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US Ecology Idaho Grand View is virtually unregulated and not designed for the radioactive waste it is accepting from around the country and around the world

The US Ecology Idaho (USEI) disposal site near Grand View, Idaho, accepted over 112,000 tons of waste from outside of Idaho in 2019 and over 109,000 tons in 2020. [1] [2] The facility estimates that over half of the waste it accepts is radioactive waste. While it accepts radioactive waste, the US Ecology Idaho facility is not regulated by the U.S. Nuclear Regulatory Commission and it is not licensed as a radioactive low-level waste (LLW) facility. [3]

In 2001, the facility accepted naturally occurring radioactive waste from the U.S. Army Corp of Engineers. [4] But the facility has expanded to accept "special nuclear material" which includes plutonium, americium, neptunium and curium. It accepts radioactive waste from nuclear reactor decommissioning, from nuclear fuels manufacturing, from various nuclear industries, and from the nuclear weapons industry via the Department of Energy and the Department of Defense. [5] [6] The facility accepts radioactive waste from around the U.S. and from countries as far away as Australia.

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[1] Idaho Department of Environmental Quality, Hazardous Waste Management in Idaho 2020, undated, at https://www.deq.idaho.gov

[2] Idaho Department of Environmental Quality, issued permits at https://www.deq.idaho.gov/permits/issued-permits-and-water-quality-certifications/ (search for "Grand View")

[3] U.S. Nuclear Regulatory Commission Adams database document ML060330078, hand dated August 4, 2004.

[4] The Department of Energy passed the problem over to the Army Corp of Engineers, who started shipping the contaminated soil know as Formerly Utilized Sites Remedial Action Program (FUSRAP) to the US Ecology Idaho facility. This contamination was from processing uranium ore to obtain the uranium and remove the decay progeny. The uranium decay progeny, released from the ore, include high energy gamma rays, beta particles, and alpha particles. The contamination actually gets more radioactive over time and never decays away.

[5] US Ecology, Inc. Request for Exemptions from Requirements in 10 CFR 30.3, 10 CFR 40.3, and 10 CFR 70.3 for US Ecology-Idaho, Grand View, ID, Studsvik Processing Facility Memphis, LLC's Tennessee Agreement State Approved Alternate Disposal Authorization and Amendment No. 82 to License # R-79273-H16, Revision 0, June 2013. ML13193A184. (Includes evaluation of Hematite Decommissioning Project. The Hematite facility manufactured nuclear fuels and buried uranium, including enriched uranium and technetium-99 shallowly at numerous locations at its site. These unlined burial pits were excavated and the waste shipped to US Ecology Idaho Grand View facility.)

[6] US Ecology Idaho, Inc., EPA ID. No.: IDD073114654, Effective Date: July 28, 2016, Modification Date: November 01, 2019, Attachment 2 Waste Analysis Plan (WAP) available at deq.idaho.gov

The US Ecology Idaho disposal facility in a RCRA hazardous chemical waste facility that expanded into acceptance of radioactive waste largely behind the scenes with approval from the Idaho Department of Environmental Quality. [7]

The facility is accepting radioactive waste that is hazardous for millennia but limits its view of disposal performance to 1000 years. Given the contaminated groundwater well between the facility and the Snake River located a couple miles away, it does not appear that the facility is designed to confine the material in the short term or the long term.

The regulations that apply to US Ecology Idaho are inadequate — and flexible. US Ecology Idaho is receiving radioactive waste that should be going to a U.S. Nuclear Regulatory Commission (NRC) licensed radioactive waste facility. The tables explaining the radioactivity limits in the Waste Analysis Plan for the US Ecology Idaho facility limit the waste to generally 3000 picocuries per gram (for the sum of all isotopes), with various radionuclides allowed at higher concentrations. Decay progeny radioactivity limits are not necessarily imposed when NRC-licensees ship waste there, depending on NRC's case-by-case exemption. (For a rough comparison, the Department of Energy's definition of transuranic waste is 33 times higher at 100 nanocuries per gram, which is equivalent to 100,000 picocuries per gram of alpha-emitting transuranic isotopes. See the DOE's definition of transuranic waste in DOE Manual 435.1. [8])

The waste acceptance for US Ecology Idaho's allowable waste concentrations are stated in tables, but these limits can be exceeded. The facility's loose and flexible permit states that the facility will accept any amount the U.S. NRC wishes to authorize, it will accept higher concentrations of radioactivity if approved in advance by USEI and IDEQ, and it will accept higher concentrations of radioactivity as long as there is notification at least 24 hours in advance. While there are stated limits on radioactivity concentrations, it appears that higher concentrations are readily approved.

For the radioactive waste sent to US Ecology Idaho from NRC licensees (or Agreement States), the NRC licensees (or Agreement States) require NRC approval to ship waste to US Ecology Idaho rather than to an NRC-licensed disposal facility. When the waste would be below 25 mrem/yr dose to the public, the NRC calls it acceptable because it is only "a few mrem." But the NRC will approve up to the maximum dose to the public that would be allowed for an NRC-

[7] Resource Conservation and Recovery Act of 1976 (RCRA), as amended, regulates selected hazardous chemical waste disposal facility permitted by the Idaho Department of Environmental Quality under U.S. Environmental Protection Agency (EPA) regulations. The US Ecology Idaho facility is the EPA Site B facility that opened in 1973 and has changed owners several times.

[8] Department of Energy, DOE Manual 435.5-1, *Radioactive Waste Management Manual*, Definition: Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy had determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

licensed radioactive waste facility, anything up to 25 mrem/yr dose to the public for an unlimited number of NRC exemptions.

The regulations for an NRC-licensed radioactive waste facility in 10 CFR 61.40 include limits on the thyroid dose (75 mrem/yr) and all other organs (25 mrem/yr) as well as the effective whole-body dose of 25 mrem/yr. The US Ecology Idaho facility ignores organ doses both while the facility is operating and post-closure, even though even organ doses (in mrem) do not fully reflect the absorbed dose or harm to the organ. And due to the lack of monitoring and favorable assumptions, organ doses are just assumed away by the NRC.

The US Ecology Idaho Grand View facility has an airborne radiological contamination problem that the U.S. Environmental Protection Agency and the Idaho Department of Environmental Quality are ignoring. The EPA's Radnet ambient air radiation monitoring shows oddly high spikes in radioactivity that are not due to naturally-occurring levels of background radiation. The dumping of rail cars into trucks and the dumping of waste from trucks into the disposal area are apparently releasing considerable airborne radioactivity which is being ignored.

Uranium and thorium, while naturally occurring, are still hazardous when inhaled or ingested. The uranium and thorium (and their decay progeny) that resulted from uranium processing that are transported to US Ecology Idaho are not in naturally occurring concentrations, chemical form, or particle size, which makes the material more prone to spread in the environment than uranium ore and more hazardous in the human body.

Poor or non-existent radiological monitoring accompany the Idaho Department of Environmental Quality's approval of radioactive waste at the US Ecology Idaho facilities.

When the US Ecology Idaho expanded to accept "special nuclear material" which is plutonium or enriched uranium and also accepted radioactive fission products such as cesium-137, and activation products such as cobalt-60, it did not expand its monitoring program adequately. The US Ecology Idaho facility accepts all radionuclides **but specifically excludes performing analysis to detect anything other than uranium, thorium and their decay progeny and plutonium-239 and americium-241.** No analysis of strontium-90, cesium-137, tritium, cobalt-60, or difficult to detect technetium-99 and iodine-129 or many other radionuclides accepted by the facility will be performed. [9]

US Ecology Idaho also accepts "mixed waste" included polychlorinated biphenyl (PCB) mixed waste. "Mixed waste" means waste that is both chemically and radiologically contaminated. Only the federal government continues to generate PCB mixed waste and it is a sacred cow related to nuclear weapons.

The total curies of each radionuclide accepted annually, in total or from each generator, does not appear to be disclosed, especially as pertains to radioactive waste from the nuclear weapons operations for the Department of Energy and the Department of Defense.

[9] US Ecology Idaho, Inc., *Exempt Radiological Materials Procedures Safety Assessment*, EPA ID No.: IDD073114654, Effective Date: July 28, 2016. See page 5.

