Public Comment Submittal on the U.S. Department of Defense Draft Construction and Demonstration of a Prototype Mobile Microreactor (Project Pele) Environmental Impact Statement Issued September 2021

Comment submittal by Tami Thatcher, November 6, 2021.

Comments Due: November 9, 2021. Sent by email to PELE_NEPA@sco.mil.

BACKGROUND

The Department of Defense has issued the *Draft Construction and Demonstration of a Prototype Mobile Microreactor Environmental Impact Statement* (Draft EIS) to satisfy the National Environmental Policy Act (NEPA) process, see https://www.mobilemicroreactoreis.com. [1] The project is part of Project Pele, named after the goddess of volcanos, and it is aptly named as volcanos are known to cause destruction of lives and homes. [2]

The Draft EIS "evaluates the potential environmental impacts of the proposed construction and operation of a prototype mobile microreactor and the fabrication of fuel (a single mobile microreactor core)." The mobile microreactors are to be gas-cooled high temperature nuclear reactors sized to provide 1 to 5 megawatts of electrical power, which has been presumed to be bounded by reactor thermal energy of 10 megawatts-thermal. The stated use for the reactors would be at foreign military bases and the goal of the project would involve transport of fresh nuclear fuel and fission-product laden spent nuclear fuel anywhere in the world by rail, ship, truck or airplane.

The Department of Energy will provide the regulatory oversight and expertise on technical, safety, environmental, and health requirements, not the U.S. Nuclear Regulatory Commission.

---

[1] The Department of Defense (DoD), acting through the Strategic Capabilities Office (SCO) and with the Department of Energy (DOE) serving as a cooperating agency, announces the availability of the Draft Construction and Demonstration of a Prototype Mobile Microreactor Environmental Impact Statement. SCO is also announcing a public comment period and public hearings to receive comments on the Draft EIS. SCO prepared the Draft EIS to evaluate the potential environmental impacts of alternatives for constructing and operating a prototype mobile microreactor capable of producing 1 to 5 megawatts of electrical power (MWe). The Draft EIS is available at https://www.mobilemicroreactoreis.com. DoD as the prime agency, acting through the SCO and in cooperation with the DOE, invites Federal agencies, state agencies, local governments, Native American tribes, industry, other organizations, and members of the public to review and submit comments on the Draft EIS. Comments will be accepted during the comment period that will extend for 45 days after the U.S. Environmental Protection Agency publishes the Notice of Availability in the Federal Register on September 24, 2021. The comment period will end on Tuesday, November 9, 2021.
Additional information about the project and the public hearings can be found at this website: https://www.mobilemicroreactoreis.com. All comments, whether oral or written, will be considered by DoD as the EIS is finalized and can be emailed to e-mailed to PELE_NEPA@sco.mil.

[2] The mobile microreactor design, construction and testing is also referred to by the Department of Defense's Strategic Capabilities Office (SCO) as Project Pele although not identified as such in the Federal Register or EIS document title.

Two designs are being considered; both are small, advanced gas-cooled reactors using high-assay low enriched uranium (HALEU tristructural isotopic (TRISO) fuel. The mobile microreactor would be fabricated at either BWXT Advanced Technologies, LLC or X-energy, LLC team facilities. The fuel would be fabricated at BWXT facilities in Lynchburg, Virginia.

Reactor fuel would be produced from DOE stockpiles of highly enriched uranium (HEU) located at DOE's Y-12 plant in Oak Ridge, Tennessee, that would be converted to an oxide form at the Nuclear Fuel Services (a subsidiary of BWXT) facility in Erwin, Tennessee, and downblended to HALEU and fabricated into TRISO fuel at the BWXT facility in Lynchburg, Virginia. The proposed fuel for the gas-cooled mobile microreactors would be tri-structural isotopic (TRISO) silicon-carbide coated fuel pellets inside cylindrical fuel compacts using high-assay low-enriched uranium (HALEU) from the National Nuclear Security Agency (NNSA) enriched uranium stockpile. The BWXT-Nuclear Fuel Services Erwin, Tennessee, and BWXT Lynchburg, Virginia, facilities are the only private U.S. facilities licensed to possess and process HEU.

The Draft EIS states that "The mobile reactor would be **fabricated** at either BWXT Advanced Technologies, LLC or X-energy, LLC team facilities." [Emphasis added.] Yet, the Draft EIS also states on page S-5 that "The primary decision to be made regarding Project Pele is whether to: **Fabricate** and demonstrate a mobile microreactor at the INL Site." [Emphasis added.] The Draft EIS appears to say it plans to **fabricate** the mobile microreactor away from the INL (at a BWXT or X-energy facility) but then states it will have a primary decision to make, as to whether to **fabricate** it at the INL. (There seems to be ambiguity in some statements in the Draft EIS about the location where fabrication would take place.)

Final assembly, fuel loading, and demonstration of the operability and mobility of the mobile microreactor would be performed at the Idaho National Laboratory (INL), using the Materials and Fuels Complex (MFC) and the Critical Infrastructure Test Range Complex (CITRC). After testing and operation of the reactor, the mobile microreactor would be placed into "temporary storage" at the DOE facility. "At some later time, it would undergo disposition." "The mobile microreactor components would be disposed of at licensed disposal sites as appropriate for the waste type." Radioactive wastes would be dispositioned using "existing processes" or stored onsite.

The Draft EIS states that it may "Temporarily store the mobile microreactor at MFC's Radioactive Scrap and Waste Facility (RSWF) or Outdoor Radioactive Storage Area (ORSA)." The Draft EIS does not clearly say how long it plans to store the mobile microreactor spent nuclear fuel from INL testing, nor where mobile microreactor spent fuel from military use of mobile microreactors would be stored. The Draft EIS also states that the mobile microreactor spent nuclear fuel may be stored indefinitely at INL's INTEC.

The Draft EIS states that the Proposed Action is the Preferred Alternative. The No Action Alternative was also considered but according to the Draft EIS, it does not meet the purpose and need. Under the No Action Alternative, a mobile microreactor would not be constructed, fuel would not be fabricated by BWXT, and the mobile microreactor would not be demonstrated at the INL Site.

The final EIS is stated to be expected in early 2022, and the Record of Decision by spring of 2022.

SUMMARY OF PROJECT PELE DRAFT EIS INADEQUACIES

I disapprove of the Department of Defense's preferred alternative, construction and testing of a prototype mobile microreactor, because it is unsafe and wasteful, and the spent nuclear fuel, which poses a radiological hazard that must be confined for millennia, is expected to remain indefinitely in Idaho, because the Department of Energy has no spent nuclear fuel disposal program.

Despite logical suggestions that the Draft EIS consider other reasonable alternatives such as continued diesel generator use, increased use of solar power, increased use of battery power, the Draft EIS authors have refused to do so. Their mission is to throw money at unreliable undesirable gas-cooled reactors, likely to be as popular and economical as the gas-cooled Fort St. Vrain reactor that the tax payers pay millions of dollars each year, just to tend to its spent nuclear fuel.

Concerns from the scoping comments over outdated and inadequate radiation protection standards (see page 1-10 of the Draft EIS) were ignored.

The Draft EIS states that publicly available annual reports document the extensive monitoring conducted on and around the INL Site. The Draft EIS does not mention important weaknesses in the environmental monitoring program conducted by the Department of Energy such as: not mentioning that extended outages and unavailable of the environmental monitoring database have been common place; that the reports available may be exclude certain months; that only the annual reports since 2000 are included at the monitoring website; that the monitoring ceases in certain locations, sometimes for months on end; that the monitoring program withholds data from the U.S. Environmental Protection Agency's Radnet at whim; that the statistical tests for declaring that a sample is radioactive have been selected to create an indefensibly high bar for stating that radioactivity was detected; that various elements of the stated monitoring program were simply never conducted, such as monitoring of the prevalent iodine-129, which was stated to be included in the monitoring program for many years, yet no monitoring results were ever presented even as the expected doses from iodine-129 were a significant portion of the INL's radiation doses from airborne waste (effluents).

The Project Pele mobile microreactors are not demonstrated to be safe or reliable, and no matter the level of inherent accident tolerance, will still remain unsafe because of being targets for sabotage and missile targets. A single mobile micro reactor may release thousands of curies of radionuclides into the environment. The term 'micro" does not characterize the potential radiological releases from a single microreactor. And it must be understood that very small curie amounts, far below a single curie, of plutonium, uranium and other actinides are very harmful when released into the environment. To be misleading, the Draft EIS has omitted the mobile microreactor spent nuclear fuel radionuclide inventory, presenting instead, only an accident source term that has been greatly reduced. The Draft EIS has not included a comprehensive or bounding set of accident consequences. The Draft EIS has not included acts of sabotage or

“intentional destructive acts” to cause an accident, despite this being a concern stated in the scoping comment summary (page 1-10 of the Draft EIS). The Draft EIS incorrectly states that it considers the consequences of “intentional destructive acts” when in fact it has not. The actual microreactor radionuclide inventory (curie amount of each radioisotope) after the reactor is operated has been unrealistically reduced to an accident source term that is one-ten-thousandth of the actual radionuclide inventory.

The mobile microreactor concept is environmentally unsound because of the health hazard of radiological effluents from routine operations, from accidents and during storage of the spent fuel. The hazard remains even when the reactors are not operating. The hazards do not diminish over time, but increase as equipment, containers and fuel degrades over time.

The accidents considered in the Draft EIS are not comprehensive over the life of the spent nuclear fuel. Accidents must be considered for all operating modes, including extended storage of the fueled mobile microreactor. The Draft EIS fails to adequately address spent nuclear fuel storage degradation issues, of the container or the fuel, during storage of the spent fuel. The preplacement of spent nuclear fuel storage containers, as they degrade, must be addressed because many decades can be expected to pass before the Department of Energy has even a disposal facility that would be hoped to confine the spent nuclear fuel from air, water and soil. Actually, it may not be feasible to develop a disposal facility that is capable of isolating the radioactive fuel, fission products and activation products from the environment over the millennia that these radionuclides are toxic and a risk to health.

The Department of Energy’s boundless enthusiasm for new reactor research is coupled with unfunded, languishing and mismanaged waste management of the spent nuclear fuel that remains a hazard for millennia. The spent fuel is packaged into containers that last hopefully for more than a few decades. The costs of management and disposal of spent nuclear fuel are so burdensome that the Department of Energy simply refuses to estimate the costs that will burden future generations. The Draft EIS also states that the mobile microreactor spent nuclear fuel may be stored indefinitely at INL’s INTEC, yet it does not evaluate the flood plain hazard for fuel stored at INTEC. In fact, the facilities at INTEC are aging. And even if spent nuclear fuel were to be repackaged, should a facility for repackaging certain Department of Energy spent nuclear fuel now stored at INL, there is no guarantee that the mobile microreactor spent nuclear fuel could be handled by the new facility, if built. The Project Pele mobile microreactor spent nuclear fuel would likely be at the end of the line for a place in a disposal facility, should one ever be built.

The Draft EIS Project Pele Flowchart misleads the reader, implying storage of the microreactor at one of two areas at the Materials and Fuels Complex (RSWF or ORSA), no mention of INTEC on the Flowchart, and strongly implies that all wastes including the spent nuclear fuel will be dispositioned within 3 years, but this is absolutely not the case. The duration of “temporary” storage of the fueled microreactor is unknown. And the duration of “temporary” storage of the spent nuclear fuel after removal from the microreactor in undetermined facility at undetermined time, in an undetermined way, is a direct plan for long-term, interim (forever) storage of the spent fuel in Idaho, until the containers and/or fuel are degraded.

The Department of Energy has no program for the disposal of spent nuclear fuel, despite the misleading and deceptive language used to make misleading assertions to the contrary. The used or spent microreactor fuel used in the prototype microreactor will languish "temporarily," for decades, but likely far longer, at the Idaho National Laboratory. Spent fuel from deployment of mobile microreactors will either languish as stranded fuel where the microreactors are deployed, or be unsafely transported back to the U.S., very likely to the Idaho National Laboratory. The transportation of the microreactors will put any community the reactors are transported through at risk of becoming permanent exclusion zones, where an accident or sabotage could contaminate land with levels of radioactivity too high for people to live in.

The Draft EIS as written white washes the radioactive waste problems and ignores the financial burdens of relocating, repackaging and disposing of (if possible) the spent nuclear fuel. These gas-cooled mobile microreactors will have harmful effects wherever they are located because of the ongoing emissions and the damage to human health for people working at the project and people living anywhere near it. The vulnerability of the fuel to oxygen or moisture is not adequately described in the Draft EIS, nor is it adequately mitigated.

The higher enrichment fuels such as high-enriched low-assay uranium fuels (HALEU) fuel, as well as the plutonium fuels the Department of Energy wishes to use in other reactor projects, create even more challenging pre-disposal and post-disposal containment and criticality issues. Early Yucca Mountain analyses simply assumed away the criticality problem, but now criticalities are deemed so likely as to be unavoidable. The impact of criticalities on the geologic medium where the waste is disposed of, remains unknown.

The U.S. Department of Energy has no idea how many trillions of dollars it will ultimately cost to continue seeking a permanent solution to isolate the radio-toxic material for millennia.

Because U.S. utilities and investors don't want the added liability or the cost of new nuclear reactors, the Department of Defense is being conned into thinking that moving truck-load sized nuclear reactors to medical or other military or non-military installations would be a dandy idea. There is likely to be very little in the way of environmental monitoring, as the negligent practices by the U.S. military have already used in allowing U.S. troops to live in areas contaminated by depleted uranium, that when surveyed by other countries, were deemed too contaminated for their troops to be stationed at. And who at the military or Department of Energy has ever cared if there is no place to dispose of the spent nuclear fuel. They will be happy to retire, having made radioactive dump sites here, there, and everywhere.

The Project Pele mobile microreactor Draft EIS presents information showing the elevated rate of the incidence of thyroid cancer in the communities surrounding the Idaho National Laboratory but is irresponsibly silent on pointing out the elevated cancer rates and apparently uninterested in the actual human health effects of the INL's ongoing radiological releases in its silence on the question of why this is so.

The Project Pele mobile microreactor Draft EIS continues to state that 100 millirem per year (also stated here as mrem/yr, 1000 millirem is equal to 1 rem) radiation dose to the public is acceptable despite the fact that when that limit was established, it was assumed that the fatal

cancer risk from radiation was 0.0001 fatal cancers per rem. Even the Draft EIS uses 0.0006 fatal cancers per rem, yet the 100 mrem/yr limit remains unchanged.

