page are from IDO-21021.

U.S. Highway 20, south of and near the SL-1, had hot particles from the SL-1 accident and the AEC estimated the range of individual particle dose rates at 1 inch as 10 milli-rem per hour to 5 rem per hour. On the site roads, farther from the SL-1, the individual particle dose rates at 1 inch were estimated as 10 millirem/hr to 15 rem/hr, according to IDO-12021, the annual report for 1961. Initially during and after the accident, it was assumed that the highways and roadways were not contaminated by the SL-1 accident. Upon further surveys, decontamination efforts of U.S Highway 20 were pursued.

[23] Atomic Energy Commission, "Annual Report of Health and Safety Division, 1959," IDO-12014, See p. 88 for iodine-131 in rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/112700.pdf
[24] Atomic Energy Commission, "Health and Safety Division Annual Report, 1960," IDO-12019, See p. 91 for iodine-131 in rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/90927.pdf
[25] Atomic Energy Commission, "Health and Safety Division Annual Report, 1961," IDO-12021, See p. 128, 133 for iodine-131 in jack rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/163656.pdf

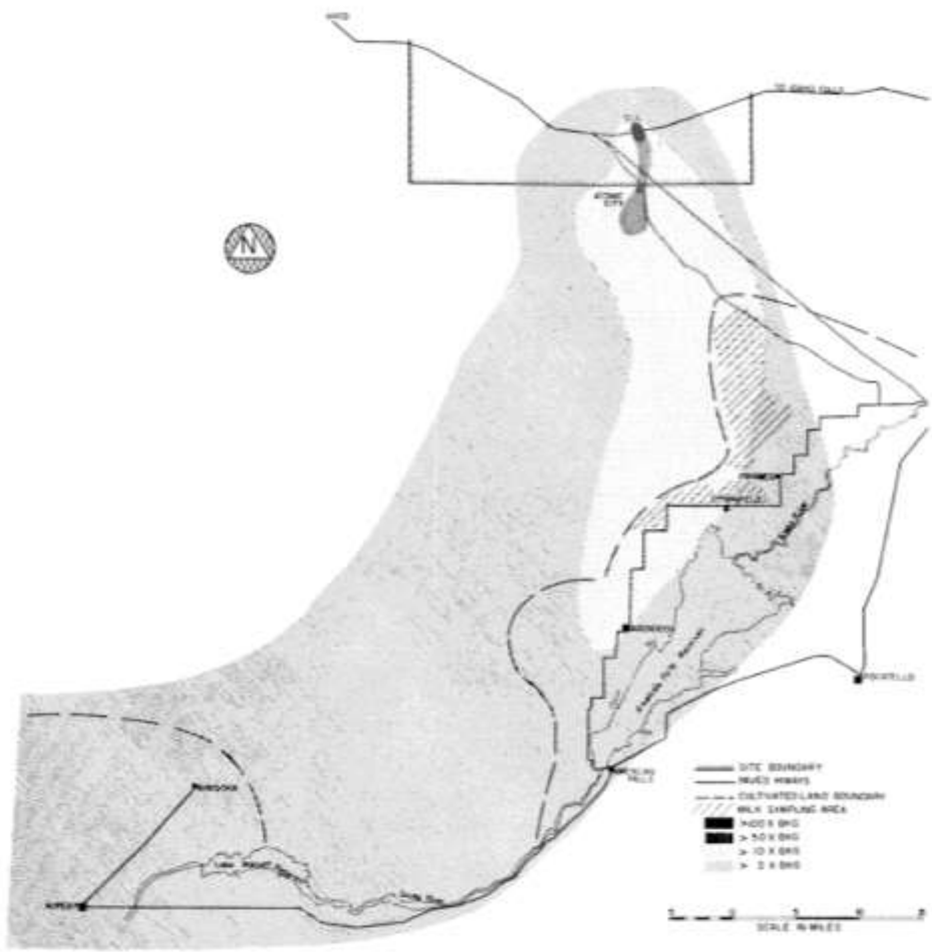

Fig. 52 Iodine-131 deposition on vegetation.

Figure 52, above, depicts the SL-1 radiological plume. The AEC claimed that the radioactive fallout from the SL-1 accident was mainly iodine-131. The AEC's claimed total iodine-131 release from the SL-1 accident would mean that an impossibly low release fraction for the iodine-131 held up the iodine-131 in the fuel. The SL-1 fuel was similar to the Materials Test Reactor fuel, which was not assumed to have low release fractions. The derived low release fractions are predicated on the AEC's stated curie release estimates and the stated curie estimate, along with the AEC's assertion that it was mainly iodine-131 that was released from the SL-1 are simply too good to be true.