The U.S. Nuclear Regulatory Commission and others often describe US Ecology Idaho as receiving "low activity" radioactive wastes. In fact, even the U.S. Environmental Protection Agency, that oversees RCRA implementation in Idaho, admits that there is no definition for "low activity" waste. [10] As I will discuss in a later article in this newsletter, high-level waste on a Department of Energy site can be treated and analyzed (and perhaps misconstrued) to be deemed by the Department of Energy as "low-activity waste." But the Department of Energy does not actually define "low-activity waste" in DOE Order 435.1 or DOE Manual 435.1-1. [11] The Idaho DEQ calls radioactive waste at the US Ecology Idaho Grand View site "Non-Haz."

Post closure monitoring for the US Ecology Idaho facility is only required for 30 years after closure. [12] The post-closure dose limit for the public 15 mrem/yr effective whole-body dose is below the NRC's 25 mrem/yr whole body dose, but less restrictive than an NRC licensed facility because US Ecology has no organ dose limits. The US Ecology Idaho facility is accepting "forever" waste — long-lived radioactive waste that is radiotoxic for millennia, yet the facility evaluates post-closure doses for 1000 years.

The radiological airborne release standards for the US Ecology Idaho Grand View facility are 100 mrem/yr while in operation (see its Waste Analysis Plan, Attachment 2, at deq.idaho.gov). This is less restrictive than allowed by the EPA for a Department of Energy facility such as the Idaho National Laboratory, which would be limited to 10 mrem/yr dose to the public from annual airborne emissions (40 CFR 61, Subpart H).

For the US Ecology Idaho facility, the allowed radiation doses to the public are too high, the air monitoring is spotty and excludes many of the radionuclides that could be released, and the dose limit is based on effective whole-body dose which ignores organ doses. The protection of human health now and in the future is inadequate at the US Ecology Idaho facility.

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[10] U.S. Environmental Protection Agency webpage "Low-Activity Wastes" at https://www.epa.gov/radiation/low-activity-radioactive-wastes which states: " 'Low-Activity' Radioactive Wastes (LARW) are informally defined as radioactive wastes that contain very small concentrations of radionuclides. The concentrations are small enough that protection of public health and the environment from these wastes may not require all of the radiation protection measures necessary to manage higher-activity radioactive material. At this time, "low-activity" itself is a concept, not a definition. Among the wastes that could be addressed as "low-activity" are mixed wastes (chemically hazardous and radioactive), wastes containing natural radioactivity, cleanup wastes and other low-level radioactive wastes." Present regulation of "low-activity" radioactive waste is inconsistent, often based on the origin of the waste. Besides inconsistent regulation, cost and availability of disposal affect the way low-activity wastes are managed.

[11] U.S. Department of Energy, *Radioactive Waste Management Manual*, DOE M 435.1-1, Approved: 7-09-99, Change 1: 6-19-01, Certified: 1-9-07, Change 2: 6-8-11, Chg 3 (LtdChg): 1-11-2021. Available online at www.directives.DOE.gov. (Also see DOE Order 435.1, *Radioactive Waste Management*, also dated 7-09-99.)

[12] An NRC review in 2004 did not seem able to discern what regulations applied or what ad hoc regulatory limits had been selected for the US Ecology Idaho disposal facility (see NRC.gov Adams database for ML060330078).

The State of Idaho lawmakers gutted state air laws regarding radiological airborne contamination, see the August 2019 Environmental Defense Institute newsletter article “Idaho Gutting Radiological Contamination Protection from Environmental Clean Air Law.” [13]

When the US Ecology Idaho facility blew up in 2018, apparently when mixing incompatible materials, the U.S. Environmental Protection Agency’s Radnet air monitoring reporting for radioactivity went offline for two weeks.

Neither US Ecology Idaho nor the Idaho Department of Environmental Quality have ever admitted what waste they were handling or why the explosion happened. The explosion killed one man has only been described as being due to “nonconforming waste.”

In 2016, USEI was asking the EPA about licensing requirements for treating PCB contaminated soils. https://www.epa.gov/pcbs/epas-response-letter-us-ecology-regarding-treatment-waste-containing-pcbs Only the federal government is making PCBs. But an NRC-licensed facility could have had legacy PCB contamination. PCBs have chlorine. Chlorine can be incompatible with magnesium and generate heat. Heat then allows other chemical reactions. Magnesium was added to waste that exploded at the USEI Grand View facility in 2018, which they claim was simply due to “non-conforming waste.”

The waste at an NRC-licensed facility in Tennessee was laden with fresh radionuclides, fresh from nuclear reactor target production. [14] This type of target production is usually associated with the use of polyvinyl chloride biphenyls (PCBs), but it is not the NRC’s concern when NRC grants the use of US Ecology Idaho, as an “alternate” disposal site rather than an NRC-licensed radioactive waste disposal facility.

Changes made to the US Ecology Idaho Grand View facility since the 2018 explosion that killed a man include more care to ensure chemical mixtures are compatible.

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[13] 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 This 2019 law change, effective spring of 2019 after the adjournment of the Idaho Legislature, changed IDAPA 58 – Department of Environmental Quality, 58.01.01 – Rules for the Control of Air Pollution in Idaho, Docket No. 58-0101-1801. The state law had included since 1995 a provision for requiring an air permit for facilities releasing 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)

[14] US Ecology, Inc. Request for Exemptions from Requirements in 10 CFR 30.3, 10 CFR 40.3, and 10 CFR 70.3 for US Ecology-Idaho, Grand View, ID, Studsvik Processing Facility Memphis, LLC’s Tennessee Agreement State Approved Alternate Disposal Authorization and Amendment No. 82 to License # R-79273-H16, Revision 0, June 2013. ML13193A184. (Includes evaluation of Hematite Decommissioning Project. The Hematite facility manufactured nuclear fuels and buried uranium, including enriched uranium and technetium-99 shallowly at numerous locations at its site. These unlined burial pits were excavated and the waste shipped to US Ecology Idaho Grand View facility.)

Neither US Ecology Idaho (USEI) nor the Idaho Department of Environmental Quality have stated where the waste that exploded was from, or what the objectives of mixing the magnesium in the waste were.

The Idaho Department of Environmental Quality avoids mentioning the amount of radioactive waste accepted by US Ecology Idaho, what the radionuclides in the waste, and monitoring data are available only through cumbersome Freedom of Information Act requests. The Idaho DEQ avoids regular and comprehensive monitoring of the airborne and aquifer contamination caused by the US Ecology Idaho Grand View disposal facility. **The US Ecology Idaho (USEI) facility is causing wide-spread airborne radioactivity contamination of southwest Idaho now and the US Ecology Idaho at Grand View is located less than 3 miles from the Snake River.**

See Environmental Defense Institute newsletters for more information about the US Ecology Idaho Grand View (EPA Site B) loosely regulated radioactive waste dump. [15]

Biden Administration wrong to agree high-level waste from nuclear reprocessing can be reclassified by the Department of Energy

The Department of Energy has announced that the Biden administration has affirmed a Trump administration interpretation of high-level radioactive waste. [16] [17]

This would allow the DOE to reclassify any amount of its high-level waste (HLW), unless legal challenges prevail. While there are some people who say this will allow what is now high-level waste to be disposed at existing permanent storage sites away from where the waste is now stored.

[15] Environmental Defense Institute newsletter articles at http://www.environmental-defense-institute.org : “Idaho DEQ Reports Concerning the Elevated Radioactivity in Drinking Water in the Boise Area Don't Identify the Source of the Radioactivity” (October 2018); “US Ecology Site in Idaho Explosion Kills Worker” (December 2018); “Serious Flaws in the Radiological Monitoring in the Boise Area and the US Ecology Idaho Disposal and Transfer Facilities” and “Two Explosions at Idaho DEQ RCRA-Permitted Facilities in Idaho in 2018 Suggest Idaho DEQ Doing a Bang-Up Job of RCRA Permitting” (March 2019); “US Ecology Idaho Resumes Limited Operations, Public Still Not Told What Caused Explosion Last November” (April 2019); and “US Ecology Idaho Update on Last November's Explosion” (May 2019).

[16] *Federal Register*, A Notice by the Energy Department on 12/21/2021, “Assessment of Department of Energy’s Interpretation of the Definition of High-Level Radioactive Waste at https://www.federalregister.gov/documents/2021/12/21/2021-27555/assessment-of-department-of-energys-interpretation-of-the-definition-of-high-level-radioactive-waste This Federal Register Notice (FRN) and other documents relevant to DOE's HLWI are available on the Department's website at: *https://www.energy.gov/em/program-scope/high-level-radioactive-waste-hlw-interpretation*

[17] Keith Ridler, AP, *The Idaho Falls Post Register*, “US affirms new interpretation for high-level nuclear waste,” December 29, 2021.