The thyroid dose from the Idaho National Laboratory's ongoing radiological airborne effluents is far larger than the thyroid organ dose from background radiation. Yet, the Department of Energy continues to emphasize and display only the effective whole-body dose estimates, a fraction of a millirem, according to DOE's annual airborne radiological effluent estimates. The deception has more to do with avoiding negative public perception and avoiding liability for causing the increased rates of cancer in the region than scientific examination of the health effects.

The Project Pele mobile microreactor Draft EIS presents selected years of Department of Energy radiation doses from the INL's ongoing and increasing annual airborne waste (effluents).

The estimated doses are effective whole body radiation doses. The Draft EIS is silent on the increasing releases over the last 20 years and on the expected large increases of airborne effluent releases from various new and existing programs. The Draft EIS is silent on the fact that the Department of Energy did not include all of the significant-to-dose airborne radionuclide effluents that it released during many years of its operations or if included, understated the amount. For example, for many years the radionuclides sent to percolation ponds from INL facilities were excluded from being included in airborne effluents used in estimating radiation dose to the public. The radioactivity in liquid waste sent to ponds was all assumed to enter the soil and groundwater below. Other radionuclides were simply not reported at all to the public on the basis of not wanting to disclose the radionuclides being released.

And other radionuclides were released, in quantities that could have been far higher than stated releases of non-noble-gas releases, but were ignored, as the drum breaches that have periodically occurred as Rocky Flats transuranic waste was being dumped into the burial ground pits at the Idaho National Laboratory. Center for Disease Control investigations for radiation worker illness compensation have learned that there were numerous such open-air drum breaches and that no monitoring or bioassay was conducted in response to these events. The releases of americium-241 and plutonium from a single barrel of waste having been breached during unloading or during past burial ground flooding events has not ever been factored in to the dose to the public despite ample evidence of excessive americium-241 in the environment. The DOE's environmental surveillance monitoring program, when it detects americium-241 off of the INL site, simply attributes it to former nuclear weapons testing.

The Draft EIS points to the estimated radiation dose of an average annual dose of 0.12 mrem (whole-body effective dose) from "ingestion of waterfowl" that had visited the INL. But it does not clarify that this means the ingestion of only a single 8-ounce portion of duck per year. Nor does it clarify that the radionuclides in the duck's bones would greatly add to the estimated dose if the person were to consume duck bone broth. Nor does it explain that it assumes that the extensive radiological contamination on the feathers were simply washed off the hands and did not contribute to the estimated dose.

Importantly, in 1985, that Department of Energy annual report acknowledges that if a person ate one duck that had visited the ATR Complex, that person would receive 10 mrem, far above the stated levels in the Draft EIS (page 3-40). I have not found enough publicly available information to determine if plutonium etc. in the waterfowl bones were assumed to be consumed in these earlier studies. The estimated radiation whole-body doses from eating a single duck are large in comparison to the DOE's stated estimated effective whole-body radiation dose estimates from ongoing airborne radiological waste (effluents) which are usually significantly below 0.1 mrem per year. (Note that the Department of Energy's annual reports prior to 2000 are not being displayed on its environmental monitoring website. Also, trending tools that were once available but revealed large gaps in the air and water monitoring data, have been removed from the DOE's environmental monitoring website.)

When waterfowl (such as ducks) are analyzed and are known to have had a visit to the Idaho National Laboratory's ATR Complex (formerly Test Reactor Area) warm waste ponds, then the radionuclides known to be in the ponds are usually acknowledged as a possible source of the radionuclides in the animal tissue. [3] The accumulation of various radionuclides in muscle and bone of ducks is made to seem that close contact with the radioactive waste ponds is required. But the fact is that detections of the same radionuclides can be found in yellow-bellied marmots located 50 miles away in Pocatello. Some of these radionuclides are prevalent at the INL's radioactive waste water ponds. And some of these radionuclides cannot have resulted from former nuclear weapons testing or any place other than the INL.

In 2002, marmot tissues were analyzed for radionuclide content by the Department of Energy's environmental surveillance program (formerly Idahoeser.com and apparently now changed to Idahoeser.inl.gov). The marmots were taken from the Idaho National Laboratory near the Radioactive Waste Management Complex and also collected from an area near the Pocatello Zoo. There was also marmot data from 1998 also detecting cobalt-60, zinc-65, niobium-95, cesium-134, cerium-141 and also strontium-90, cesium-137 and plutonium-238, consistent with INL radioactive waste water ponds.

Both the INL's RWMC and the Pocatello marmots had the mainstays: strontium-90 and cesium-137 in their tissues. And in 2002, both the INL's and the Pocatello marmots had these short-lived neutron activation products that can only be from the INL: cerium-141, cobalt-58 and cobalt-60, chromium-51, hafnium-181, manganese-54, niobium-95, zinc-65, and the fission product ruthenium (either Ru-103 or Ru-106, both of which are short-lived).

The only way from the marmots residing near the Pocatello Zoo to have these radionuclides in their tissues is from the spread of airborne contamination from the INL. The DOE's environmental surveillance program, as usual, discarded strong evidence of radioactivity in the marmot tissues based on its decision to require an infinitesimal probability of false positives, its

[3] Ronald W. Warren et al., Under contract for the Department of Energy, "Waterfowl Uptake of Radionuclides from the TRA Evaporation Ponds and Potential Dose to Humans Consuming Them," Stoller-ESER-01-40, October 2001. http://idahoeser.com/Surveillance/PDFs/TRADuckReport.pdf

practice of accepting a very high probability of false negatives (with probability as high as 50 percent), and ambiguous gamma spectroscopy practices.

The question of what radionuclides from the INL we have in our muscles and bones from the INL was never raised, largely because it was a simple matter for the environmental monitoring program to claim that the gamma spectroscopy peaks exhibited by the marmot tissues from Pocatello were not going to be deemed true detections due to the practice of requiring miniscule probability of false positive detections while allowing the probability of false negatives to be as high as 50 percent.

The entire Project Pele mobile microreactor Draft EIS is misleading, exemplified by the avoidance of clarity concerning the radiation dose from ingestion of waterfowl. The Draft EIS favors assumptions that it does not provide documented bases for. The unsupported assumptions are not conservative or bounding but are intended to grease the presented information in a way so that the public does not understand the true ramifications of either the project or the INL's past and ongoing environmental effects. The Draft EIS does not meet the intent of the NEPA process: it does not protect people or the environment.

The military's proposed Project Pele Mobile Microreactor project is ill-conceived, puts troops, the public and the environment at risk, wastes precious resources, and bases its contrived safety case on biased assumptions that they don't wish to disclose. The radiological releases from a 10 megawatt-thermal [4] reactor could be far higher than the draft EIS discusses. The risks and costs associated with the management of its spent fuel are also very important and dismissed with vague and misleading statements that is would be addressed by "existing processes" pretending as though the Department of Energy has a spent nuclear fuel disposal program. The draft EIS is misleading, lacks transparency, and fails to protect people or the environment. I oppose the Project Pele Mobile Microreactor project and this first step of fabricating the reactor somewhere and of testing the reactor at the Idaho National Laboratory and of storing the resulting spent nuclear fuel in Idaho, at the INL indefinitely.

No Realistic Military Mission for Missile-Targeted Mobile Microreactors

The Project Pele proposal to build portable gas-cooled nuclear reactors for transport around the globe puts any community and country in its transportation path at risk of becoming an "exclusion zone," an area so radioactive, that no one can live there. The Project Pele mobile microreactors, from 1 to 5 megawatts-electric in size, put military bases and other installations where these would be located at risk as they would become missile targets. The dispersal of nuclear fuel, especially after the buildup of fission products from operating the reactor, would force the permanent evacuation of the area where the mobile microreactors are located.

[4] The megawatts-thermal figure represents the reactor's energy production without reduction of the inefficiencies in creating electrical energy. Generally, the megawatts-electrical capacity might be roughly one-third of the megawatts-thermal energy of the reactor.

Critics say that the nuclear reactors will be targets and that it is unwise to deploy nuclear reactors in theaters of war. [5]

Even the military does not want these reactors deployed at foreign military bases. [6] The project is a way to funnel government money to the nuclear industry for projects that cannot obtain private investor support. The refusal of the Draft EIS authors to even consider obviously more safe, reliable and affordable options is proof of the unacceptable bias of the Draft EIS.

Draft EIS Stated Accident Consequences Unrealistically Low-Balled

The uranium fuel is part of the radionuclide inventory of the microreactor spent fuel and must be included in the accident source term for any accident with dispersal of the spent nuclear fuel, such as from an intentional destructive act. The radionuclide inventory was not included in the Draft EIS but must be included in the Draft EIS and substantial evidence must be provided for the greatly reduced accident source terms used in the Draft EIS.

The proposed high-assay low-enriched uranium fuel known as HALEU is stated in the draft EIS to be composed of just under 20 percent uranium-235 (by weight), just under 80 percent uranium-238 (by weight) and also uranium-234 and uranium-236. See Table 1 for the HALEU weight fraction and radioactive activity for a mobile microreactor using 400 kg HALEU fuel.

Table 1. Beginning-of-life fuel content of high-assay low-enriched uranium (HALEU) fuel proposed for the Project Pele mobile microreactor.

Radioisotope	Weight Fraction	Activity (curie) for 1/10th of 400 kg HALEU	Activity (curie) for 400 kg HALEU
Uranium-234	0.0021	2.74E-2	2.74E-1
Uranium-235	0.1975	8.86E-4	8.86E-3
Uranium-236	0.0011	1.41E-4	1.41E-3
Uranium-238	0.7994	5.58E-4	5.58E-3

Table notes: Information source is *Draft Construction and Demonstration of a Prototype Mobile Microreactor Environmental Impact Statement (Draft EIS),* September 2021, https://www.mobilemicroreactoreis.com, Table 4.12-2 for roughly 40 kg of HALEU fuel. The mobile microreactor will use 400 kg of HALEU fuel.

The fuel, and end-of-life fission and activation product radionuclide inventory for a 10 megawatt-thermal reactor is anything but "micro," see Table 2. The radiological inventory for a "mobile microreactor" is thousands of curies and is not included in the Draft EIS.

Rather, the draft EIS points to unavailable documents to explain why the draft EIS stated releasable material, the "source term" is a tiny fraction of the fission and activation products inventory that will be in the spent fuel. Both the radionuclide inventory for the mobile

[5] Associated Press, *The Idaho Falls Post Register*, "US military eyes prototype mobile nuclear reactor in Idaho," September 26, 2021.

[6] Alan J. Kuperman, Nuclear Proliferation Prevention Project, NPPP Working Paper #4, *Proposed U.S. Army Mobile Nuclear Reactors: Cost and Risks Outweigh Benefits*, April 22,2021. www.NPPP.org

microreactor and the greatly reduced source term assumed in the draft EIS are provided in Table 2. The Draft EIS must include the entire maximum radionuclide inventory following reactor operations. The Draft EIS must allow address all accidents and sabotage or military attack.

Table 2. The estimated 10 megawatt-thermal mobile microreactor spent fuel radionuclide inventory decayed by 7 days and the greatly reduced "source term" presented in the draft EIS.

Isotope (Half-Life)	Inventory of spent fuel, curie	Greatly reduced "source term" stated in the draft EIS
Krypton-85, noble gas (10.7 year)	3,200	0.279
Krypton-88, noble gas (2.84 hour)	4.83E-13	4.43
Strontium-90 (28.9 year)	28,000	2.52
Yttritium-90 (64.0 hour)	23,500	-
Ruthenium-103 (39.26 day)	539,000	4.48
Rhodium-103 stable. It is unknown what is meant here. But note that Ru-106 (1.02 year) would decay to Rh-106 (30 seconds) which would decay to stable Pd-106.	486,000	-
Silver-110 (24.6 seconds)	6.54	2.31
Silver-111 (7.45 day)	26,600	102
Antimony-125 (2.73 year)	3,880	0.165
Tellurium-125 (stable) It is unknown what they are representing here. I-125 (59.37 day) decays to stable Te-125.	315	-
Tellurium-132 (3.20 day) Te-132 decays to I-132 which decays to stable Xe-132.	99,000	12.3
Iodine-131 (8.04 day)	180,000	10.8
Iodine-132 (83 minute)	102,000	-
Iodine-133 (20.8 hour)	2,220	7.96
Xenon-131	886	41.1

Isotope (Half-Life)	Inventory of spent fuel, curie	Greatly reduced "source term" stated in the draft EIS
(5.25 day) I-131 decays to stable Xe-131.		
Xenon-133, noble gas (5.25 day) I-133 decays to Xe-133 which decays to stable Cs-133.	286,000	-
Cesium-134 (2.07 year)	30,800	3.62
Cesium-137 (30.2 year)	28,000	16.0
Barium-137 is stable, it is unknown what this represents. Cs-137 beta decays to stable Ba-137.	26,500	-
Lanthanum-140 (1.6785 day) Ba-140 (12.7 day) decays to La-140 which decays to stable Cs-140.	30,600	0.593
Cerium-144 (284.6 day)	383,000	1.95
Praseiodymium-144 (17.3 minute) (Cerium-144 beta decays to Pr-144, not stable)	383,000	-
Plutonium-239 (24,110 year) Pu-239 decays through many more decay progeny)	78	0.000172

Table notes: Source of 10 megawatt-thermal mobile microreactor radionuclide inventory from Idaho National Laboratory for the U.S. Department of Energy operated by Battelle Energy Alliance, *Pele Microreactor Hazards and Impacts Information in Support of National Environmental Policy Act Data Needs*, INL/EXT-21-62873, September 2021. This appears to be only a partial inventory of the radionuclides. Source of "source term" is Table 4.11-2 in the mobile microreactor draft EIS, *Draft Construction and Demonstration of a Prototype Mobile Microreactor Environmental Impact Statement (Draft EIS),* September 2021, https://www.mobilemicroreactoreis.com. I have included the radioactive half-life from various information sources for information, but the value cited may not necessarily be from the most recent or consistent information source.

As shown in Table 2, there is an extremely large reduction of the radionuclide inventory to the curie amounts considered releasable as the accident "source term." The draft EIS did not disclose the total radionuclide inventory and is not disclosing how it arrived at the far smaller "source term" that it assumes could be released to the environment.