A building with offices, adjacent to the SL-1 reactor had been in use for decades after the SL-1 accident, but was deemed too radiologically contaminated to remediate after CERCLA investigations commenced in 1995. I'm not aware of the reasons for the AEC's and later the Department of Energy's flawed radiological monitoring programs ever being revealed. I would suppose that instruments may have been manually calibrated such that, systematically, too much background radiation was subtracted from the monitoring instruments.

At the Idaho National Laboratory, the burial ground for the Stationary Low-Power Reactor No. 1 (SL-1), which includes one trench and two pits 1600 ft east of the SL-1 area, fission and activation products were buried directly in soil below ground level. Radioactive waste from the SL-1 accident was also buried in Pit 1 at the Radioactive Waste Management Complex. The RWMC burial grounds flooded in 1962 and again in 1969 from high levels of precipitation and snow drifts. The CDC fails to point out that later radiological surveys at and near the SL-1 burial ground would also reveal extensive surface or shallow soil contamination that required further remediation under CERCLA cleanup for Waste Area Group WAG 5.

You can read my report about the consequences of the SL-1 accident on the Environmental Defense Institute website, *The SL-1 Accident Consequences*, at http://environmental-defense-institute.org/publications/SL-1Consequences.pdf and the cause of the SL-1 accident on the Environmental Defense Institute website, *The Truth about the SL-1 Accident – Understanding the Reactor Excursion and Safety Problems at SL-1* at http://environmental-defense-institute.org/publications/SL-1Accident.pdf

AMWTP's Flawed Hazardous Waste RCRA Permit Modification Request

On top of granting the hazardous waste RCRA permit for the Advanced Mixed Waste Treatment Project (AMWTP) without ensuring that all needed improvements and corrections were made in response to the four drums that rapidly overpressurized and ejected their contents hours after being repackaged into new drums last April 2018, the State of Idaho Department of Environmental Quality has already granted temporary authorization, July 29, for significant new operational changes to allow treatment of pyrophoric radionuclides at the AMWTP.

A meeting was held August 28 by Fluor Idaho to support the Partial Modification Request (PMR) for treating pyrophoric materials at the treatment facility and supercompacting pyrophoric materials. Some of my questions were answered, but many of my questions, although responded to, were not answered. My partial comments were sent to the Idaho DEQ August 29. [26] The comment period closes September 23. Comments can be sent to Brian English, Idaho DEQ, 1410 N. Hilton, Boise, ID 83706 or email Brian.English@deq.id.gov

EIS Scoping Comments for Proposed Versatile Test Reactor

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-

[26] Comment submittal to Idaho Department of Environmental Quality regarding Permit Modification Request (PMR) and Request for Temporary Authorization for the AMWTP, August 29, 2019 at http://environmental-defense-institute.org/publications/CommentIDEQAMWTPpmr1.pdf

neutron source facility (VTR) and associated facilities for preparation, irradiation, and post-irradiation examination of test and experimental fuels and materials.

The scoping period closes on September 4, 2019. Comments can be emailed to VTR.EIS@nuclear.energy.gov. 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 existing security fence would be expanded to include VTR. The existing facilities within the MFC would be modified as necessary to support fabrication of VTR driver fuel or test items and to support post- irradiation examination of irradiated targets withdrawn from the VTR. These types of activities are ongoing within the MFC. Under the conceptual design, the existing infrastructure including utilities and waste management facilities would be utilized to support construction and operation of the VTR. While some modifications and upgrades to the infrastructure might be necessary, the current infrastructure should be largely adequate to support the VTR. The post-irradiation examination capabilities at MFC, including existing facilities, equipment, technical, engineering and support staff, would be capable of supporting the anticipated post-irradiation examination activities that the VTR would create. The potential increase in workload among the MFC facilities in the post-startup timeframe might require increased technical and operating staff. Driver fuel for the VTR would likely be manufactured at the MFC or the Savanah River site, depending on multiple factors including the source of the nuclear material and the availability and capabilities of DOE, commercial, or foreign suppliers.

Under the Oak Ridge National Laboratory (ORNL) VTR Alternative, the VTR would be sited at ORNL at a location to be identified.

My public comments the scope of an Environmental Impact Statement for a Department of Energy Versatile Test Reactor, [27] Public Comment Period August 5 to September 4, 2019, sent to VTR.EIS@nuclear.energy.gov

In my view, 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

[27] 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

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 but deny the harm by using outdated and wrong radiation health models.

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."

My comments 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.

Second, when the severe reactor accidents for the VTR are considered, the economic consequences must also be included. 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.

Item 2: "Potential impacts on surface and groundwater, floodplains and wetlands, and on water use and quality" and 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.

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.

See my detailed Scoping EIS for the Versatile Test Reactor at http://environmental-defense-institute.org/publications/ScopeEISVTR.pdf

Articles by Tami Thatcher for September 2019.