But the reality is that this allowing the DOE to reclassify its high-level waste (HLW) to low-level waste (LLW) may allow the DOE to dispose of vast quantities of the radioactive waste at DOE sites. A report about the DOE's Hanford radioactive waste published by the Government Accountability Office in 2021, GAO-21-73, included in a footnote the following: "DOE stated that it will make subsequent decisions on how this interpretation [the HLW Interpretation] will apply to existing wastes and whether these wastes may be managed as non-HLW on a case-by-case basis. DOE officials told us that DOE does not currently intend to use this interpretation for the waste in the tanks at Hanford in the near future, but DOE could apply it in the future." [18]

When high-level waste (HLW) is reclassified, it becomes low-level waste (LLW). It could become a subset of LLW that is recognized as defense-related transuranic waste, potentially qualifying it for disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. But it is important to understand that the DOE's regulations for onsite disposal of radioactive waste that is classified as low-level waste (LLW) on DOE's federal sites are extremely flexible.

Radioactive high-level waste that resulted from spent nuclear fuel reprocessing and nuclear weapons production in the U.S. is stored at the Hanford site in Washington, the Savannah River site in South Carolina and the Idaho National Laboratory (INL). The liquid sodium-bearing waste at the INL has remained classified as high-level waste although the Department of Energy has for several decades now claimed that the sodium-bearing waste could be considered defense transuranic waste that could be sent to the Waste Isolation Pilot Plant (WIPP) in New Mexico, although WIPP currently prohibits it.

The other high-level waste at INL is the highly soluble, powder called calcine waste that resulted from the calcining of liquid high-level waste from nuclear fuel reprocessing to extract the enriched uranium. [19] The calcine waste is stored in various vintages of flooding vulnerable and seismically fragile metal structures inside seismically vulnerable concrete vaults that are partially above and partially below grade.

A release of the calcine material would release highly radioactive and chemically toxic material to leach into groundwater and/or blow in the wind. The risk of the now very flexible reclassification of the high-level waste in Idaho and other states is that the Department of Energy will call the waste "low-level" waste and grout it and walk away.

The DOE Manual 435.1-1, *Radioactive Waste Management Manual,* is called out by DOE Order 435.1, *Radioactive Waste Management*.

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[18] Government Accountability Office, Hanford Cleanup – DOE's Efforts to Close Tank Farms Would Benefit from Clearer Legal Authorities and Communication, GAO-21-73, January 2021 at www.gao.gov (See page 29.)

[19] U.S. Nuclear Waste Technical Review Board, Factsheet, Calcined High-Level Radioactive Waste – June 2020. https://www.nwtrb.gov/our-work/fact-sheets/calcined-high-level-radioactive-waste

But it is very easy for the Department of Energy to change its requirements in either the DOE Order or DOE Manual 435.1-1 [20] for radioactive waste because these documents can be modified without public notification at the whim of the Department of Energy and any requirement that is deemed too difficult can just be waived by the Secretary of Energy.

The Performance Assessments for waste disposal are not realistic, not conservative and so far have not been based on sound science. As currently conducted, the Performance Assessment are models manipulated without adequate scientific basis to produce slow, steady trickle-out of radionuclides into soil and groundwater. Sporadically higher releases from the waste would result in far higher contamination of groundwater and thus, higher radiation doses from water ingestion or ingestion of crops irrigated with the contaminated water.

The assumptions made that are used as inputs to these Performance Assessment models can achieve the wished-for performance, but may not reflect the actual performance of the facilities to confine the waste. Furthermore, the Performance Assessment for confinement of wastes and the prediction of waste migration typically assume no flooding or other catastrophic events.

The Performance Assessments also facilitate misinformed decisions on disposal facility performance by basing compliance decisions on the average (median) predicted radiation doses rather than 95th percentile upper bound doses. The upper bounds of the contamination levels could be devastating to human health. In other words, the Performance Assessments typical of waste disposal areas are a sham and serve only the industries seeking to dump their waste, as they continue making more and more radioactive waste.

Beware of the Department of Energy's Waste Incidental to Reprocessing Reclassification Effort at Hanford

The Department of Energy has presented a reclassification of waste from high-level waste (HLW) to low-level waste (LLW) for treating and disposing of 2000 gallons of liquid waste "incidental to reprocessing" from a single tank containing roughly 1.1 million gallons of waste. [21] The DOE's Hanford site has 177 tanks holding or leaking 56 million gallons of high-level waste. DOE estimates that 68 of the single-shell tanks may have already collectively leaked over 1 million gallons of waste into the ground. [22]

The reason to remove the 2000 gallons of the least radioactive waste in the tank is not to help clean up the Hanford site. The reason cited by the DOE in its Draft Waste Incidental to

[20] U.S. Department of Energy, *Radioactive Waste Management Manual*, DOE M 435.1-1, Approved: 7-09-99, Change 1: 6-19-01, Certified: 1-9-07, Change 2: 6-8-11, Chg 3 (LtdChg): 1-11-2021. Available online at www.directives.DOE.gov.

[21] Department of Energy, *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration*, DOE-ORP-2021-01, Revision 0, October 2021. The Draft WIR Evaluation is available on the internet at *https://www.hanford.gov/page.cfm/ReprocessingEvaluationforBedInitiative*.

[22] Government Accountability Office, Hanford Cleanup – DOE's Efforts to Close Tank Farms Would Benefit from Clearer Legal Authorities and Communication, GAO-21-73, January 2021 at www.gao.gov (Only 28 of the 177 tanks are double-shell tanks; 149 are single-shell tanks.)

Reprocessing (WIR) evaluation [23] is to make more room in the tank for additional radioactive waste. And while this Draft WIR evaluation is consulting the NRC and providing for public comment, according to the GAO report GAO-21-73, there are no provisions in DOE Order or DOE Manual 435.1 requiring that DOE seek Congressional, State, Tribal, or public involvement in WIR determinations. In other words, it appears to me that this 2000-gallon case is intended to lull the public into complacency.

Public comments on the Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration are due by February 2, 2022. [24] See comments by Tami Thatcher on the Environmental Defense Institute's home page. [25]

Other organizations are worried about the ramifications of this Waste Incidental to Reprocessing effort. Columbia Riverkeeper has stated: "The U.S. Dept. of Energy's Test Bed Initiative will determine the future of radioactive tank waste at the Hanford nuclear site." [26]

The GAO reminds us in its report GAO-21-73 that the Department of Energy has a difficult task cleaning up the radioactive waste at Hanford. **But the DOE has created the Hanford radioactive mess, along with countless other radioactive messes across the U.S. without any serious regard for current or future generations. I see no sign that the DOE is serious about the existing radioactive contamination or is ceasing or slowing its creation of more radioactive waste. The DOE is throwing money at new ways to make more radioactively contaminated sites and more spent nuclear fuel, without knowing how it will confine existing or future nuclear waste.**

I think there is a long-term game plan for the serious deception going on in the documentation for removing the 2000 gallons of liquid waste from a single tank, mixing it with grout and sending it to an out-of-state low-level waste disposal facility. The deception is how the Department of Energy's Manual 435.1-1 requirements for waste incidental to processing are misrepresented. The Manual 435.1 requirements are improperly quoted and made to appear as though the requirements are stated in their entirety even though less restrictive requirements were lopped off mid-sentence.

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[23] Department of Energy, *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration*, DOE-ORP-2021-01, Revision 0, October 2021. The Draft WIR Evaluation is available on the internet at *https://www.hanford.gov/page.cfm/ReprocessingEvaluationforBedInitiative*. (See also https://pdw.hanford.gov Administrative Records.)

[24] Federal Register https://www.federalregister.gov/documents/2021/11/05/2021-24213/notice-of-availability-of-draft-waste-incidental-to-reprocessing-evaluation-for-the-test-bed Written comments should be submitted to: Ms. Jennifer Colborn, U.S. Department of Energy, Office of River Protection, 2440 Stevens Drive, Richland, WA 99354. Alternatively, comments may also be filed electronically by email to: *TBIWIR@rl.gov*.