In addition to the factor of 10,000 reduction from "attenuation," also unexplained are how many significant radionuclides have been screened out. Note that none of the uranium fuel is

assumed to be released. Why other actinides such as plutonium-240 and plutonium-241 have not been included in the source term is not explained.

In reality, the release of the mobile microreactor fuel could be released to the environment by sabotage or "intentional destructive acts" which the Draft EIS did not include as well as by the limited set of evaluated reactor transients that could lead to an accident. It appears that the draft EIS is understating the possible radiological impacts by a tremendous degree, in order to create a false impression of the project as being "safe."

The TRISO fuel safety for all accident scenarios has not been presented. Nor has the radiological risk during spent nuclear fuel storage been adequately evaluated.

The Draft EIS portrayal of inadvertent criticality states that it could occur during any phase of the project. "An inadvertent criticality is assumed to occur because of human errors, fuel handling errors, plant design or construction errors, or a transportation accident (e.g., flooding or core reconfiguration)." "An inadvertent criticality could expose personnel to high levels of radiation and could lead to fuel temperatures higher than those for which the TRISO fuel is designed. TRISO fuel could crack and/or degrade, resulting in a release of fission products into the environment." Yet, the Draft EIS ignores the additional end-of-life fission product inventory which may add to the fresh core source term from the criticality (Table 4.11-1). The radiological release from a criticality accident has been low-balled. And no degradation of the fuel from failure to keep moisture away from the microreactor fuel or other operating or aging degradation has been considered. The propensity for methane generation when carbide is exposed to moist air or water must also be addressed.

Very importantly, explosion or sabotage that would compromise the structure confining the mobile microreactor fuel has not been included. The confinement and fuel have been assumed to stay intact despite the fact, that in actual service or realistic transportation accidents such as aircraft transport, the confinement structures and fuel could be widely dispersed.

It should be noted that in the Department of Defense's stated envisioned role for mobile microreactor operations, that failure to properly supervise mobile microreactor operations at an isolated installation must also address reactor operators who are not fit for duty and fail to operate the reactor in a safe manner, due to lack of training or drunken or drugged mental impairment, causing a reactor accident. The failure to properly install or configure various equipment, which may result in degradation of the fuel or equipment, or compromise the protection of personnel near the reactor due to improperly installed shielding or other operational features would increase routine exposures from the mobile microreactor and this must also be considered, as the lack of supervision and safety oversight would increase the likelihood of shortcutting safety requirements and produce unpredictable and unsafe operations.

The TRISO fuel, X-energy has publicly claimed, won't release fission products but didn't discuss actual fission product releases from routine operation or accident conditions. TRISO fuel particles are made from a mixture of uranium carbide and uranium oxide. TRISO fuel was used in the U.S. Fort St. Vrain and the Peach Bottom nuclear reactors. Even if the fuel were more robust than fuel in conventional light-water reactors, the storage of TRISO high enriched fuel and its disposal is proven to be costly and also susceptible to degradation over time. And of

course, the Fort St. Vrain gas-cooled nuclear reactor was a complete economic disaster and rarely operated because it was always needing repairs.

The spent nuclear fuel resulting from new research from X-energy TRISO fuel and other higher enriched fuels proposed for various small and microreactors will require additional research for spent fuel container, transportation and disposal, according to a May presentation to the U.S. Nuclear Waste Technical Review Board. [7]

Project Pele Draft EIS Fails to Disclose Serious SNF Storage and Disposal Issues

The Draft EIS regarding spent nuclear fuel management is inadequate. And spent nuclear fuel management is unsustainable from a growing cost liability point of view that places an enormous burden on future generations to continue to try to isolate the waste from air, soil and water by repeatedly repackaging the waste and/or by continuing to seek a repository to adequately confine the waste.

The criticality and/or breach of a mobile microreactor spent nuclear fuel container for the decades and longer that such containers may languish in Idaho has not been adequately addressed in the Draft EIS.

Project Pele Waste Management Approach Anything But "Cradle to Grave"

The so-called mentioned "cradle to grave" management of the project's spent nuclear fuel, at the public meeting, is misleading because the Department of Energy has no spent nuclear fuel disposal program. A court of law made this finding and forced the Department of Energy to cease collecting fees from electricity rate payers who use nuclear power because the DOE actually has no spent nuclear disposal program.

The Project Pele Flowchart (Figure S-2 and Figure-2.3-2) is misleading and implies that disposition of the mobile microreactor and its spent nuclear fuel will take place in three years after testing. The Flowchart shows temporary storage at RSWF or ORSA and then a dotted line to waste disposition, taking 3 years.

The text several pages down does say that the duration of the "temporary storage" is unknown. The text also describes INTEC, located in a flood plain, also may be used as a temporary storage location but this is not included on the Flowchart.

The Project Pele Flowchart must be changed to state clearly state the length of time and the design life of the storage of the fueled mobile microreactor. The Project Pele Flowchart must state on the flowchart that the duration called "temporary" is completely unknown and may be many, many decades or longer. The Project Pele Flowchart must state all locations where the spent nuclear fuel that has been removed from the mobile microreactor may be stored, and must correspond to the writing in the text, and therefore include storage of Project Pele spent nuclear fuel in a flood plain at the INL's INTEC facility. When the Project Pele Flowchart does not

[7] Sylvia Saltzstein et al. (Sandia National Laboratories, Oak Ridge National Labs, Pacific Northwest National Laboratory, Argonne National Labs and Department of Energy Office of Nuclear Energy), Presentation: Accident Tolerant Fuel and the Back End of the Nuclear Fuel Cycle, U.S. Nuclear Waste Technical Review Board, may 12-13, 2021, Virtual Meeting. https://www.nwtrb.gov/docs/default-source/meetings/2021/may/saltzstein.pdf?sfvrsn=8

match the text, it is deceptive. It appears to deliberately give the impression of timely radioactive waste disposition when in fact the spent nuclear fuel will languish in Idaho, forever.

The degree to which the 1995 Idaho Settlement Agreement is on target to be missed must be discussed in the Draft EIS. The applicability of the 1995 Idaho Settlement Agreement to the mobile microreactor spent fuel must be addressed in the Draft EIS. The disposal challenges that the TRISO fuel mobile microreactor fuel creates for a spent nuclear fuel repository must also be addressed. The degree to which the mobile microreactor project simply puts the burden on future generations, which is unacceptable, must also be addressed in the mobile microreactor Draft EIS.

The Project Pele Flowchart used in presentations and in the Draft EIS must address the number of years that the mobile microreactor may remain fueled and the number of years of spent nuclear fuel storage. How is container or fuel design life determined to be adequate when the storage life is unknown? Such fuzzy thinking has long been the strong suit of the Department of Energy. The citizens of the region are continually inhaling Three Mile Island Unit 2 radioactive debris in the air because the Department of Energy didn't know how to confine this fuel. The citizens of the U.S. continue to pay millions of dollars every year for management of existing spent nuclear fuel from a single facility, the Fort St. Vrain gas-cooled reactor, and are on the hook for untold trillions of dollars to continue to attempt to find a way to dispose of the spent nuclear fuel this country has accumulated.

The Project Pele Draft EIS tries to hide the fact that the mobile microreactor spent nuclear fuel is going to languish in Idaho indefinitely (which could mean forever). The meaning of the dotted line in the flowchart means that it is undecided if post-irradiation examination (PIE) will actually be conducted but the Project Pele Flowchart misleads the reader as it implies that the spent nuclear fuel and all waste from the project will be dispositioned in 3 years.

Several pages away from the Flowchart, in the statement describing the temporary storage of the used mobile microreactor on page S-13 admits that "There is no defined duration for this phase. Temporary storage of at least portions of the mobile microreactor would continue until an off-site spent nuclear fuel disposal facility or geologic repository is available to accept the mobile microreactor spent nuclear fuel. "

Despite no mention of INTEC for fuel storage on the Flowchart, on page S-14, it is stated that "Any spent fuel designated for disposal would be packaged in standard casks and transferred to a storage location on the INL Site (several locations such as the Idaho Nuclear Technology and Engineering Center [INTEC] or RSWF would be capable of storing the spent fuel) pending shipment to an interim storage facility or geologic repository."

This fuel is also not covered by the Idaho Settlement Agreement. And if there were a spent fuel disposal facility, this fuel would likely be placed at the end of the line. And wouldn't any spent fuel from the deployment of mobile reactors be likely to return to languish in Idaho due to the lack of a spent nuclear fuel repository?

The Draft EIS has not stated the storage life of any storage container, nor are there any licensing requirements of the mobile microreactor or any aspect of its storage. The project is

setting a course for another unsafe and irresponsible nuclear boondoggle at the Idaho National Laboratory to further burden future generations.

According to the Pele Project draft EIS, "SNF would be managed and stored at the INL Site but pending off-site shipment to a permanent repository. SNF would be managed in accordance with applicable laws and other requirements…."

In other words, the mobile-microreactor Pele Project spent nuclear fuel will be indefinitely stored at the INL because there is no SNF disposal facility on the horizon. The Department of Energy does not have a spent fuel disposal program, nor does it have a program to repackage spent nuclear fuel in Idaho or at stranded fuel sites around the country where spent nuclear fuel is stored at operating or closed commercial nuclear reactor sites.

Spent nuclear fuel management, according to a 2019 report by Sandia National Laboratory, [8] will require some combination of three options: 1) repackaging spent fuel in the future, 2) constructing one or more repositories that can accommodate DPCs [dual purpose canisters that are canisters that can be disposed of in the repository], and/or 3) storing spent fuel at surface facilities indefinitely, repackaging as needed. The report admits that current practices "are not optimized for transportation or disposal."

The Sandia report downplays the technical problems we face in designing a safe repository for spent nuclear fuel. The report mentions that for a repository, post-closure criticality continues to be analyzed and the capability of predicting how fast the radionuclides will escape the repository continues to be studied.

Unlike anyone I listened to from the Nuclear Energy Institute during public comment for consolidated spent nuclear fuel storage in New Mexico, the Sandia report admits that "stress corrosion cracking of canisters may be a concern in some parts of the country, and work is ongoing in analysis, detection, and mitigation." Sandia also states that monitoring and aging management practices at storage sites will be important to confirm storage system performance during extended service.

The enrichment of fuel used in earlier commercial nuclear reactors was only about 3 percent uranium-235. With increasing enrichment comes significantly more criticality risk during spent nuclear fuel storage and disposal, should a repository ever become available.

While operating the reactor, fission products build up in the fuel that can be released during routine operation or from an accident. Every phase of Project Pele's Mobile Microreactor — from fuel fabrication, to fuel transport, to reactor transportation prior to operation, to reactor operation, to stranded spent fuel storage, to spent fuel transportation — poses the risk of harming people and contaminating communities. Although the radiological release can be far higher after the reactor has operated, even before operating a nuclear reactor, the uranium in the reactor can be dispersed upon explosion due to sabotage. Uranium is known to cause birth defects and other health problems.

---

[8] Nuclear Energy Fuel Cycle Programs, *Spent Nuclear Fuel Storage R&D at Sandia National Laboratories*, SAND2019-1140PE, February 7, 2019. https://www.osti.gov/servlets/purl/1598436

The radionuclides released for routine operations and from accidents cannot be remediated and will continue to sow seeds for birth defects, increased infant mortality, cancer and many other adverse health effects. The nuclear industry focuses primarily on cancer mortality (or death by cancer), choosing to downplay the incidence of cancer, birth defects, genetic effects, increased heart disease especially from cesium-137 and damage to the immune system especially from bone seekers such as strontium-90, plutonium-239, and americium-241.

The Department of Energy would like to give the public the idea that the "existing processes" for addressing spent nuclear fuel storage and disposal are adequate. The reality is that the Department of Energy has no repackaging facilities for continued storage of spent nuclear fuel and has no spent nuclear fuel disposal program.

The real Project Pele approach to waste management is like a song, "Tomorrow, tomorrow, there's always tomorrow…" This is the Department of Energy's approach to spent nuclear fuel management and disposal. And it generally hinges on the DOE manager's retirement being only a day away, so that it's always someone else's problem.

The Draft EIS must acknowledge that the DOE has already exceeded its allotted limit of spent nuclear fuel and HLW in Yucca Mountain. The Draft EIS must explain how after decades of promising to open a repository but failing to, that the DOE, with no repository program since 2010, is going to obtain a repository.

The Draft EIS Has Relied on Inadequate and Deeply Flawed EISs for Spent Nuclear Fuel Management and Disposal

The Draft EIS relies on out-of-date, inappropriate, now known to be inadequate Department of Energy spent nuclear fuel disposal environmental impact statements. The Draft EIS relies on the deeply flawed assumptions in other Department of Energy EISs for the management of the spent nuclear fuel (and high-level waste).

The fact is that the Department of Energy **has no spent nuclear fuel disposal program** for either its DOE-owned spent fuel or for the spent nuclear fuel from commercial nuclear power plants. Consolidated interim storage is not a substitute for a permanent solution.

The fact is that the Nuclear Waste Fund that collected fees from electricity generated by nuclear power plants has been discontinued and the $30 billion or so that it collected is not even enough money to package commercial spent nuclear fuel in disposal containers, let alone to license and construct a repository.

The many trillions of dollars that this will cost the U.S. taxpayer to continue to seek a repository is not being opening and honestly presented, by the Department of Energy or by propaganda sessions conducted at taxpayer expense by the Idaho National Laboratory.

The Department of Energy habitually ignores state and federal laws. For example, the amount of spent nuclear fuel and HLW allocated to the DOE for the failed Yucca Mountain repository effort is limited and the DOE already has exceeded its lawful allotment. The Nuclear Waste Policy Act remains the law; it limits the quantity of spent nuclear fuel from commercial nuclear power plants to 63,000 metric tons heavy metal (MTHM), 2,333 MTHM for DOE SNF

and 4,667 MTHM for HLW. The quantity of commercial SNF, DOE SNF, and DOE-managed HWL are each greater than DOE's allotment for the first repository. [9] But DOE hasn't obtained its first repository, which by law, would be at Yucca Mountain.

The Department of Energy promised to begin disposal of spent nuclear fuel by 1998. Then came other promised dates that have come and gone. The U.S. Nuclear Regulatory Commission believed those empty promises from the Department of Energy, expecting to disposal by 1998, then 2008, and then by the first quarter of this century. [10] [11] The Department of Energy's rapidly evolving waste emplacement concepts continued to evolve as every assumption about how the repository would contain the waste didn't hold up. No utility has packaged its spent nuclear fuel into DOE's recommended "transport, aging and disposal" TAD canister. The Yucca Mountain repository concept also relies on never designed titanium drip shields that no one honestly believes are feasible to install decades after the waste is emplaced.

The Draft EIS must address that fact that the Department of Energy has no spent nuclear fuel repository program and hasn't since 2010. It must address the fact that the Department of Energy **has no credible cost estimate for the costs of disposal of now-existing spent nuclear fue**l plus the fuel from already operating reactors. Few people know that there is already more than double the amount of spent nuclear fuel (and high-level waste) than Yucca Mountain was set to legally hold. And few people know that if nuclear energy were to make a dent in climate, we would need a new Yucca Mountain every year.

While the Department of Energy's estimated releases from the proposed Yucca Mountain repository are unbelievably low, this is an artifact of reducing the water infiltration rates through the corroding waste containers. Using more realistic water infiltration rates and their variability over time results in far higher releases.

The heat load of the spent nuclear fuel placed in the repository poses a risk to the structure of the repository and the DOE never actually decided whether to use a "hot" repository or a "cool" repository design. The amount of waste and how it is spaced in the repository obviously affect the ability to cool thermally hot spent nuclear fuel.

The criticality issues for Yucca Mountain have grown substantially as the enrichment level used in commercial nuclear power plants has increased. It has also grown because YM originally was not envisioned to dispose of the Department of Energy's highly enriched fuels. And another change has been the included possibility of disposal of surplus plutonium at Yucca Mountain. The Department of Energy concedes that criticalities are possible in the repository, yet it does not address the harm to the repository or the additional spacing requirements.

Doubling the capacity of Yucca Mountain, the slated 70,000 metric tons of spent nuclear fuel and high-level waste, may seem easy, when only the fraudulent radionuclide trickle-out radiation

---

[9] U.S. Nuclear Waste Technical Review Board (NWTRB), Management and Disposal of U.S. Department of Energy Spent Nuclear Fuel. Arlington, December 2017. See p. 15.

[10] Nuclear Regulatory Commission, 10 CFR 51, Waste Confidence-Continued Storage of Spent Nuclear Fuel, Federal Register, Vol. 78, No. 178, September 13, 2013.

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

doses are reviewed but in reality, is far more problematic. The slated capacity of Yucca Mountain already required skirting around seismic faults and required 40 miles of underground tunnels.

U.S. Nuclear Regulatory Commission Chairman Kristine Svinicky recently characterized the nation's growing inventory of spent nuclear fuel as having a volume that would fit in a football field. That the head of the agency that would grant a license to the Department of Energy's proposed Yucca Mountain repository would omit the realities of the difficulties of safely containing the spent nuclear fuel is very telling of the mindset of the NRC. The NRC wants to grow nuclear energy no matter the cost to rate-payers, taxpayers, or to humanity. All the NRC has to do is sign off that they believe the DOE's safety case for repository provides a "reasonable expectation" of meeting stipulated requirements.

An online briefing "What Congress Needs to Know About Pending Nuclear Waste Legislation" was held November 13, 2020 by the Environmental and Energy Study Institute, with guest speakers Robert Alvarez, Institute for Policy Studies; Don Hancock, Southwest Research and Information Center; and Diane D'Arrigo, Nuclear Information and Resource Service to explain hazards associated with spent nuclear fuel and history pertaining to the Nuclear Waste Policy Act. [12]

The State of Nevada was attentive to the DOE's rapidly changing disposal concepts and the many times that technically indefensible studies were used to form the basis for how long it would take the waste containers to corrode and how long it would take radionuclides from the waste to migrate to groundwater.

The Draft EIS cites various DOE EISs that are grossly inadequate as well as inconsistent in every essential aspect related to the spread of radiological material and the harm. The Yucca Mountain safety evaluations assumed 0.9999 efficiency for HEPA filters and that there would be no releases from spent fuel stored outdoors and without HEPA filtering. The Yucca Mountain safety evaluations have used fraudulent and unscientific water infiltration modeling to lower predicted doses from the migration of radionuclides from the disposed of waste. The Yucca Mountain EIS assumes the design of spent fuel canisters, the "TADs," that have not been used for commercial spent nuclear fuel storage

When the Department of Energy twice proposed a disposal container for the commercial nuclear power plant owners to use, they ignored it. The electrical utilities would choose cheaper canister designs not intended for disposal because they planned on it becoming the Department of Energy's problem. And this means that the problem would be solved at the expense of the U.S. taxpayer. And the U.S. Nuclear Regulatory Commission did everything in its power to limit the utilities' costs.

The U.S. Nuclear Regulatory Commission claims to have accepted the highly speculative safety case for DOE's proposed Yucca Mountain, yet no construction license was ever issued.

[12] Environmental and Energy Study Institute (EESI) briefing at https://www.eesi.org/briefings/view/111320nuclear#RSVP and see "Yucca Mountain in Brief at https://www.eesi.org/files/Letter_to_Congress-Yucca_Mountain_in_Brief.pdf

Current law prohibits consolidated interim storage about 10,000 metric tons (MT). Despite this, the U.S. NRC is planning to license two far larger consolidated interim storage facilities for spent nuclear fuel. One facility is in New Mexico and the other in Texas.

Many electrical utilities are seeking to move their spent nuclear fuel away from places the U.S. NRC never should have allowed the spent fuel to be "indefinitely" stored: ocean coastlines and lake shores, among them. These consolidated interim storage sites are planning to accept spent nuclear fuel in non-disposable containers. The proposed consolidated interim storage facilities will have no capability for repackaging a damaged canister, nor repackaging for disposal if a repository were found. And importantly, the Nuclear Waste Policy Act sought to prevent consolidated storage that would have the effect of lessoning the effort to attain a permanent solution for the permanent isolation of the radioactive waste, which remains radio-toxic for millennia.

To help the SONGS utility understand their options for moving their spent fuel farther from the California coastline, they have hired a consultant, North Wind. A tangled web of possibilities was presented at a public meeting for the San Onofre spent fuel but currently there is no place to move their spent nuclear fuel to. [13]

The utility is also concerned that the full costs of transportation and storage may not be fully reimbursable from the Judgment Fund from the litigation with the Department of Energy's partial breach of contract in failure to start disposing of the spent nuclear fuel from commercial nuclear power plants. Also, it was pointed out that utility customers may not be fully shielded from liability for accidents involving storage of spent nuclear fuel at private storage facilities. Utilities want the Department of Energy to take ownership of the spent nuclear fuel. But the Department of Energy has no place to put it. The Nuclear Waste Policy Act of 1982 and amended in 1987 sought specifically to avoid letting up the pressure on the Department of Energy to obtain permanent, safe disposal of spent nuclear fuel. The DOE was restricted from obtaining interim spent fuel storage unless it had obtained a license for a facility for permanent disposal.

Both the U.S. NRC and the Department of Energy are touting consolidated interim storage as though it were equivalent to obtaining a permanent solution for isolating the radioactive waste. They know that repackaging will be needed, acknowledged to be needed every one hundred years or so. Yet both proposed consolidated storage facilities the NRC is planning to approve this year do not have any canister repackaging or isolation capability.

So why would the U.S. NRC be ready and willing to license two consolidated interim storage facilities that by design will not include any capability to repackage damaged canisters? The answer that the U.S. NRC has given is that the situation is similar to the spent fuel facility it licensed in Utah but which was never built. The U.S. NRC said that the Private Fuel Storage facility in Utah did not need any repackaging capability because if a canister of spent nuclear fuel was damaged, it would be sent back to the licensee that generated the waste.

---

[13] San Onofre Nuclear Generating Station (SONGS), 11/20/20, North Wind slide presentation https://www.songscommunity.com/_gallery/get_file/?file_id=5faf01792cfac225d3c64352&ir=1&file_ext=.pdf

This is important to understand, as the Department of Energy is actively promoting nuclear energy and failing to mention its continuing failure to find a permanent solution to safety isolate the spent nuclear fuel (and high-level waste) and failing to discuss the problems of short-sighted consolidated interim storage that the U.S. NRC is ready to approve. The challenges of spent nuclear fuel disposal are greater now than they were assumed to be 40 years ago. In fact, the technology to safely isolate these radioactive wastes from our air, soil and water has not been found and this is whispered by the U.S. Nuclear Waste Technical Review Board.

The ridiculousness of the NRC's argument that the consolidated storage facilities have no need for repackaging capability because they would just require the waste to be returned to the utility that generated it shows the extent of nonsensical lying the agency is prone to. A damaged canister cannot be legally shipped. And spent nuclear fuel being sent to a consolidated storage site may have shut down its reactors and decommissioned all its facilities. The NRC's argument that the compromised canister would simply be shipped back to the utility that generated the spent nuclear fuel is utterly absurd. But this is the quality of thought that the NRC has put into much of its licensing and its "waste confidence" rule and its subsequent environmental impact statement for continued storage of spent nuclear fuel. The NRC gave up on trying to keep track of the latest promised date that a repository would be available and now assumes that a repository will become available "when needed." The NRC also assumes that the facilities to repackage the spent nuclear fuel, every 100 years or so, will also become available "when needed." And it simply isn't the NRC's problem what the cost is, or who pays for it, as long as it is not one of its licensees, the electrical utilities who operated nuclear reactors.

The technology to repackage the spent nuclear fuel canisters used prevalently by commercial nuclear power plants does not exist. It is recognized that these operations will pose many worker risks and radiological release risks as well as billions of dollars in cost. The disposal canister designs do not exist. And the capability to terminate the radiological release from a damaged canister does not exist. This is problem for the U.S. NRC who assumes no liability for the releases. And actually, the U.S. NRC undermines the radiological monitoring where spent nuclear fuel is stored so that citizens won't know that actual release levels either.

The Draft EIS fails to mention that the Department of Energy has no designed disposal canister for its spent nuclear fuel, for disposal at the repository that the DOE has long promised but, in fact, does not exist, and was never licensed or constructed.

The Department of Energy is rushing to create more spent nuclear fuel, both DOE-owned SNF and new kinds of commercial spent nuclear fuel, while ignoring the problems we already face from decades of spent nuclear fuel accumulation. Each new variety of spent fuel cladding type, enrichment type, burnup and design require new storage and disposal analyses and designs, and more indefinite storage facilities, which fall to the U.S. taxpayer to fund

Project Pele Draft EIS May Leave Citizens Uncompensated for Transportation Accidents and Facility Accidents

As a country, we have not found the money to keep up with normal and expected repair of our crumbling roads, railways and bridges. Bridge and railway accidents have increased during the last twenty years, as has the severity of fires involved with railway transport of oil.

Yet the nuclear promotors want to greatly increase the transportation of nuclear waste and often in larger and heavier containers. The Price Anderson Act does not compensate citizens for radiological releases from transportation accidents that may result in contaminated homes, property, businesses and shortened life spans and disease. The radiological contamination could be severe, despite assertions and active government-sponsored propaganda campaigns to the contrary.

The legal and liability ramifications of a transportation accident of a mobile microreactor and/or its spent nuclear fuel beyond U.S. borders is a show-stopper for the mobile microreactor that the advertising in the Draft EIS has not included.

Project Pele's Duck Soup Problem

The draft EIS is full of deception and a good example is its statements about waterfowl ingestion. The Draft EIS states that the dose in millirem per year from "consumption of waterfowl" is an average of 0.12 mrem/yr, which is based on the Department of Energy's environmental surveillance program. What the draft EIS did not say when it presented the estimated radiation dose from ingestion of waterfowl (page 3-40) is important.

The draft EIS does not state that this is dose is from eating one duck. If you were to eat one duck that has visited a radioactive waste pond at the INL and it is assumed that you only eat one 8-ounce portion of the meat, per year. And it is assumed that you cannot have made bone broth or gravy with the bones present. If you did, you would get a far higher dose from radionuclides such as the plutonium, americium-241 and strontium-90. The draft EIS hides the truth of the possible radiation dose from consuming waterfowl in the region.

The INL has continued to release radionuclides to the air within 50 miles of the lab with radionuclides including iodine-131, iodine-129, americium-241, strontium-90, cobalt-60, plutonium-238, plutonium-239, ruthenium-103, cesium-134 and cesium-137 and many others. And while doing so, has continued to insinuate that all the radionuclides are from former nuclear weapons testing or some other mysterious source. A study published in 1988 found the mallard ducks near the ATR Complex percolation ponds at the Idaho National Laboratory to be full of transuranic radionuclides including plutonium-238, plutonium-239, plutonium-240, americium-241, curium-242 and curium-244. [14] An employee who I knew had the habit of jogging around the radioactive waste ponds at lunchtime. He died of liver cancer in his 50s. This health-

[14] O. D. Markham et al., Health Physics, "Plutonium, Am, Cm and Sr in Ducks Maintained on Radioactive Leaching Ponds in Southeaster Idaho," September 1988. https://pubmed.ncbi.nlm.nih.gov/3170205/ (This study evaluated the concentrations of strontium-90, plutonium-238, plutonium-239, plutonium-240, americium-241, curium-242 and curium-244 in the tissues of mallard ducks near the ATR Complex reactive leaching ponds at the Idaho National Laboratory. It found the highest concentrations of transuranics occurred in the gastrointestinal tract, followed closely by feathers. Approximately 75%, 18%, 6% and 1% of the total transuranic activity in tissues analyzed were associated with the bone, feathers, GI tract and liver, respectively. Concentrations in the GI tracts were similar to concentrations in vegetation and insects near the ponds. The estimated total dose rate to the ducks from the Sr-90 and the transuranic nuclides was 69 millrad per day, of which 99 percent was to the bone. The estimated dose to a person eating one duck was 0.045 mrem. The ducks were estimated to contain 305 nanoCuries of transuranic activity and 68.7 microCuries of strontium-90.)

conscious non-smoker was told, like the rest of us, that the radioactivity in the ponds was mainly tritium and was of no health concern what-so-ever.

Project Pele's Draft EIS Does Not Address Existing INL Radiological Releases From TRISO Fuel Testing

Edwin Lyman, Union of Concerned Scientists, calls out increased fission product releases from the Idaho National Laboratory's Advanced Reactor Test due to testing of TRISO fuel. Elevated fission product releases were discussed in TRISO fuel presentations for the fourth quarter of 2019. [15] [16] No one in Idaho learned of these releases from the Department of Energy or Idaho Department of Environmental Quality environmental monitoring.