[25] Environmental Defense Institute home page at http://www.environmental-defense-institute.org. Public Comment Submittal on the U.S. Department of Energy Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration, due by February 2, 2022 at http://www.environmental-defense-institute.org/publications/Hanford2021tankWIRcomment.pdf

[26] Columbia Riverkeeper factsheet at https://www.columbiariverkeeper.org/news/2021/12/important-hanford-comment-period?eType=EmailBlastContent&eId=a2a14f30-2d70-45f5-a578-1a029ff37acb

I think the DOE knows that the proper way to quote a portion of a sentence is to use three dots at the end of the quote, signifying that there were more words following what is quoted. The Department of Energy deceptively simply places a period where it truncated the quoted section of the regulation it was quoting.

Then, in other places in DOE's document for the treatment of 2000 gallons of waste, the Department of Energy cites "the criteria in Section II.B.(2)(a) of DOE Manual 435.1-1" and the reader has no idea whether or not the truncated requirement or the full and far less restrictive requirements in Manual 435.1-1 are intended. [27]

At first, I thought it was a mistake but the deception about DOE Manual 435.1-1 appears to be intentional. And it could have ramifications for any future legal challenges to DOE's desired latitude in reclassifying HLW to LLW. The Department of Energy is presenting DOE Manual 435.1-1 as a restrictive and reasonable document by intentionally leaving out the fact that DOE Manual 435.1-1 allows the DOE to do anything it wants with radioactive waste, at whim. **The DOE Manual allows DOE to reclassify high-level waste to meet [up to Class C] LLW concentrations "or will meet alternative requirements for waste classification and characterization as DOE may authorize."**

It is this phrase, "or will meet alternative requirements for waste classification and characterization as DOE may authorize" that the DOE omitted from its recent Hanford tank waste incidental to reprocessing evaluation. And what DOE omitted, it appears, that DOE doesn't want to remind people that DOE allows itself to, at whim, reclassify high-level waste (HLW) to low-level waste (LLW) which includes Greater-Than-Class-C low-level waste which is virtually unlimited radioactivity concentrations.

The DOE's Draft WIR Evaluation [28] states (and it added italics):

The criteria in Section II.B.(2)(a) of DOE Manual 435.1-1 provide, in relevant part, that the wastes:

"(1) Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical;

(2) Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR 61, Subpart C, Performance Objectives; and

(3) Are to be managed, pursuant to DOE authority under the Atomic Energy Act of 1954, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the

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[27] U.S. Department of Energy, *Radioactive Waste Management Manual*, DOE M 435.1-1, Approved: 7-09-99, Change 1: 6-19-01, Certified: 1-9-07, Change 2: 6-8-11, Chg 3 (LtdChg): 1-11-2021. Available online at www.directives.DOE.gov.

[28] Department of Energy, *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration*, DOE-ORP-2021-01, Revision 0, October 2021. The Draft WIR Evaluation is available on the internet at *https://www.hanford.gov/page.cfm/ReprocessingEvaluationforBedInitiative*.

applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, Waste Classification."

But in contrast, the most recent DOE Manual 435.1-1 [29] is stated below (and does not use italics throughout):

(a) Will be managed as low-level waste and meet the following criteria:

(1) Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

(2) Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and

(3) Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; **or will meet alternative requirements for waste classification and characterization as DOE may authorize. [Emphasis Added]**

In addition to the misrepresentation of the DOE's Manual 435.1-1 in the 2000- gallon Waste Incidental to Reprocessing draft document, [30] the GAO report GAO-21-73, while informative, leans toward an overly favorable presentation of the Department of Energy and does not provide an accurate depiction of DOE's enormous latitude under DOE Manual 435.1.

NRC-licensed disposal facilities typically handle Class A LLW and may also accept the more radioactive Class B and Class C LLW. In the Hanford tank waste incidental to reprocessing (WIR) evaluation for the 2000 gallons of waste, the DOE's document states only that DOE can reclassify high-level waste (HLW) to concentrations that do not exceed Class C low-level waste.

While the DOE could have stated its Manual 435.1-1 requirements in their entirety and then stated that it elected, in this isolated case for the Hanford tank WIR, that it would not exceed Class C concentrations, it is important to understand why they are trying to obscure what DOE Manual 435.1-1 actually allows.

DOE Manual 435.1-1 allows DOE to reclassify any radioactive concentrations of high-level waste to be low-level waste of Class C, Class B, Class C or Greater-Than-Class-C low-level radioactive waste. The disposal of Greater-Than-Class-C LLW away from the DOE site is far

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[29] U.S. Department of Energy, *Radioactive Waste Management Manual*, DOE M 435.1-1, Approved: 7-09-99, Change 1: 6-19-01, Certified: 1-9-07, Change 2: 6-8-11, Chg 3 (LtdChg): 1-11-2021. Available online at www.directives.DOE.gov.

[30] Department of Energy, *Draft Waste Incidental to Reprocessing Evaluation for the Test Bed Initiative Demonstration*, DOE-ORP-2021-01, Revision 0, October 2021. The Draft WIR Evaluation is available on the internet at *https://www.hanford.gov/page.cfm/ReprocessingEvaluationforBedInitiative*.

more difficult. In fact, the DOE has never found a location for disposal of its large inventory of Greater-Than-Class-C LLW.

This matters because the Department of Energy already shallowly buries low-level waste (LLW) including Greater-Than-Class-C LLW over the Snake River Plain Aquifer at the Idaho National Laboratory. At the INL, the Department of Energy offers this excuse: that DOE is not required to classify its low-level radioactive waste into classes at all, for the disposal of LLW at Department of Energy sites.

To the DOE, at least in Idaho, Class A, Greater-Than-Class-C — its all the same to them. I should also point out that defense transuranic waste is a subset of low-level waste that can be accepted by the Waste Isolation Pilot Plant (WIPP) in New Mexico, if the waste meets certain requirements.

What is at stake is the millions of gallons of Department of Energy high-level waste that the DOE is itching to reclassify as low-level waste so that the waste can remain unburied or shallowly buried at Department of Energy sites. The Department of Energy has admitted this and won't clarify to states or stakeholders how much of the HLW will ultimately be reclassified.

The recent endorsement of DOE's HLW interpretation by the Biden Administration while touted as being based on science, is not based on science. It is rooted in DOE's vague and inaccurate depictions of certain wastes as "low-activity waste," the lack of a repository for high-level waste and the desire to wiggle out of federal laws pertaining to stricter disposal requirements for HLW in a geologic repository.

It is not scientific to mislead the public with regard to the actual requirements in DOE Manual 435.1-1.

A recent National Academy of Sciences report [31] **incorrectly states that the term "low-activity waste" has been defined by the Department of Energy in the current version of DOE Manual 435.1,** stating that low-activity waste means the waste that remains after as much of the radionuclides as technically and economically practicable have been removed from the tank waste, and that when immobilized in waste forms, may be disposed as low-level waste in a near-surface facility, as long as the waste meets criteria in the Waste Incidental to Reprocessing determination. Supplemental treatment refers to processing of the low-activity waste that is excess to that portion to be treated by vitrification in the Waste Treatment and Immobilization Plant at the Hanford site. **But the term "low-activity waste" is not used or defined anywhere, not even in DOE Manual 435.1-1, available online.**

[31] National Academies of Sciences, Engineering, and Medicine 2020. *Final Review of the Study on Supplemental Treatment Approaches of Low-Activity Waste at the Hanford Nuclear Reservation: Review #4*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25710. Access to free PDF downloads is available currently.

The NAS report actually muddies the water more than it provides clarity and it does not come close to providing useful and candid information — it advises trying to loosen drinking water standards as the way to solve radiation waste disposal issues.

The Department of Energy can change its Manual 435.1-1 without public input or notification and the DOE can also waive any of the requirements in Manual 435.1-1 at any time, with no public input or notification.

Finally, it is not scientific to emphasize the large curie amounts of cesium-137 in high-level waste and the need for shielding the gamma rays from cesium-137's decay progeny barium-137m but not emphasize how far lower curie amounts of plutonium, americium, curium and uranium and others pose radiological hazards for millennia. The DOE's so-called "science" has tended to emphasize unbalanced discussion of short-lived higher curie hazards from certain radionuclides while ignoring the greater repository hazards over far lower curie amounts over the long term for the actinides (uranium, plutonium, americium, neptunium, curium and others) and for fission products iodine-129 and technetium-99 that are highly mobile in the environment and difficult to detect.