The TRISO fuel released fission products to the skies of southeast Idaho from the INL's Advanced Test Reactor, which had to terminate the testing or exceed 10 mrem annual doses from INL radiological airborne effluents.

The environmental monitoring at the INL reveals very elevated radionuclides in air, with far higher gross beta levels detected on the INL site at the Experimental Field Station. Correspondingly, there are missing weeks of air monitoring data at Howe, Idaho, north of the Advanced Test Reactor.

The quarterly reports for 2020 show that the State of Idaho's environmental monitoring program for air monitoring in Idaho Falls did not collect any radiological air monitoring data from July 1 to September 18 in 2020. [17]

Despite having some strong program elements, the Idaho Department of Environmental Quality can be counted on to downplay or to not discuss elevated detections of radionuclides in its air monitoring program. I was sad to observe how hard the Idaho DEQ is trying to not acknowledge elevated radiological detections and to not attribute elevated radiological detects to the Idaho National Laboratory when the radiological contamination is certainly due to INL operations. The Department of Energy has stated that it funds the Idaho DEQ's environmental monitoring program; but, even so, the citizens of Idaho expect the Idaho DEQ's program to have some integrity.

---

[15] Edwin Lyman, Union of Concerned Scientists, "Advanced" Isn't Always Better – Assessing the Safety, Security, and Environmental Impacts of Non-Light-Water Nuclear Reactors, March 2021. https://www.ucsusa.org/sites/default/files/2021-05/ucs-rpt-AR-3.21-web_Mayrev.pdf

[16] Joe Palmer, Idaho National Laboratory, Presented at the Gas-Cooled Reactor Program Annual Review July 14, 2020 via Videoconference from the Idaho National Laboratory, *AGR-5/6/7 Irradiation Summary as of the End of Cycle 167A*, https://art.inl.gov/Meetings/GCR%20Program%20Review%20July%202020/Presentations/Session%202/04_PALMER_AGR%205-6-8%20Irradiation%20Summary.pdf Plots huge increase in gamma counts from the end of Cycle 166A, around September 30 through October 7, 2019. Maximum 95,535.81 counts per second.

[17] See the rarely trended and ever-shrinking set of INL environmental monitoring reports by the Idaho Department of Environmental Quality as decades of monitoring reports are no longer online at https://www.deq.idaho.gov/idaho-national-laboratory-oversight/inl-oversight-program/monitoring-activities/

Project Pele's Draft EIS Failure to Acknowledge Far Higher INL Releases Over the Last Twenty Years

The DOE greatly increased, sometimes by ten-fold or more, its releases of strontium-90, cesium-137, americium-241, and other radionuclides since 2000, above the levels of the 1990s. With the increase with INL's radionuclide airborne waste (effluent) emissions, the DOE's environmental surveillance contractor **raised the bar defining what would be considered a positive detection of radioactivity** in a sample.

Sample results that were solidly indicating radiological contamination could then be discarded as "not detected." The bar was raised to require the result to be three standard deviations above the mean result, rather than 2 standard deviations. This greatly reduces the probability of a false detection but allows the error of "failure to detect the radionuclide when it is present" to be as high as 50 percent.

And even when that wasn't good enough, the environmental surveillance program sometimes **would degrade its stated goal for detection capability**. For example, they raised the iodine-131 detection capability in milk from 1 picocurie per liter (pCi/L) to 3 pCi/L for several years, as these release of iodine-131 were increased. When an environmental surveillance program says nothing was detected, it has long been understood that it is imperative to state the monitoring program's specified detection capability, usually expressed in terms of minimum detectable concentration. But it has become increasingly common for the DOE's monitoring program and the Idaho DEQ's monitoring program not to disclose their specified minimum detectable concentration, the a priori level, or the actually attained minimum detectable concentration.

The Draft EIS mischaracterizes the escalating radionuclide releases by the Idaho National Laboratory by selected years discussed. And it mischaracterizes the trends for the estimated radiation doses from INL airborne radiological releases. Importantly, the Draft EIS ignores the already greatly increased airborne waste (effluents) that have been projected in Table 6 based on the Department of Energy's DOE/EA-2063.

The Prototype Mobile Microreactor draft Environmental Impact Statement [18] states the following, which is correct:

"Facilities at the INL Site have the potential to emit radioactive materials and, therefore, are subject to NESHAP, Subpart H, *National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities* (EPA, 2021d). This regulation limits the radionuclide dose to a member of the public to 10 millirem per year from the air pathway. Subpart H also establishes requirements for monitoring emissions from facility operations and analyzing and reporting of radionuclide doses. Airborne radiological effluents are monitored at

[18] The Department of Defense (DoD), acting through the Strategic Capabilities Office (SCO) and with the Department of Energy (DOE) serving as a cooperating agency, announces the availability of the Draft Construction and Demonstration of a Prototype Mobile Microreactor Environmental Impact Statement. The Draft EIS is available at https://www.mobilemicroreactoreis.com.

individual facilities at the INL Site (including MFC) to comply with the requirements of NESHAP and DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE, 2020b)."

In reality, there is inadequate monitoring at INL facilities and radionuclide releases are only guesstimated. But then the draft EIS states:

"Radionuclide emissions at the INL Site occur from (1) point sources, such as process stacks and vents; and (2) fugitive sources, such as waste ponds, buried waste, contaminated soil areas, and D&D operations. During 2019, an estimated 1,611 curies of radioactivity were released to the atmosphere from all INL Site sources (DOE-ID, 2021c). This level of release is within the range of releases from recent years and is consistent with the general downward trend observed over the past 10 years. For example, reported releases for 2010 and 2015 were 4,320 curies and 1,870 curies, respectively."

There is a general downward trend in the curie amounts of radionuclides over the last ten years; however, **the releases over the last twenty years have generally been higher than the releases during the 1990s**, see Figure 1. The DOE isn't about to discuss the increasing radionuclide releases that commenced in 2001.

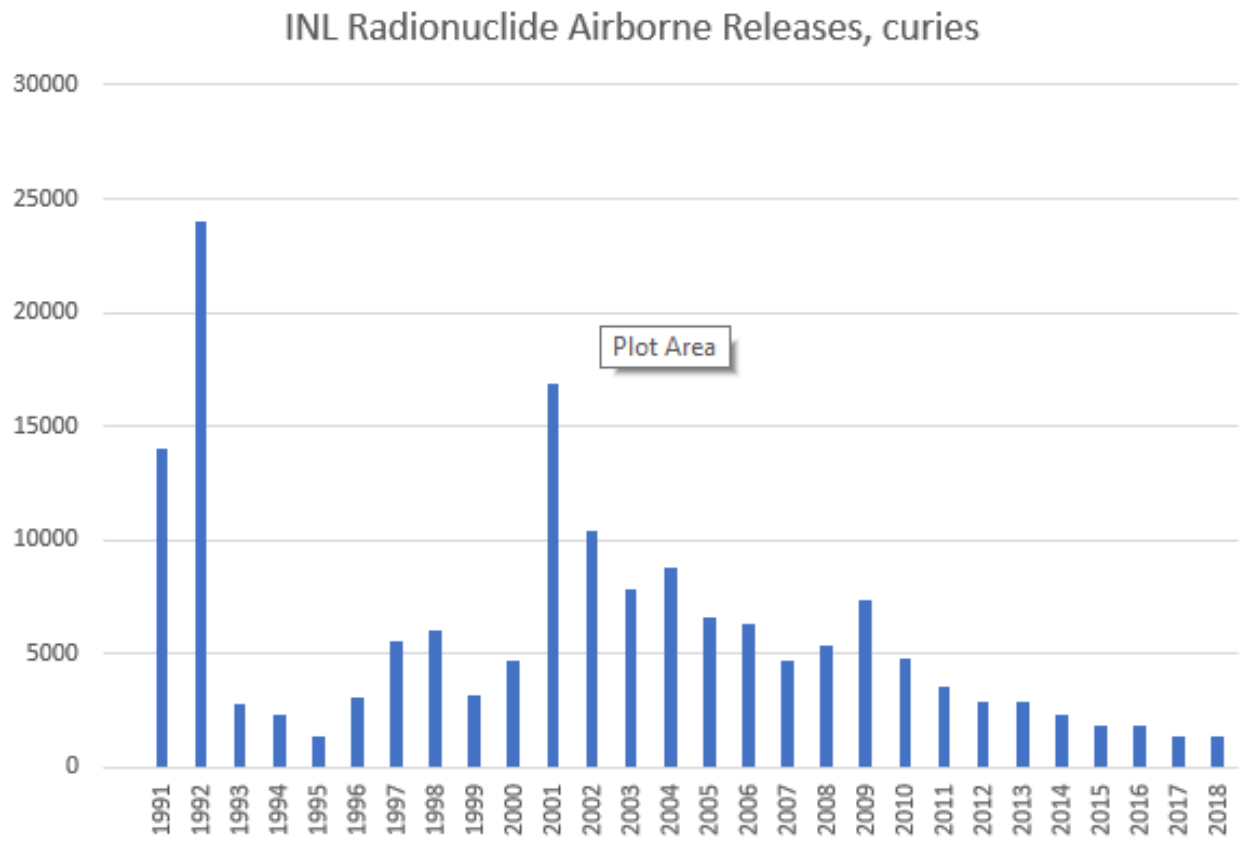

Figure 1. INL Radionuclide Airborne Releases, curies, from 1991 to 2018. Source: Idahoeser.com

The next thing to know is that for some radionuclides like krypton-85, very large curie amounts yield small radiation doses, while **for other radionuclides like iodine-129, plutonium-239 and americium-241, very small curie amount releases yield large contributions to radiation dose.** The trend in annual estimated effective dose is provided in Figure 2.

Year	Effective whole body dose, mrem
1991	0.02
1992	0.004
1993	0.011
1994	0.004
1995	0.018
1996	0.03
1997	0.03
1998	0.007
1999	0.008
2000	0.057
2001	0.035
2002	0.055
2003	0.024
2004	0.044
2005	0.077
2006	0.039
2007	0.093
2008	0.131
2009	0.069
2010	0.058
2011	0.046
2012	0.036
2013	0.03
2014	0.036
2015	0.033
2016	0.014
2017	0.008
2018	0.0102
2019	0.0559

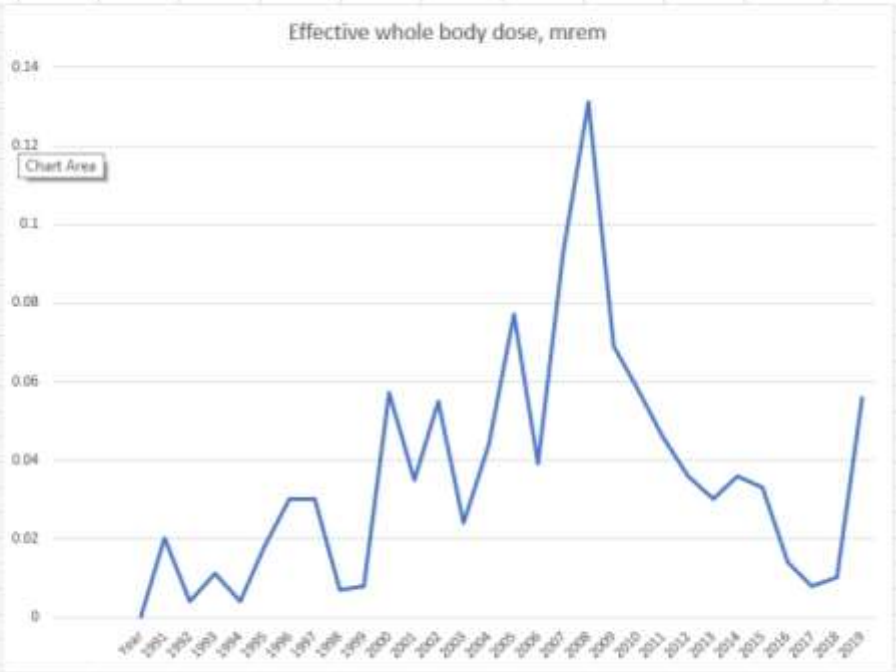

Figure 2. Department of Energy estimated annual effective whole-body dose in millirem from INL airborne releases. Source: Idahoeser.com

As you can see in Figure 2, the radiation doses from the Idaho National Laboratory from 2000 to 2019 are generally higher than for the 1990s. **And the radiation dose trend over the last few years is increasing, not decreasing**. This is without accounting for ingestion of radioactive animal tissue, which the draft EIS does discuss, but I have not included here. The draft EIS asserts that water we drink here, which sporadically includes high levels of radionuclides such as tritium and other man-made radionuclides, don't come from the INL and so they don't add these to the radiation dose. The dose from radioactively contaminated food and water not included in the DOE's dose estimates actually dwarf the annual radiation dose estimates.

The specific radionuclides released from the INL each year vary, as do their curie amounts. The radionuclides that tend to dominate the radiation effective whole-body dose include tritium, argon-41, strontium-90, cesium-137, iodine-129, plutonium-239 and americium-241. **In 2015,**

561 curies of argon-41 yielded a 0.0025 mrem dose, while 0.000673 curies of plutonium-239 yielded a comparable dose contribution of 0.0019 mrem.

In 1998, most of the radiation dose came from iodine-129 (6.3E-3 mrem) and argon-41 (1.8E-3 mrem), while in 2008 most of the dose came from strontium-90 (0.03 mrem), americium-241 (0.011397 mrem) and plutonium-239 (0.011528 mrem).

The effective dose in millirem for 2015 and 2018 are provided in Table 3, to illustrate the variety of radionuclide contributors to dose.

The draft EIS for Project Pele states on page 4-69 that "The highest average individual dose calculated for the MEI (i.e., someone located at the INL Site boundary south of CITRC), regardless of minority or low-income population was 7.0 x 10-3 millirem (i.e., 0.007 millirem). This number is so small that it represents no appreciable change in dose exposure over natural background levels at the INL Site (i.e., 382 millirem) and is well below regulatory limits (i.e., DOE annual public dose limit of 100 millirem or EPA air pathway dose limit of 10 millirem) …"

There are a few things to keep in mind whenever these seemingly negligible doses are discussed. First, they are using the effective whole-body dose which waters down the dose and does not reflect the far higher organ absorbed doses and in no way provides a reliable indicator of health risk, not even fatal cancer risk (more about this in the next article). Second, the organ doses, absorbed doses, need to be presented but are not. The thyroid doses in particular need to be displayed. The thyroid doses are far above natural background levels. And third, the 100 millirem per year that the Department of Energy keeps emphasizing as their allowable and safe level was based on faulty models limited almost exclusively to cancer mortality risk and the incorrect presumption by the ICRP that the risk was 0.0001 fatal cancers per year. This risk was the basis for various regulations selecting 100 mrem per year. But the risk is now admitted to be at least 0.0006 fatal cancers per year (more about this later in this article.)