The Department of Energy has tended to assume unrealistically slow migration of radionuclides from waste disposal sites in its performance assessments. By assuming higher retention of plutonium and other actinides to soil, for example, disposal performance assessments appear to adequately slow the migration of these radionuclides to groundwater. The slowed trickle-out of contaminants underestimates the releases the continue for waste that is radioactive over more than hundreds of thousands of years, over millennia. Flooding is assumed to never occur. And the average doses may be far exceeded from time to time, for many years, but this devastating impact on human life is ignored. And for waste sites including those involving U.S. Environmental Protection Agency CERCLA [32] disposal, the performance criteria for the disposal site are arbitrarily truncated to 1000 or 10,000 years, despite increasing levels of radioactivity migrating from the site after 10,000 years.

The Department of Energy has refused to say what its plans really are, for high-level waste at the Hanford site as well as at the Idaho National Laboratory. The INL has liquid sodium-bearing high-level waste and powdery, soluble calcine high-level waste that is unsafely stored in flooding vulnerable and seismically vulnerable bin sets.

[32] U.S. Environmental Protection Agency's Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

INL Buried Waste Exhumation of "Targeted" Waste Leaves Most of the Buried Radioactive Waste Over the Snake River Plain Aquifer

The buried waste exhumation of targeted waste at the Idaho National Laboratory's Radioactive Waste Management Complex is winding up but most of the plutonium, americium and other radioactive and chemical waste will remain buried over the Snake River Plain Aquifer.

The exhumation of 10,300 cubic meters of targeted waste of the over 125,000 cubic meters of transuranic waste buried there has been expensive and hazardous work. But the targeted waste was focused on the most chemically-laden waste from the Rocky Flats weapons plant and most of the transuranic and other radioactive waste will remain buried over the Snake River Plain Aquifer.

Accounts of the amount of waste buried since the burial ground opened in 1952 vary. The amount of radioactivity in the waste was never accurately known. But to give an idea of the amount of waste that remains buried, one source of information in 1994 stated that 125,700 cubic meters of transuranic waste had been buried at the RWMC by 1994. [33] Exhumation of 10,300 cubic meters leaves most of the transuranic waste buried and all of the non-targeted waste. [34]

Estimates of the americium-241 that will remain buried over the aquifer have been made that indicate that over 90 percent of the buried americium-241 will remain buried after the waste exhumation of "targeted" waste is completed.

The waste in the pit includes plutonium-laced sludges, graphite materials and filters. It also included vast amounts of poorly reported elevated concentrations of americium-241, concentrated from various purification processes at Rocky Flats.

As with the inability to know the amount of plutonium or americium in a barrel of waste at the February 2014 accident at WIPP, it is not feasible to know the amount of these wastes present in the pit or after retrieval because estimates of quantity are based on spot sampling yet the material is not evenly distributed in the waste. Records of the buried waste are known to be highly inaccurate, but especially so with sporadically elevated levels of americium-241 at times.

Minute amounts of these alpha emitting wastes are a serious internal radiation hazard once inhaled or ingested. Even with modern equipment and controlled laboratory environment, an amercium-241 release at INL's Materials and Fuels Complex in 2014 that caused significant internal contamination events went undetected for over a month. Read our May 2016 newsletter

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[33] Raymond L. Murray, Understanding Radioactive Waste, Fourth Edition, Battelle Press,1994. Page 63. This table shows 64,800 cubic meters of (above ground) stored transuranic waste at the Idaho National Laboratory. This waste is also being shipped to the Waste Isolation Pilot Plant (WIPP) in New Mexico.

[34] Keith Ridler, AP, *The Idaho Falls Post Register*, "US close to ending buried nuke waste cleanup at Idaho site," January 4, 2022.

article: "Three events show that the Idaho National Laboratory still doesn't know how to monitor airborne alpha contamination." [35]

The RWMC began accepting radioactive waste in 1952 and the Department of Energy continued disposing of radioactive waste there, even after waste exhumations were conducted. Of the 97-acre burial ground, waste was buried in pits and trenches in 35 acres. Of the 35 acres of buried waste, only 5.69 acres are designated to be sifted through to exhume only "targeted" waste and return non-targeted waste for reburial. The "targeted" waste was the most chemically laden waste that was already exceeding federal drinking water standards in the aquifer because of the buried waste. An estimated initial radionuclide inventory is provided in Table 1. [36]

The most mobile contaminants, such as technetium-99, iodine-129, and chlorine-36 are from INL wastes and remain poised to contaminate the aquifer because "targeted waste" includes only a portion of Rocky Flats waste and not INL wastes.

These contaminants will exceed federal drinking water standards even though their curie inventory seems small. Other rather low curie amounts of radionuclides like uranium, plutonium and americium will cause seriously unhealthy drinking water for hundreds of thousands of years.

Downgradient of INL, the migrating buried waste will reach 100 mrem/yr unless the soil cap performance is perfect for millennia. But that is based on contrived modeling of soil "sorbing" factors that slow the migration of the waste into the aquifer and contrived mixing that maximizes dilution. [37] [38] "Fast paths" that can move relatively concentrated contamination through lava tubes in the aquifer downgradient are ignored. [39] And more long-lived radioactive waste is being buried at the INL. [40]

[35] Environmental Defense Institute May 2016 newsletter: http://www.environmental-defense-institute.org/publications/News.16.May.pdf

[36] Tami Thatcher, "Important Long-Lived Contaminants at INL's RWMC Not Remediated," at http://www.environmental-defense-institute.org/publications/RWMCunrem.pdf

[37] Idaho National Laboratory, "Explanation of Significant Differences Between Models Used to Assess Groundwater Impacts for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater-Than-Class-C-Like Waste Environmental Impact Statement (DOE/EIS-0375D) and the Environmental Assessment for the INL Remote-Handled Low-Level Waste Disposal Project (INL/EXT-10-19168)," INL/EXT-11-23102, August 2011. http://www.inl.gov/technicalpublications/documents/5144355.pdf and a report prepared for the US Department of Energy, DOE Idaho Operations Office, "Preliminary Review of Models, Assumptions, and Key Data Used in Performance Assessments and Composite Analysis at the Idaho National Laboratory," INL/EXT-09-16417, July 2009. See p. 11, Tables 3 and 4 for sorption coefficients.

[38] See that the publicly 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

[39] 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.

[40] 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

Table 1. Radionuclide and chemical contaminants at RWMC for 1000 year and 10,000-year groundwater ingestion peak risk estimates and groundwater concentrations, unremediated.

Radionuclide (half-life)	Inventory	Source[a]	Peak Risk	Calendar Year	Peak Aquifer Concentration (Percent of MCL)	Maximum Contaminant Level
Am-241 (432 yr)	243,000 Ci	RFP	3E-3[b]	3010	6.8E-8 (< 1 percent)	15 pCi/L
C-14 (5,730 yr)	731 Ci	INL	1E-5	2133	186 **9.3 percent**	2000 pCi/L
Cl-36 (301,000 yr)	1.66 Ci	INL	2E-6	2395	21.2 3 percent	700 pCi/L
I-129 (17,000,000 yr)	0.188 Ci	INL	4E-5	2111	13.1 **1310 percent**	1 pCi/L
Tc-99 (213,000 yr)	42.3 Ci	INL	3E-4	2111	2710 **301 percent**	900 pCi/L
Np-237 (2,144,000 yr)	0.141 Ci	INL	1E-4	12000	86.8 **579 percent**	15 pCi/L[c]
U-238 (4,470,000,000 yr)	148 Ci	RFP[f]	9E-5	12000	47.1 **472 percent**	1.01E1 pCi/L[d]
Total Uranium [c]			NA	12000	1.44E-1mg/L **480 percent**	3.00E-2 mg/L[e]
Carbon Tetrachloride	7.9E8 g	RFP	5E-4	2133	3.07E-1 mg/L **6140 percent**	5.0E-3 mg/L
1,4-Dioxane	1.87E6 g 4.24E4 g	RFP INL	2E-5	2111	1.69E-01 mg/L **5633 percent**	3E-3 mg/L
Methylene chloride	1.41E7 g	RFP	5E6	2245	5.85E-2 mg/L **1170 percent**	5E-3 mg/L
Nitrate	4.06E8 g 4.97E7 g	RFP INL	(Hazard index 1)	2094	66.7 mg/L **667 percent**	10 mg/L
Tetrachloroethylene	9.87E7 g	RFP	7E-7	2145	6.64E-2 mg/L **1328 percent**	5.0E-3 mg/L
Trichloroethylene	8.92E7 g	RFP	9E-4	2130	3.8E-2 mg/L **760 percent**	5.0E-3 mg/L

Sources: DOE/ID-11241 sections 4 and 7.
a. Rocky Flats Plant (RFP); Idaho National Laboratory (INL)
b. The peak risk for Americium-241 is due to external exposure, soil ingestion, inhalation and crop ingestion. The risk for the other contaminants is primarily groundwater pathways.
c. The limit is 15 pCi/L for total alpha (40 CFR 141).
d. The limit is 3.0E-2 mg/L (30 microgram/L) for total uranium. To compare concentrations of uranium isotopes, 3E-2 mg/L is converted to the equivalent activity for each isotope.
e. Total uranium is presented for comparison to the maximum contaminant limit.
f. Table 4-4 of the RI/BRA shows that most of the U-238 waste is from Rocky Flats. Of this, 24.9 curies of U-238 was placed on pad A which is not currently planned to be removed.