There are other problems such as the rate of the releases and which direction the wind is blowing during that release has not been accounted for. And the estimates of the curies released from the INL of each radionuclide are un-scrutinized because the estimate methodologies are not made public. And, it is very possible for the estimated releases to omit actual radiological releases, like the radioactive resin beads released for years from the Advanced Test Reactor and not included in stated releases from the evaporation ponds. And, the deposition rate of various radionuclides on the ground and on crops are only guessed at and greatly influence dose estimates. And, some of the radionuclides very important to dose are also very difficult to detect, like iodine-129, which has a 16-million-year half-life. And finally, the radiological monitoring programs are trying very hard not to attribute radiological contamination to the Idaho National Laboratory.

Often forgotten is the fact that the effective whole-body dose is applicable only to late stochastic effects, basically only cancer mortality (fatal cancers) and not to immediate deterministic effects. This fact was forgotten when the Department of Energy misused effective dose and the cancer mortality rate to incorrectly state that doses as high as 1000 rem, yes, 1000 rem, caused no harm, despite the long-known fact that 50 percent of people exposed to 500 rem

would die within weeks. (Read more in the August 2021 Environmental Defense Institute newsletter.)

Table 3. Radionuclides contributing to estimated radiation dose from airborne radionuclide effluents at the Idaho National Laboratory for 2015 and 2019.

Radionuclide (Half Life)	Curies released by INL in 2015	2015 MEI mrem due to INL air effluents	Curies released by INL in 2019	2019 MEI mrem due to INL air effluents
Tritium (H-3) (12.3 year)	532	0.0111	450	0.0011
Carbon-14 (5,700 year)	0.988		0.683	
Chlorine-36 (301,000 year)	-		7.19E-3	0.0035
Argon-41 (1.83 hour)	561	0.0025	884	
Chromium-51 (27.7 day)	-		-	
Cobalt-60 (5.27 year)	1.30E-2		8.22E-3	
Zinc-65 (244 day)	3.26E-5		0.16	0.0019
Krypton-85 (10.7 year)	733		51.1	
Strontium-90 (28.6 year)	3.05E-2	0.0020	2.36E-2	
Antimony-125 (2.73 year)	7.33E-4		-	
Iodine-129 (16,000,000 year)	2.15E-2	0.0037	1.31E-3	
Iodine-131 (8.04 day)	1.1E-2		9.0E-2	
Cesium-137 (30.2 year)	0.0239	0.0010	0.267	0.0314
Plutonium-238 (87.7 year)	1.33E-4		-	
Plutonium-239 (24,000 year)	6.73E-4	0.0019	1.94E-5	
Plutonium-240 (6580 year)	1.90E-4	0.0004	1.88E-6	

Radionuclide (Half Life)	Curies released by INL in 2015	2015 MEI mrem due to INL air effluents	Curies released by INL in 2019	2019 MEI mrem due to INL air effluents
Plutonium-241 (14.35 year)	4.19E-3		-	
Americium-241 (458 year)	3.36E-3	0.0093	7.19E-5	
Uranium-234 (246,000 year)	-		5.88E-2	0.0430
Uranium-238 (4.47E9 year)	-		1.29E-1	0.1124
		Total 0.033 mrem, 2015		Total 0.0588 mrem, 2019

Table notes: MEI is the hypothetical maximally exposed individual located near the Idaho National Laboratory residing south of the INL near the Big Southern Butte. A mrem is the annual radiation dose in units of millirem, or 1.0E-3 rem. The source data for the radionuclide curie releases and the estimated radiation dose is from the Department of Energy's Idahoeser.com website for those years. Note that uranium, plutonium and americium decay half-lives are only the beginning of long decay series of radionuclides before ultimately decaying to a stable isotope of lead.

Draft EIS Fails to Acknowledge the Inadequacies of the DOE's Environmental Surveillance Program

DOE's environmental monitoring program is inadequate and the program is designed more around hiding the INL's contamination than revealing it. When INL's airborne releases were increased, the program raised the bar for what would be considered a detection of radioactivity. When that wasn't enough, the program would raise the concentration level that could be detected. So, when the technology had easily allowed 1 picocurie/liter to be detected, the specified sampling program minimum detectable concentration would be raised to 3 pCi/L in milk, for example. Taking air monitors offline, destruction of samples and similar approaches have been taken in order to keep a lid of the growing radiological contamination in southeast Idaho.

Even now, when ambient air filters are evaluated and found to have americium-241, plutonium-238 and plutonium-239, for example, the DOE and State of Idaho pretend that the source of the radionuclides is due to former weapons testing, even though the ratios of the material and the historical levels of the material do not support this assertion.

Monitoring of waste burial sites for CERCLA at INL and the Snake River Plain Aquifer has often been inadequate and biased to hide contamination findings by reduced monitoring and reduced reporting. The ease with which strong detections can be discounted and the deliberate practice of conducting spotty, infrequent monitoring of land and the aquifer often means "no discernable trend could be found."

Project Pele's Definition of The Radiation Dose Unit of Rem Is Inadequate

Many places in the Draft EIS offer a definition of REM which is close to being correct, that the REM unit is a unit of effective absorbed dose of ionizing radiation in human tissue. But in over a dozen places in the Draft EIS, the Project Pele Draft EIS states, incorrectly, that a rem is defined as "roentgen equivalent man, a measure of radiation."

The roentgen, used before the SI unit system was adopted, corresponds to an absorption of 87.7 ergs per gram of air, or a dose to the air of 0.877 rad. This is sometimes considered similar to the absorbed dose in tissue and would be nearer to a "rad" of absorbed dose, analogous to the SI unit of Gray, where 100 rad equals 1 Gy. However, a roentgen is NOT a rem. The unit of "rem" is analogous to the SI unit of sievert, where 100 rem equals 1 Sv. However, while the "rad" is a physical quantity, the "rem" is adjusted by a series of multipliers that are selected by the ICRP based on the ICRP's opinion of the biologic effect of the radiation, particularly regarding the cancer mortality effect of the absorbed dose. [19]

The rem unit starts off with consideration of the absorbed dose, which is related to the number of ionization events in the target region. The absorbed dose, for external radiation, may correlate with the biological effects. However, the rem waters down the absorbed dose by various multipliers chosen by the ICRP based on selected biologic effects, namely "fatal cancer," that was observed from the nuclear weapons industry biased assessments of the survivors of the atomic bombing of Japan.

The explanation of how effective dose equivalent is adjusted for biological endpoints such as for fatal cancer needs to be described in the Draft EIS. Also, the way that the whole-body effective dose gives no indication of the organ absorbed dose or the cancer incidence risk for an organ must be described in the Draft EIS.

The Draft EIS must not simply include "fatal cancer" but must also include a responsible and up-to-date, scientifically valid way of including birth defects, shortened life span, infertility, decreased immune system functioning, increased risk of heart disease, and cancer incidence that does not ignore what has been learned by the Chernobyl nuclear disaster and other nuclear disasters.

Project Pele's Draft EIS Failure to Acknowledge the Elevated Incidence of Thyroid Cancer in Communities Surrounding the INL

The DOE emphasizes that radiation doses from INL ongoing radiological airborne releases are far below background levels. However, the actual absorbed doses to the organs and tissues in the body are not disclosed. The thyroid organ dose, for example, from the INL releases of iodine-131, iodine-129, americium-241, and others give a far higher thyroid organ absorbed dose than

[19] One rad of absorbed dose is 100 ergs per gram of tissue and 100 rad is 1 Gray. And 1 Gray is 1 Joule per kilogram. The SI unit of Gray is equivalent to 100 rad. Rad is used for absorbed dose in the U.S. which does not widely use the SI system for radiation workers or EISs, but neither rad nor rem have been defined in terms of roentgens for decades. A roentgen, used before the SI unit system was adopted, corresponds to an absorption of 87.7 ergs per gram of air, or a dose to the air of 0.877 rad.

the whole-body millirem dose stated by DOE and stated in the draft EIS. **The dose to the thyroid is actually far higher than received from natural background radiation.**

For a recent period of more than ten years, every county surrounding the INL, **the incidence of thyroid cancer has been roughly double the rate in all of the counties surrounding the INL, compared to the rest of the state and the country.** [20] **The draft EIS (page 3-42) presents the higher thyroid cancer incidence rates for a few years but does not address why.**

For years, since 1991 at least and off and on until 2001, the DOE's environmental surveillance program written plans included monitoring iodine-129. But no results were ever presented. They listed iodine-129 (in writing) as a radionuclide that would be specifically monitored in their surveillance program. **But while they sometimes offered excuses, no iodine-129 monitoring results were ever presented.** Meanwhile the releases of iodine-129 sometimes exceeded the iodine-131 releases (8-day half-life). The iodine-129 stays in the environment forever; it has a half-life of 16 million years.

By now, the Department of Energy should have been requiring organ dose assessments, not just a single whole body effective dose estimate. But they aren't. Not event t**hyroid organ doses are being presented from INL's releases and the thyroid organ dose would be far higher than the effective whole-body dose.** And the risk of the incidence of thyroid cancer would be far higher than the fatal cancer rate that the draft EIS uses, of 0.0006 fatal cancers per rem. [21] The thyroid organ dose is also far higher than received from naturally occurring background radiation and this is never presented.

Project Pele Draft EIS Fails To Acknowledge and Explain Elevated Thyroid Cancer and Childhood Cancer Incidence

The Draft EIS fails to address the inadequacy of the radiation health modeling despite years of double the thyroid cancer incidence in the counties surrounding the INL. As the DOE has been forbidden to conduct epidemiology because of its many past efforts to improperly bias human epidemiology, the assessment of growingly obvious health impacts of INL radiological releases must be conducted by properly independent evaluation. This has not been done, as is evident in the Draft EIS which displays some of the increased cancer rates yet fails to utter any recognition of the obvious doubling of thyroid cancers in counties surrounding the INL. The

[20] See the July 2020 Environmental Defense Institute newsletter for more information about the elevated rates of thyroid cancer in the countries surrounding the Idaho National Laboratory. "Counties near the INL have double the thyroid cancer incidence while other counties in Idaho did not approach these high thyroid cancer incidence rates. The counties near the INL listed in the table [in the newsletter for 2017] are Butte, Bonneville, Madison, Jefferson, Bingham and Fremont counties, which ranged from 42.8 per 100,000 for Butte to 27.9 per 100,000 for Fremont. These cancer incidence rates are double, or more, the US and the Idaho state average for incidence of thyroid cancer which are 15.7 per 100,000 and 14.2 per 100,000." Bonneville country's thyroid cancer incidence rate in 2017 was 30.9 per 100,000.

[21] Project Pele draft EIS, page 4-36 states that a risk factor of 0.0006 LCFs per rem (person-rem) was used in this EIS to estimate risk impacts due to radiation doses from normal operations and accidents.

incidence of thyroid cancer has been doubling for years and is wide-spread, yet the rates ramp up at double the rest of Idaho and the US, in the counties surrounding the INL. Refusing to recognize the impact, which would not be predicted by DOE's accepted radiological release estimates and radiation health models, is immoral as well as not based on scientific integrity.

In 1975, the rate of thyroid cancer incidence for men and women combined was 4.8 per 100,000 in the US. In 2015, thyroid cancer incidence reached 15.7 per 100,000 according to the Surveillance, Epidemiology, and End Results Program (SEER) website. Thyroid cancer incidence and mortality in the US may have finally leveled off after years of increases, according to the National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). [22] However, several counties surrounding the Idaho National Laboratory have roughly double (or more) the thyroid cancer incidence than the Idaho state average and US average.

The SEER 9 region is roughly 10 percent of the US population and includes parts of California [San Francisco and Oakland], Connecticut, Georgia [Atlanta only], Hawaii, Iowa, Michigan [Detroit only], New Mexico, Utah, and Washington [Seattle and Puget Sound region]. [23]

Thyroid cancer incidence in the US increased, on average, 3.6 percent per year during 1974-2013, from 4.56 cases per 100,000 person-years in 1974-1977 to 14.42 cases per 100,000 person-years in 2010-2013. These thyroid cases were not trivial: the mortality also increased. Mortality increased 1.1 percent per year from 0.40 per 100,000 person-years in 1994-1997 to 0.46 per 100,000 person-years in 2010-1013 overall and increased 2.9 percent per year for SEER distant stage papillary thyroid cancer. [24] From 1974 to 2013, the SEER 9 region cancer data included 77,276 thyroid cancer patients and 2371 thyroid cancer deaths.

Bonneville County, where Idaho Falls is located, has double the thyroid cancer rate of the US and double the rate compared to the rest of Idaho, based on the Cancer Data Registry of Idaho (CDRI) for the year 2017. [25] See Table 4.

[22] National Cancer Institute, Surveillance, Epidemiology, and End Results Program, Cancer Stat Facts: Thyroid Cancer. https://seer.cancer.gov/statfacts/html/thyro.html

[23] National Cancer Institute, Surveillance, Epidemiology, and End Results Program, Cancer Query System. https://seer.cancer.gov/canques/incidence.html

[24] Hyeyeun Lim et al., JAMA, "Trends in Thyroid Cancer Incidence and Mortality in the United States, 1974-2013," April 4, 2017. https://pubmed.ncbi.nlm.nih.gov/28362912/ or https://jamanetwork.com/journals/jama/fullarticle/2613728

[25] C. J. Johnson, B. M. Morawski, R. K., Rycroft, Cancer Data Registry of Idaho (CDRI), Boise Idaho, Annual Report of the Cancer Data Registry of Idaho, *Cancer in Idaho – 2017*, December 2019. https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf

Table 4. Bonneville County thyroid cancer incidence rate compared to the rest of Idaho, 2017.