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. [41] A figure from the DOE's report showing the rising radiation doses largely from migration of contaminants to the aquifer is shown in the 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 has already exceeds federal maximum contaminate level (MCL) drinking water standards.

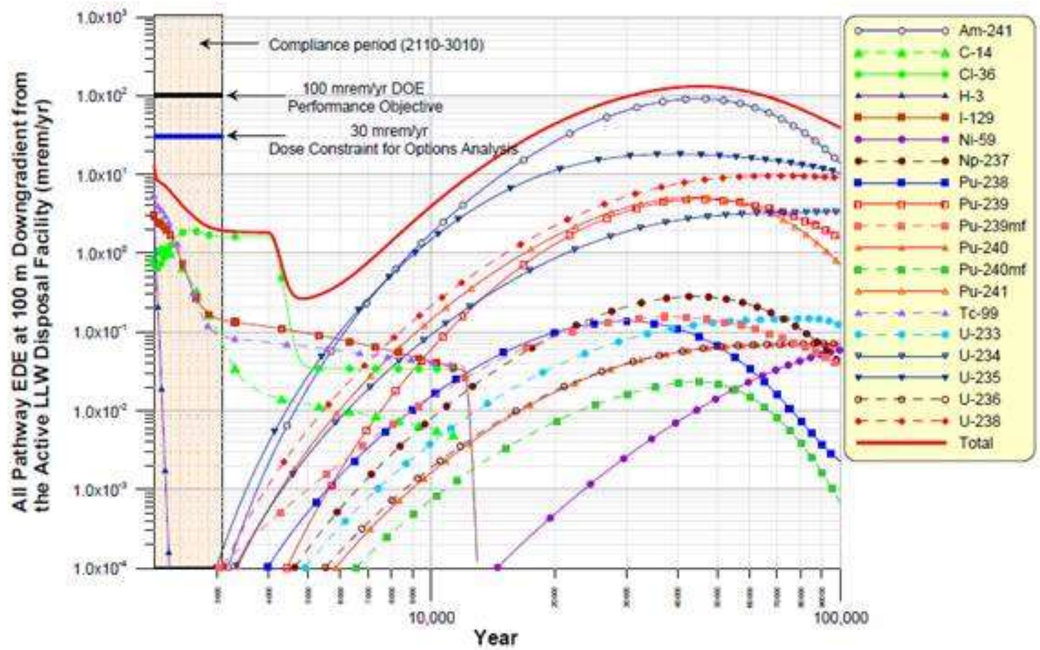

Figure 4-2. All-pathways effective dose equivalent 100 m downgradient from the Radioactive Waste Management Complex boundary from year 2110 to year 100,000 with cover infiltration rate equal to 1 cm/year.

The figure above shows the rising contamination levels after 10,000 years, with the leading Snake River Plain Aquifer contaminant being from americium-241. Please note the U.S.

[41] 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/

Environmental Protection Agency allows the Department of Energy to ignore and not display to the public the obscene radioactive contamination levels after 10,000 years at DOE cleanup sites.

A review was conducted that found that the Center for Disease Controls (CDC) National Institute for Occupational Safety and Health (NIOSH) presumption that radiation monitoring was adequate at the INL's burial grounds prior to about 1970 found the opposite: radiation monitoring of workers at the burial grounds was inadequate and they found that radiation dose reconstruction cannot be adequately conducted. Under the Energy workers compensation act of 2000, radiation dose reconstruction is used to determine eligibility for compensation if the worker has been diagnosed with one of twenty-two cancers. [42]

Decades after many workers were exposed to radiation, most — about two-thirds — of Idaho National Laboratory worker compensation claims have been denied for either radiation or chemical exposure claims. [43] Only in recent years has NIOSH determined that alpha monitoring was inadequate at some INL facilities.

Regarding radiation dose reconstruction at the burial grounds now called the Radioactive Waste Management Complex the review by NIOSH consultant Sanford Cohen and Associates (SC&A) found that radiation dose reconstruction would not be feasible.

". . . SC&A finds that the Burial Ground (1) was considered a low priority by INL Management and was so underfunded that needed health physics smear instrumentation was lacking; (2) apparently lacked a management culture that supported disciplined operations and a formality of radiological controls to minimize unnecessary contamination; (3) dealt with high-exposure MFPs and transuranics that were often unidentified as to specific isotopic content, activity levels, and physical form and quantity ; (4) lacked adequate alpha monitoring capability; and (5) lacked adequate bioassay and occupational air sampling responsive to Burial Ground contamination. From worker interviews, radiological incidents, and photographs of dumping operations, it is clear that an exposure potential existed for waste handlers, and that personal contamination was experienced during both waste handling and cleanup."

"It is also clear that airborne contamination may not have been detected and necessary bioassay follow-up would not have occurred given the lack of alpha monitoring, lack of both routine and special bioassay monitoring, limited workplace air monitoring, and the apparent lack of smear counting instrumentation during certain time periods."

Regarding the Snake River Plain Aquifer, the estimated migration of radioactive waste from the RWMC will still be dominated by americium-241, followed by other long-lived

[42] 42 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

[43] See the NIOSH Radiation Dose Reconstruction Program at http://www.cdc.gov/niosh/ocas. See the Idaho National Laboratory status at http://www.cdc.gov/niosh/ocas/ineel.html and see the portion of INL formerly ANL-W at http://www.cdc.gov/niosh/ocas/anlw.html

radionuclides or radionuclides such as plutonium and uranium that decay through a long series of radioactive progeny. Americium-241, with its radioactive half-life of 430 years decays into neptunium-237 which has a radioactive half-life of 2.1 million years. The Np-237 then decays through a long series of radioactive progeny. Americium-241 is the decay product of plutonium-241. Americium-241 decay ingrowth causes it to build up during the first 70 years from the time the plutonium-241 was created in a nuclear reactor. Plutonium-239 is the sought-after nuclear weapons material, but plutonium-240 and plutonium-241 are also created in a reactor along with the plutonium-239 and not easily separated out. Separation of the americium-241 from weapons material was conducted at the Rocky Flats plant and contamination levels of the Am-241 in the waste from Rocky Flats was highly variable and not well known.

The Department of Energy's disposal site at the RWMC will have a deep soil cap installed, but this situation would not meet U.S. Nuclear Regulatory Commission requirements [44] for stability of the disposal site after closure because both DOE and the EPA have acknowledged that the soil cap at the INL will require maintenance over millennia to maintain the integrity of the soil cap.

NRC Denies Oklo Aurora Microreactor Licensing Application

The U. S. Nuclear Regulatory Commission has denied the Oklo Aurora microreactor licensing application. [45] NRC license applications do not need to have complete facility and component designs, but the conceptual designs do need to be specific enough that the NRC has something to evaluate. The denial letter states that the NRC had insufficient information to establish a schedule or conduct a full review of the license application. But the NRC denial is "without prejudice," which means that Oklo can resubmit a license application in the future.

In September 2020, the NRC staff made formal requests for additional information (RAIs) on the subject of the maximum credible accident (MCA) analysis, the safety classification of SSCs, and QA program implementation (ADAMS Accession Nos. ML20265A121, ML20265A123, ML20265A346, and ML20267A529). Oklo submitted a reply on October 30, 2020, but its reply did not provide the detailed technical information needed to respond to the staff's questions (ADAMS Package Accession No. ML20305A582). [46]

The Oklo reactor was to produce roughly 1.5 megawatts-electric from a 4 megawatts-thermal reactor. The fuel was to be a metallic uranium-zirconium high-assay low-enriched uranium

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[44] 10 CFR 61.44 – Stability of the disposal site after closure. https://www.law.cornell.edu/cfr/text/10/61.44 See § 61.44 Stability of the disposal site after closure. The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

[45] *The Idaho Falls Post Register*, "NRC denies license to Oklo's nuclear reactor project," January 7, 2022.