Cancer type	Sex	Rate in Bonneville County	Adjusted Rate in Bonneville County	Rate for remainder of Idaho
Thyroid	Total	28.2	30.7	14.2
	Male	16.0	17.8	7.4
	Female	40.3	43.5	21.0

Table notes: Rates are expressed as the number of cases per 100,000 persons per year (person-years). Rates are expressed as the number of cases per 100,000 persons per year (person-years). Adjusted rates are age and sex-adjusted incidence rates for the county using the remainder of the state as standard. Data from Factsheet for the Cancer Data Registry of Idaho, Idaho Hospital Association. Bonneville County Cancer Profile. Cancer Incidence 2013-2017. https://www.idcancer.org/ContentFiles/special/CountyProfiles/BONNEVILLE.pdf

Some people have wondered if the thyroid incidence rate is due to overdiagnosis of elderly patients — no, it is not. A study of pediatric thyroid cancer rates in the US found that in pediatric patients with thyroid cancer diagnosed from 1973 to 2013, the annual percent change in pediatric cancer incidence increased from 1.1 percent per year from 1973 to 2006 and markedly increased to 9.5 percent per year from 2006 to 2013. [26]

Some people have wondered if the increased rate of incidence is due to overdiagnosis of trivial nodules — no, it is not. The figures for the incidence rates for large tumors and advanced-stage disease suggest a true increase in the incident rates of thyroid cancer in the United States. I've seen this just from a handful of acquaintances in Idaho Falls.

For pediatric patients, the thyroid incidence rate was 0.48 cases per 100,000 person-years in 1973 to 1.14 cases per 100,000 person-years in 2013. The incidence rate for large tumors were not significantly different from incidence rates of small (1-20 mm) tumors.

Both thyroid cancer US trend studies (by Lim and by Qian) used the SEER cancer incidence file maintained by the National Cancer Institute and includes 9 high-quality, population-based registries.

As the SEER 9 region thyroid incidence peaked at 15.7 per 100,000, and the State of Idaho thyroid incidence average was 14.2 per 100,000, Bonneville County reached thyroid cancer rates of 30.9 per 100,000. [27] But other counties near the Idaho National Laboratory also have elevated thyroid cancer incidence rates: Madison (29.3 per 100,000), Fremont (27.9 per 100,000), Jefferson (28.9 per 100,000), and Bingham (28.6 per 100,000). But let's not forget Butte county. Butte county's thyroid cancer rate of 45.9 per 100,000 puts it in a class by itself. Much of Butte county is within 20 miles of the INL and nothing says

[26] Z. Jason Qian et al., *JAMA*, "Pediatric Thyroid Cancer Incidence and Mortality Trends in the United States, 1973-2013," May 23, 2019. https://pubmed.ncbi.nlm.nih.gov/31120475/ or https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6547136/

[27] Environmental Defense Institute February/March 2020 newsletter article "Rate of cancer in Idaho continues to increase, according to Cancer Data Registry of Idaho."

radiation exposure like Butte's leukemia rate at 3 times the state rate and myeloma at 5 times the state average rate.

The news headline for the Idaho cancer register report issued in 2018 read that "cancer trends for Idaho are stable." [28] That is what citizens were supposed to take away from the 2017 cancer rate study in Idaho. Why were citizens not told about any of the cancers in the counties in Idaho that significantly exceeded state average cancer rates and exceeded the rest of the US? [29]

The wide-spread thyroid cancer incidence increases in the US do not appear to be due to radiation exposure. I suspect other governmentally permitted and highly profitable environmental toxins related to our food and perhaps also cell phone use. **But the rates that are double the rest of Idaho and the US in only counties near the Idaho National Laboratory are, I believe, due to the radiological releases from INL and are perhaps aggravated by airborne chemical releases from the INL.**

The Department of Energy and the State of Idaho are actively ignoring the likely environmental causes of elevated rates of cancer in the communities surrounding the INL and especially the elevated rates of childhood cancer.

The forty-first annual report of the Cancer Data Registry of Idaho (CDRI) was issued in December 2019 for the year 2017. [30] While the rate of some cancers decreased, the bad news for the State of Idaho is that the overall rate of cancer incidence continues to increase.

And, very importantly, childhood cancers in Idaho continue to increase. Pediatric (age 1 to 19) cancer increased at a rate of about 0.6 percent per year in Idaho from 1975 to 2017, see https://www.idcancer.org/pediatriccancer.

The rate of childhood cancer incidence in Bonneville County exceeded the remainder of the state for boys, based on the adjusted rate of cancer incidence. For girls the rate was high, but not above the remainder of the state, see Table 5.

Table 5. Bonneville County childhood cancer incidence rate compared to the rest of Idaho, 2017.

Cancer type	Sex	Rate in Bonneville County	Adjusted Rate in Bonneville County	Rate for remainder of Idaho
Pediatric	Total	17.8	17.9	18.2
Age 0 to 19	Male	19.0	**19.3**	19.1
	Female	16.5	16.5	17.2

Table notes: Rates are expressed as the number of cases per 100,000 persons per year (person-years).

[28] Brennen Kauffman, *The Idaho Falls Post Register*, "New cancer report on 2017 shows stable cancer trends for Idaho," December 13, 2018.

[29] https://statecancerprofiles.cancer.gov/

[30] C. J. Johnson, B. M. Morawski, R. K., Rycroft, Cancer Data Registry of Idaho (CDRI), Boise Idaho, Annual Report of the Cancer Data Registry of Idaho, *Cancer in Idaho – 2017*, December 2019. https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf

The stated radionuclide releases from the Idaho National Laboratory to air have often been incomplete or underestimated the releases. The stated "effective dose equivalent" whole body dose has been a *fictional* fraction of a millirem.

Given the elevated rates of the incidence of thyroid cancer in the counties surrounding the INL due to its ongoing radiological releases, the Draft EIS must present thyroid organ dose and cancer incidence rate from americium-241 and other radionuclides.[31] The Draft EIS has currently addressed only the fatal cancer risk, not the risk of non-fatal cancer. The Draft EIS has not addressed the higher rates of cancer in children due to airborne radioactivity. And the Draft EIS has not addressed the higher rates of infant mortality and birth defects in our region and in INL workers.

Draft EIS Actively Ignores the Current Scientific Evidence of Radiation Health Harm

The Department of Energy's accepted modeling of health risk from radionuclide emissions (routine or from accidents) actively ignores diverse, compelling human epidemiology. I have been told that the reason is "that somebody high up has decided that the benefit of changing the radiation protection standards isn't worth the cost." This basic description comes from university professors and INL lab directors. Basically, the Department of Energy has decided that protecting your health, or your child's health or protecting human beings in the future from its growing inventory of radioactive waste just isn't worth the cost. It would, after all, increase the cost of nuclear waste disposal and it would require reducing airborne emissions from its facilities.

The rates of cancer for children continue to be elevated, especially in counties surrounding the Idaho National Laboratory. The incidence of thyroid cancer is double in the counties surrounding the INL and double that of all other counties in Idaho and double the rates for the country from the SEER database. This is a consistent result over a decade. As thyroid cancer incidence was climbing everywhere, is has been consistently double in the counties surrounding the INL (and unlike the Draft EIS, I reviewed all the counties). The Draft EIS presents some of the cancer data and is silent on the trends. The Draft EIS is also silent on many radiogenic cancers such as male breast cancer. And the Draft EIS is silent on the rates of childhood cancer which are elevated.

The Department of Energy, while accepting lower tabulated radiation doses and focusing on whole-body doses exclusively, has remained silent on the increased thyroid cancer incidence rates from various alpha emitters, and especially americium-241. Due to the low tissue weighting value, whole body dose estimates are not affected much by the elevated thyroid doses.

A 2013 Pacific Northwest National Laboratory (PNNL) report incorporating Federal Guidance Report 13 tabulated whole body and organ specific dose conversion factors for an average half-male and half-female at various ages. [32] The 2013 PNNL report is to be used for

[31] T.R. Hay and J.P. Rishel, Pacific Northwest National Laboratory, Department of Energy, *Revision of the APGEMS Dose Conversion Factor File Using Revised Factor from Federal Guidance Report 12 and 13*, PNNL-22827, September 2013. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22827.pdf

[32] T.R. Hay and J.P. Rishel, Pacific Northwest National Laboratory, Department of Energy, *Revision of the APGEMS Dose Conversion Factor File Using Revised Factor from Federal Guidance Report 12 and 13*, PNNL-22827, September 2013. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22827.pdf

calculating radiation dose but not the risk of higher radiation risks recognized in the EPA's 1999 Federal Guidance Report 13. Buried near the end of the PNNL report is a chart of how wildly increased the thyroid cancer incidence was for various radionuclides, by a factor of 10, of 100, of 1000, of 10,000 and of 100,000! See Figure 3.

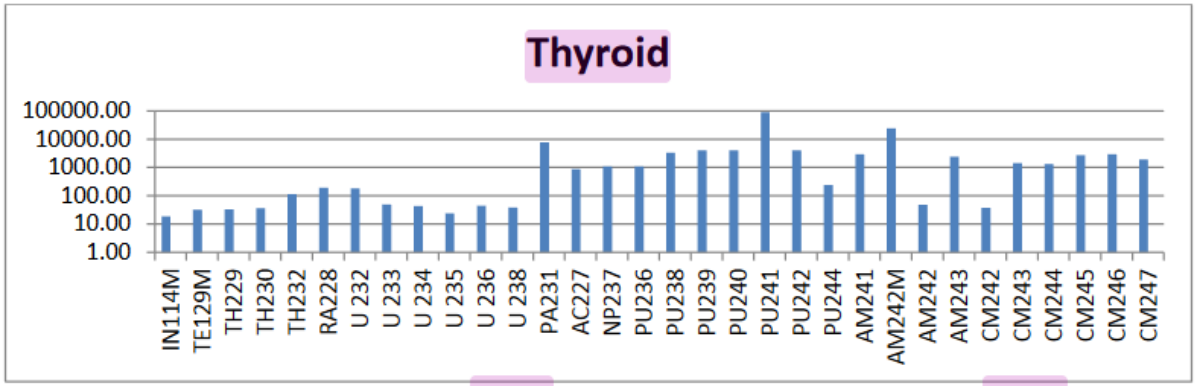

Figure 3. Ratio of the revised Federal Guidance Report (FGR) 13 thyroid dose conversion factors (DCFs) to the original Department of Energy (HUDUFACT.dat) thyroid DCF for radionuclides having the largest increases. (PNNL-22827)

The radionuclides in Figure 3 include thorium, uranium and uranium decay progeny, plutonium, curium and americium. The thyroid cancer incidence rate increases for plutonium-238, plutonium-239, plutonium-240, plutonium-241 and americium-241 is over 1000.

It is important to understand that for many years, releases of these various americium, curium and plutonium radionuclides were not stated or were understated by the Department of Energy in its environmental monitoring reports. The 1989 INEL Historical Dose Evaluation does not list americium-241 as a radionuclide that it released. Yet, there is evidence of extensive americium-241 contamination at INL facilities when CERCLA cleanup investigations were conducted in the early 1990s.

The levels of transuranics including americium-241 and curium in the air at the ATR Complex and other facilities at the INL are sometimes extensive and the Department of Energy simply assumed their dumping of this waste was to the aquifer and did not include it in public dose estimates for many years. [33] [34]

[33] F. Menetrier at al., *Applied Radiation Isot*., "The Biokinetics and Radiotoxicology of Curium: A Comparison With Americium," December 2007. https://pubmed.ncbi.nlm.nih.gov/18222696/ (This study found that the biokinetics of curium are very similar to those of americium-241. Lung and bone tumor induction appear to be the major hazards. Retention in the liver appears to be species dependent.)

[34] R. L. Kathren, Occupational Medicine, "Tissue Studies of Persons With Intakes of the Actinide Elements: The U.S. Transuranium and Uranium Registries," April-June 2001. https://pubmed.ncbi.nlm.nih.gov/11319054/ (This study finds that the dose coefficients for alpha radiation induction of bone sarcoma may be too high while those for leukemia are a factor six too low.

The extensive airborne concentrations of americium-241 at the INL may be important to the underestimation of thyroid doses and risks of thyroid cancer incidence. A 1993 study estimated that the dose to the thyroid from americium-241 to be about 1.42 times that delivered to bone. They concluded that the thyroid dose is much higher from americium-241 than has been reported in people. [35]

On the potential health harm of americium-241, the Agency for Toxic Substances and Disease Registry has stated that: "The radiation from americium is the primary cause of adverse health effects from absorbed americium. Upon entering the body by any route of exposure, americium moves relatively rapidly through the body and is deposited on the surfaces of the bones where it remains for a long time. As americium undergoes radioactive decay in the bone, alpha particles collide with nearby cell matter and give all of their energy to this cell matter. The gamma rays released by decaying americium can travel much farther before hitting cellular material, and many of these gamma rays leave the body without hitting or damaging any cell matter. The dose from this alpha and gamma radiation can cause changes in the genetic material of these cells that could result in health effects such as bone cancers. Exposure to extremely high levels of americium, as has been reported in some animal studies, has resulted in damage to organs.

The Department of Energy has largely thwarted efforts to have epidemiology conducted near the INL. Epidemiology that was conducted of INL workers found unexplained elevated levels of certain radiogenic cancers in both radiation and non-radiation workers.

The routine emissions from the Idaho National Laboratory and also from U.S. Nuclear Regulatory Commission approved radioactive waste disposal on the western side of the state of Idaho are poisoning the state, as airborne contamination results in gyrating public drinking water contamination. The Draft EIS and the Department of Energy fail to acknowledge the airborne pathway into our drinking water supplies.

Public water supplies are intermittently monitored, yet reveal gyrating levels of high levels of gross alpha emitters which usually cannot be shown to be from natural uranium and thorium levels or from past weapons testing fallout. Monitoring programs routinely seek to avoid reporting elevated levels of radionuclides in water, air and soil. These programs, including the state program for the INL and the DOE's contractor for environmental reporting, actively use poor sampling protocols, data deletion, biased blanks for count comparison, and false narratives to explain elevated results.

The internal radiation cancer harm is not based on solid epidemiological evidence and there are experts from Karl Z. Morgan to Chris Busby to Jack Valentin that understand that the accepted models may understate the cancer harm by a factor of 10, 100 or more. The nuclear industry continues to ignore the epidemiological evidence that implies tighter restrictions are needed. Jack Valentin, former chair of the International Commission on Radiological Protection (ICRP) has admitted, before resigning from the ICRP, that the ICRP's radiation model underpredicts the harm of internal radiation by over a factor 100. The Draft EIS, which

[35] G. N. Taylor et al., Health Physics, "241Am-induced Thyroid Lesions in the Beagle," June 1993. https://pubmed.ncbi.nlm.nih.gov/8491622/

references Valentin and the ICRP, must explain why DOE decided to adopt the ICRP recommendations and why it considers the very inadequate ICRP models to be acceptable.