[46] *Federal Register*, Nuclear Regulatory Commission, "Oklo Power LLC, a subsidiary of Oklo Inc.; Oklo Aurora Combined License Application Idaho National Laboratory," January 11, 2022. Document Citation 87 FR 1441 https://www.federalregister.gov/documents/2022/01/11/2022-00339/oklo-power-llc-a-subsidiary-of-oklo-inc-oklo-aurora-combined-license-application-idaho-national

(HALEU) fuel that is just less than 20 percent enriched in uranium-235. The power conversion system uses supercritical carbon dioxide (sCO2) as the working fluid. The CO2 flows through the heat exchanger system, removes heat from the heat pipes of the reactor cells, and transports it to the power conversion system. It is the only material that enters and exits the reactor module during normal operation, and is the only potential source of secondary activation to components outside the reactor module. (ML20075A003.pdf)

HALEU fuel is being recovered from the highly enriched Experimental Breeder Reactor II (EBR-II) fuel which is pyroprocessed at the Idaho National Laboratory. **Despite the hype that Oklo would utilize nuclear waste, it does not utilize spent nuclear fuel from commercial nuclear power plants, fuel that is left over from the commercial nuclear power fleet which is only 2 to 5 percent enriched in uranium-235.**

The pyroprocessing of roughly 80 percent enriched EBR-II fuel to recover U-235 for high-enriched low-assay uranium (HALEU) fuel increases radioactive airborne emissions from the INL to the surrounding communities by a factor of 170. All communities surrounding the INL have had roughly double the incidence of thyroid cancers compared to the rest of Idaho and the rest of the country. HALEU fuel also contains radioactive contaminants, making it unsuitable for use in some reactor fuels.

The Oklo documents emphasize that the reactor will be "low burnup" meaning that very little of the highly polluting recovery of the HALEU fuel recovered from the EBR-II fuel will be utilized by the Oklo reactor. The Oklo reactor generates less power per gram of fuel and fewer fission products in its less efficient spent nuclear fuel. The spent fuel it creates will need expensive pyroprocessing and/or disposal. Disposal of the higher-enriched fuels create more difficult issues in spent fuel disposal, as if those issues, including nuclear criticalities in a repository or during spent fuel storage and transportation were not difficult enough already.

And Oklo concluded that "There is no credible accident within the site envelope which leads to a [radiological] release." (See ML20265A123) The NRC had questions about how Oklo arrived at this conclusion. In one NRC request for additional information (RAI), the NRC asked for more information pertaining to what failures could initiate an accident and what the radiological release be for the maximum credible accident would be. [47] It appears that unsupported gloss-over answers won't be adequate for the U.S. NRC, at least not this time around.

[47] See ML20265A123.pdf on the nrc.gov Adams database regarding Maximum Credible Accident requests for additional information and see other NRC license application Oklo documents at https://www.nrc.gov/reactors/new-reactors/col/aurora-oklo/documents.html

Denial of Accident Causes and Consequences 60 Years After SL-1 Reactor Accident

Opinion Editorial by Tami Thatcher printed in The Idaho Falls Post Register *on January 2, 2022*

The January 3, 1961 accident at the Stationary Low-Power Reactor (SL-1) nuclear reactor at what is now called the Idaho National Laboratory killed three crewmen.

I have studied every report I could find on the SL-1 accident and prepared several reports and articles, beginning several years ago. [48] [49] [50]

The SL-1 reactor had a history of control rod sticking. During the last weeks of power operation, the Atomic Energy Commission (AEC) had given verbal permission for testing the reactor above its rated power level. During the high-power tests, reactor power was unstable and the power oscillations were swinging pen recorder charts off the page and required an automatic shutdown. The high-power tests were performed when the reactor fuel had accumulated a high fission product inventory. During those last few weeks of its operation, swelling of core internals greatly worsened.

The accident happened during an outage to reconnect the control rod drives. The center control rod had an extensive history of sticking during shutdown during these manual lifts, but the AEC preferred to emphasize that the center rod had stuck less than other rods during power operation. The lift involved bending and lifting an 80-lb drive mechanism. Within one third of a second of over-lifting the rod, a prompt critical condition vaporized fuel and the reactor vessel jumped nine feet due to a steam explosion.

The experts could hardly believe that the "inherently safe" boiling water reactor had exploded and investigations were conducted to determine whether or not a chemical bomb had been set off.

The safety analysis for the SL-1 did not include any accident that could damage the fuel and did not include analysis of accidents during shutdown.

The experts found that the manual lifting of the rod could initiate the accident and with no time for correction of the over-lift. They also found that the accident was ten times worse

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[48] Tami Thatcher, Environmental Defense Institute Special Report, *The Truth About the SL-1 Accident, Understanding the Reactor Excursion and Safety Problems at SL-1*, January 8, 2015, updated September 1, 2019. http://environmental-defense-institute.org/publications/sl-1accident.pdf

[49] Tami Thatcher, Environmental Defense Institute Special Report, *The SL-1 Accident Consequences*, September 1, 2019. http://environmental-defense-institute.org/publications/sl-1consequences.pdf

[50] See the Environmental Defense Institute website for newsletters for November and December 2021 regarding the Department of Defense's Proposed Mobile Microreactors (Project Pele) and public comment on Project Pele including SL-1 lessons not learned at http://environmental-defense-institute.org/publications/Pele2021commentdraftEIS.pdf and the recording of the public hearings available at https://www.mobilemicroreactoreis.com

because the coolant temperature in the vessel had fallen so far below saturation temperature that January evening. There was no safety requirement preventing that subcooled condition during core changes.

The AEC ruled out rod sticking as the cause of the accident despite an independent review board's opinion that rod sticking had likely caused the accident and before core internals were examined.

The crewmen were misidentified at times and much was made of a crewman who was having marital problems. But autopsy showed that his hands were undamaged and he could not have lifted the rod. [51] The crewman whose hands were damaged had been promoted, was married for one year and the couple was expecting their first child.

I and others conclude that the rod drive was stuck due to material swelling from reactor operations and was jerked free, causing the over-lift of the rod that initiated the accident.

A review board has long ago written a report that found that SL-1 had design problems, including excessive reactivity associated with the center control rod; degrading core internals; continued operation with almost no safety reviews or inspections; and poor safety oversight by the Atomic Energy Commission (AEC), the agency that would become the Department of Energy. Importantly, that review board found no fault with the crew. [52]

But the Department of Energy has done nothing to dispel the myths and its non-technical document *Proving the Principle* incorrectly describes the amount of rod over-lift and insinuates the rod over-lift was deliberate. [53] [54]

An environmental impact statement issued in 2021 for a Department of Defense Project Pele mobile reactor states that a control rod was improperly withdrawn and concludes that the only lesson learned from the SL-1 accident was the need to address emergency planning. The EIS refers to a single document regarding the SL-1 accident: *Proving the Principle.*

CERCLA cleanup investigations that commenced in 1995 found the SL-1 burial ground and buildings near where the reactor had been located highly radiologically contaminated. [55] Site

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[51] C. C. Lushbaugh et al., Los Alamos Scientific Laboratory of the University of California, *The SL-1 Reactor Accident Autopsy Procedures and Results*, LAMS-2550, May 1961. https://inldigitallibrary.inl.gov/PRR/163773.pdf

[52] Joint Committee on Atomic Energy, *SL-1 Accident Atomic Energy Commission Investigation Board Report,* U.S. Government Printing Office, Washington, June 1961. available at INLDigitalLibrary.inl.gov

[53] Susan Stacy, "Proving the Principle – A History of the Idaho National Engineering and Environmental laboratory, 1949-1999," Washington, D.D.: US Department of Energy. p. 148. http://www.inl.gov/publications/ and http://www.inl.gov/proving-the-principle/introduction.pdf

[54] Although not a text book for nuclear engineering, the book by Howard G. Wilshire et al., The American West at Risk" includes in a footnote information typical of prevalent misinformation from Atomic Energy Commission. It describes the SL-1 accident as an "apparent sabotage" and says an AEC memo stated that "the …accident is now known to have been initiated on purpose by one of the operators," suspicious of an affair between his wife and a shift partner."

workers had continued to use those buildings since 1961. The reasons why the extensive radiological contamination had not been detected by the Department of Energy were not explained and I have found other problems with the assessment of the SL-1 radiological release depictions.

Isn't it time for the truth about the SL-1 accident to be acknowledged?

Top Ten Lessons Not Learned by the 1961 SL-1 Reactor Accident

Here are my top ten "lessons not learned" from the SL-1 accident, particularly in light of some proposed new nuclear reactors being regulated by the Department of Energy (rather than the U.S. Nuclear Regulatory Commission) such as the mobile microreactor proposed for Project Pele at the Idaho National Laboratory and elsewhere.

1. **The pressure to show progress and within the least cost makes an enormous incentive to take shortcuts with safety, and it was this tendency within the high-cost world of nuclear energy that was a very important lesson not learned by the Department of Energy concerning the SL-1 accident.**
2. **The Department of Energy is prone to accept unsafe reactor designs.** The agency still hasn't admitted how egregiously unsafe the SL-1 design was or its mismanagement of the SL-1 reactor was even though an independent board pointed this out. Instead, the agency still supports propaganda that blames a crewman for the SL-1 accident. The lack of safety system design reviews and inadequate testing of reactor and storage pools in the DOE Complex is pervasive.
3. **The predecessor to the Department of Energy, the Atomic Energy Commission, had the role of safety oversight over the SL-1 reactor and was not even following its own regulations and commitments when it verbally authorized exceeded rated power without conducting safety reviews, for the SL-1 reactor.** The high-power operations approved without any documented review accelerated core swelling and degradation and had greatly worsened control rod sticking at the SL-1. Rod sticking is very likely to have been a direct cause of the accident, as the stuck rod was jerked free and over lifted, resulting in a prompt critical power excursion, vaporization of a portion of the fuel, and a steam explosion that caused the vessel to jump.
4. **The Department of Energy has a long-standing practice of underfunding nuclear safety including underfunding its contractors and ignoring or pressuring safety professionals.** Prototype reactor promotors, like Combustion Engineering, the company that took over operations and safety management of the SL-1 (under the oversight of the Atomic Energy Commission) decided to simply exclude the nuclear physics personnel who were aghast at the way the SL-1 was being operated. CE excluded the nuclear

[55] See the Idaho Environmental Coalition, LLC (IEC) that will take over the Idaho Cleanup Project on January 1, 2022 for the new location of the Administrative Record and Information Repository for Idaho National Laboratory CERCLA cleanup records at http://www.idaho-environmental.com/ARIR/

physicists from meetings and project involvement as their objections were considered costly and adverse to productivity.

5. **Even the need for better emergency planning has not been learned by the Department of Energy.** The Department of Defense Project Pele is going to rely on the Department of Energy to license and regulate the micro mobile reactor. The Environmental Impact Statement for the reactor stated that the only lesson learned about the Army reactor, the SL-1 was that better emergency planning was needed. The Project Pele reactor, with its military base use, would require putting protection of the mobile microreactor ahead of protecting people and providing military defense, so even that SL-1 lesson was not learned by the military. Recent accidents at the Idaho National Laboratory reveal that emergency planning is just a poor as ever. The 2011 plutonium inhalation accident at the Zero Power Research Reactor and the 2018 four-drum explosion at Accelerated Retrieval Project enclosure V both reveal ongoing serious deficits in emergency planning at the INL.

6. **The need for safety review of all operating modes, not just power operations, is vital.** There remained in the nuclear industry for many years after the SL-1, the tendency to ignore or gloss over safety during shutdown. Safety during transportation and storage of nuclear fuel remains an experiment, largely based on conjecture, not validation. The U.S. Nuclear Regulatory Commission is tougher but still an industry lap dog. The NRC has approved licensing changes, like the use of higher enriched, high-burnup fuels, all without evidence that fuel storage and transportation could be safely conducted. The NRC is still trying to figure out how to inspect spent fuel storage canisters. And it would not have a way to confine or repair the canisters even if it found a defect that would cause radioactive material to leak and prohibit the canister from being transported. (See SanOnofreSafety.org for more information on spent nuclear fuel canisters.)

7. **Allowed radiation monitoring practices and annual radiation dose limits don't necessarily protect worker's reproductive health.** The reproductive health for the one crewman examined post-mortem had been adversely affected before the accident from routine SL-1 operations, not just increasing to likelihood of infertility but also increasing the likelihood of birth defects. The radiation dose to the gonads was inadequately monitored then, as now. Even the tighter limits on pregnant female radiation workers are not protective of the unborn child.

8. **Radiation workers in the U.S. remain inadequately protected.** The twenty-five rem doses to SL-1 emergency responders should not have caused an elevated cancer rate in the responders, but it appears that it did. Even 400 mrem per year annual radiation doses to workers has been found to increase cancer risk in epidemiology. The annual limit for radiation workers in the U.S. remains 5000 mrem per year (which is equivalent to 5 rem/yr).

9. **The U.S. is still not prepared for radiologically contaminated patients.** Medical facilities and their staff are not going to be safe if seriously radiologically contaminated patients need help. The nurse assisting the one crewman who survived for a short time after the accident, was not adequately protected. The victims of the SL-1 accident required lead-lined casks, even though body parts had to in some cases be severed and buried at the Radioactive Waste Management Complex at the INL. Despite this, the INL

propaganda folks insisted that the Chernobyl mini-series was over stating the radiation levels of Chernobyl emergency responders. Medical facilities in the U.S. are not prepared for injured people who are seriously radiologically contaminated.

10. **The radiation doses from an accident as allowed by nuclear safety evaluations of dose to the public are far too high and allow levels of contamination that cannot be remediated.** The doses depend on the distance to the public and thus the radiological release can be very large when the distance to the public is many miles. The entire framework for licensing a nuclear reactor does not ensure public safety and does not ensure that homes and property won't become exclusion zones where living and growing crops must be prohibited. The SL-1 accident radiological release was stated to be mainly iodine-131 but the reality was that cesium-137, strontium-90, uranium and plutonium were released to nearby communities, adversely affecting people's health.

To read more about the 1961 SL-1 accident, Environmental Defense Institute reports are available online.

I wrote the first report about the causes of the SL-1 accident in 2015 and updated it in 2019. I have also written a report about the consequences of the SL-1 accident, and why the radiological release from the SL-1 accident probably dwarfs other past INL radiological releases.

My two stand-alone reports on SL-1 about the causes and the consequences, are at the "Nuclear Accident History at INL" webpage at Environmental Defense Institute website at http://www.environmental-defense-institute.org/inlrisk.html [56] [57]

In the September 2019 newsletter I compare the SL-1 fuel release fractions to the Three Mile Island accident. http://www.environmental-defense-institute.org/publications/News.19.Sept.pdf

In the December 2019 newsletter I compare the SL-1 accident to the Chernobyl accident. http://www.environmental-defense-institute.org/publications/News.19.Dec.pdf

In November 2021, I submitted public comment on Department of Defense's Project Pele. [58]

And in January 2022, I wrote an article describing the independent review that absolved the crew at the SL-1 reactor, how the serious and increasing problems of rod sticking was downplayed by the AEC and why I and many others believe that a stuck rod was jerked, unintentionally causing the SL-1 accident. http://www.environmental-defense-institute.org/publications/News.22.Jan.pdf

Articles by Tami Thatcher for February 2022.

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[56] Tami Thatcher, Environmental Defense Institute Special Report, *The Truth About the SL-1 Accident, Understanding the Reactor Excursion and Safety Problems at SL-1*, January 8, 2015, updated September 1, 2019. http://environmental-defense-institute.org/publications/sl-1accident.pdf

[57] Tami Thatcher, Environmental Defense Institute Special Report, *The SL-1 Accident Consequences*, September 1, 2019. http://environmental-defense-institute.org/publications/sl-1consequences.pdf

[58] See the Environmental Defense Institute website for newsletters for November and December 2021 regarding the Department of Defense's Proposed Mobile Microreactors (Project Pele) and public comment on Project Pele including SL-1 lessons not learned at http://environmental-defense-institute.org/publications/Pele2021commentdraftEIS.pdf and the recording of the public hearings available at https://www.mobilemicroreactoreis.com