Project Pele's Draft EIS Fails to Explain Why the 100 mrem/yr Radiation Dose Limit is Acceptable

The Department of Energy emphasizes that its regulations allow it to dose the public with 100 mrem/yr. The Draft EIS discusses the 100 millirem per year limit pertaining to DOE Order 458.1 on page 3-40 and in other places in the Draft EIS.

The Draft EIS needs to discuss that when in the 1970s when that annual limit was created, it was assumed that the fatal cancer risk from radiation exposure was 0.0001 fatal cancers per rem. Even as the DOE accepts that the fatal cancer risk is at least 6 times higher, at 0.0006 fatal cancers per rem, [36] which would imply a limit of 16 mrem/yr, the DOE retains the same 100 mrem/yr limit.

Despite the Department of Energy's insistence that a 100 millirem/year dose, every year, would be acceptable, anyone who understands anything about radiation health effects, and especially of the increased harm from internal radionuclides knows that 100 mrem per year for a lifetime would cause a health catastrophe. Even the U.S. Environmental Protection Agency, unless knuckling under nuclear industry pressure, understands that a chronic 100 mrem per year dose should be avoided and the authorized limit should be a fraction of the dose limit.

The 100 mrem per year all pathways radiation dose limit was born based on the International Committee on Radiological Protection (ICRP) assumption back in 1977 that the fatal cancer risk per rem from ionizing radiation was 0.0001 fatal cancers per rem. Then, by 1994, it was recognized that the risk of fatal cancer from ionizing radiation was at least 0.0005 fatal cancers per rem. Current Department of Energy environmental impact statements acknowledge the more recent recommendation (and also underestimate) to be 0.0006 fatal cancers per rem.

Note that the 100 mrem per year radiation health protection standard based on 0.0001 fatal cancers per rem was never changed even when the fatal cancer risk from ionizing radiation was increased 6-fold to 0.0006 fatal cancers per rem.

This is why the EPA was attempting to use 15 mrem per year as the dose limit for various radioactive waste disposal regulations. It wasn't for factors of safety below 100 mrem. It was to try to maintain the same factor of safety presumed in the 1970s that had been wild-assed, hoped for cancer rates by the ICRP! And you can read more about this in a report about TENORM which stands for Technologically Enhanced Naturally Occurring Radioactive Materials. [37]

---

[36] Project Pele draft EIS, page 4-36 states that a risk factor of 0.0006 LCFs per rem (person-rem) was used in this EIS to estimate risk impacts due to radiation doses from normal operations and accidents.

[37] National Research Council, Committee on Evaluation of EPA Guidelines for Exposure to Naturally Occurring Radioactive Materials. Evaluation of Guidelines to Exposures to Technologically Enhanced Naturally Occurring Radioactive Materials. Washington DC, National Academies Press, 1999. https://www.nap.edu/catalog/6360/evaluation-of-guidelines-for-exposures-to-technologically-enhanced-naturally-occurring-radioactive-materials and chapters at https://www.nap.edu/catalog/6360/evaluation-of-guidelines-for-exposures-to-technologically-enhanced-naturally-occurring-radioactive-materials#toc

It gets worse. No really! It gets worse. It has been known now for a few decades that radiation exposure to the developing embryo and fetus "can cause growth retardation; embryonic, neonatal, or fetal death; congenital malformations; and functional impairment such as mental retardation." [38]

In 2007, the International Commission of Radiological Protection (ICRP) lowered its estimate of the risk of genetic harm of congenital malformations by 6-fold, from 1.3E-4/rem to 0.2E-4/rem. Based on the belief that the study of the Japanese bomb survivors did not detect genetic effects, **the ICRP genetic effect estimate for humans is based on studies of external radiation of mice.**

The ICRP estimate of risk of congenital malformations is a fraction of its predicted cancer risk for cancer mortality (or latent cancer fatality). The ICRP latent cancer fatality risk was 5.0E-4 LCF/rem (1991 estimate), close to the cancer mortality rate used in the Department of Energy's Versatile Test Reactor EIS of 6.0E-4 LCF/rem. [39]

While the studies of genetic injury to the Japan bombing survivors declared that they found no evidence of genetic damage, other researchers have found those studies to have been highly flawed. A report published in 2016 by Schmitz-Feuerhake, Busby and Pfugbeil summarizes numerous human epidemiology studies of congenital malformations due to radiation exposure. [40]

The 2016 report disputes the ICRP genetic risk estimate and finds that diverse human epidemiological evidence supports a far higher genetic risk for congenital malformations. **Nearly all types of hereditary defects were found at doses as low as 100 mrem.** The pregnancies are less viable at higher doses and so the rate of birth defects appears to stay steady or falls off at doses above 1000 mrem or 1 rem. The 2016 report found the excess relative risk for congenital malformations of 0.5 per 100 mrem at 100 mrem falling to 0.1 per 100 mrem at 1000 mrem.

The 2016 report's result for excess relative risk of congenital malformations of 5.0/rem is 250,000-fold higher than the ICRP estimate of 0.2E-4/rem which ICRP appears to assume has a linear dose response. (See the August 2021 Environmental Defense Institute newsletter.)

The bottom line is that the nuclear industry and especially the Department of Energy is grossly underestimating the fatal cancer risk of their radiological releases, and ignoring serious adverse health effects such as cancer incidence, heart disease, reduced immune system function, fertility problems, increased rates of infant death, and reduced life span. And they are also grossly underestimating the risk of genetic effects of ionizing radiation exposure prior to

---

[38] Eric J. Hall, *Radiobiology for the Radiologist*, 5th ed., 2000, p. 190.

[39] U.S. Department of Energy's Versatile Test Reactor Draft Environmental Impact Statement (VTR EIS) (DOE/EIS-0542) (Announced December 21, 2020). A copy of the Draft VTR EIS can be downloaded at https://www.energy.gov/nepa or https://www.energy.gov/ne/nuclear-reactor-technologies/versatile-test-reactor. (See discussion in VTR EIS Appendix C, page C-4).

[40] Inge Schmitz-Feurerhake, Christopher Busby, and Sebastian Pflugbeil, *Environmental Health and Toxicology, Genetic radiation risks: a neglected topic in the low dose debate*, January 20, 2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4870760/ The 2016 report found the "excess relative risk for congenital malformations of 0.5 per mSv at 1 mSv falling to 0.1 per mSv at 10 mSv exposure and thereafter remaining roughly constant."

conception that are passed on to their children and grandchildren, by relying on ICRP's industry-biased recommendations.

The Draft EIS must include not the deceptive look at five years of estimated effective whole-body doses from INL's airborne waste effluents, it must include the trending of the releases of americium, plutonium and iodine releases from the INL. Figure ?? shows the plutonium and americium-241 releases from the Idaho National Laboratory between 2001 and 2017 based on Department of Energy environmental monitoring reports. [41] The State of Idaho DEQ does not display, report or trend any data before 2013….can anyone guess why? The huge releases from the INL between 2004 and 2013 are shocking and certainly would not fit well with a tourist brochure for visiting Idaho.

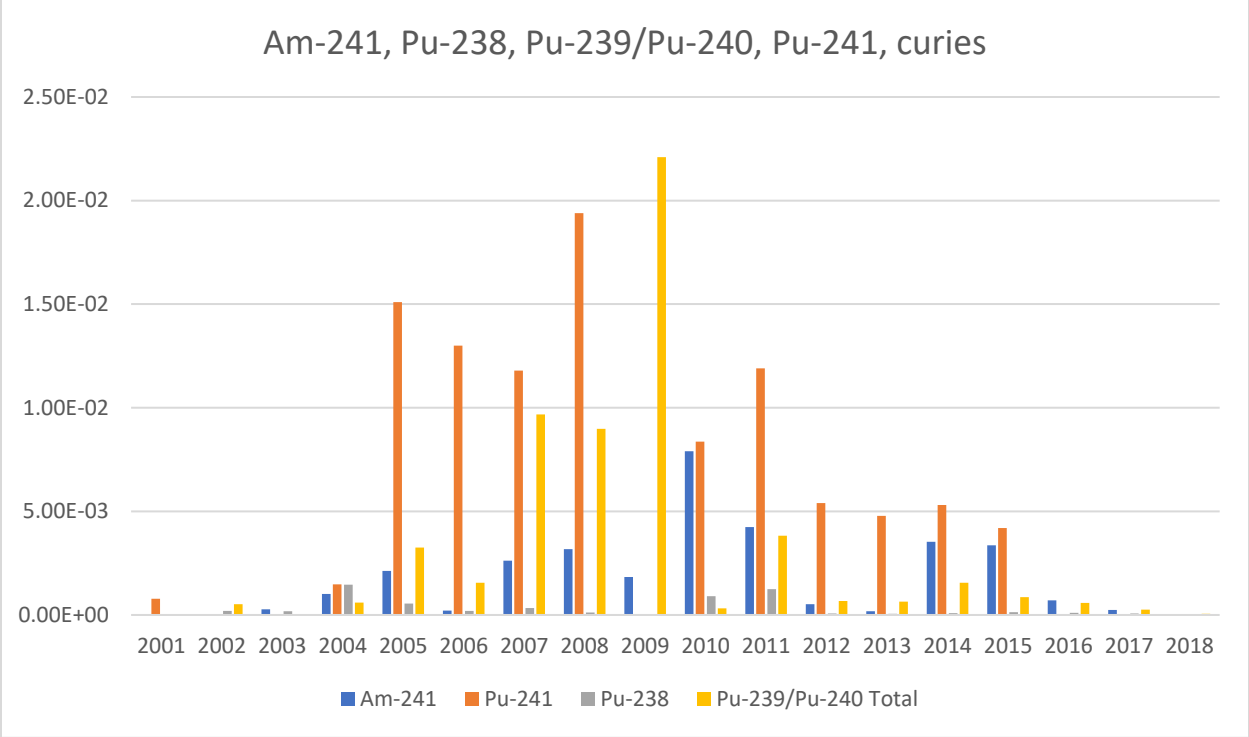

Figure 4. Americium-241, plutonium-238 and other actinides released by the INL between 2001 and 2018.

Figure 5 shows the iodine-129 and iodine-131 releases between 1973 and 2017, in curies. The State of Idaho DEQ went from displaying all of their environmental monitoring reports to displaying ten years of the reports, to know displaying only six years of annual reports and only 4 years of quarterly data reports from 2013 to 2018. **Again, here you can see why the Idaho DEQ didn't want to display INL monitoring data before 2013.**

[41] Department of Energy's environmental monitoring reports, see idahoeser.com and inldigitallibrary.inl.gov.

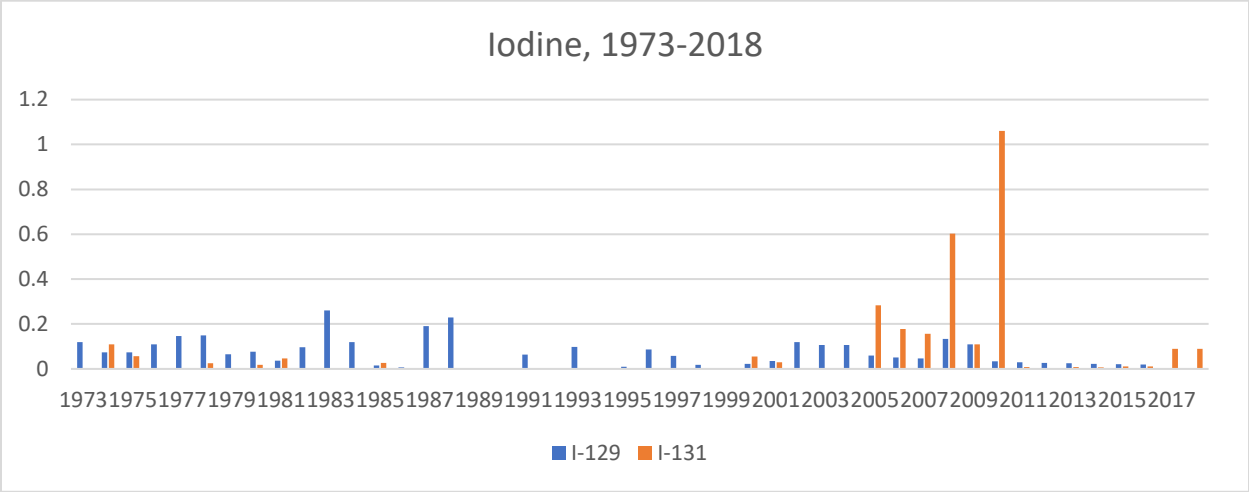

Figure 5. Iodine-129 and iodine-131 released from the INL between 1973 and 2018.

The plutonium and americium-241 and the iodine-129 and iodine-131 are not the only radionuclides with elevated releases from the INL. But these radionuclides might have influenced the elevated thyroid cancers in Bonneville County reported for 2013 to 2017, yet the Department of Energy continued ignoring the thyroid organ doses.

Iodine-129 with its 16-million-year half-life has higher inhalation and ingestion dose conversion factors than iodine-131 with its 8-day half-life. While iodine-131 does give a higher air emersion and ground shine dose, the iodine-129 dose often is a dominant dose contributor for INL airborne releases.

The Draft EIS fails to address the fact the radiation workers are still wrongly told that there is no evidence of damage to DNA or genetic effects from radiation exposure to humans. DOE's radiation workers are not told of the infertility and increased risk of birth defects from radiation.

The Draft EIS fails to address the fact that the investigations into worker contamination at the INL historically are not complete and do find evidence of inadequate worker protection. The investigations continue at a snail's pace by the Center for Disease Control's National Institute of Occupational Safety and Health (NIOSH) for the Energy Employee Occupational Illness Compensation Program. Meanwhile, injured workers and their survivors die, having had their illness claim wrongly denied.

The Draft EIS needs to acknowledge the inadequacy of the 5 rem (or 5,000 millirem per year) limit to actually protect adult radiation workers, page 4-62 of the Draft EIS. The Draft EIS needs to acknowledge the extent that radiological records of contamination in urine and fecal samples is withheld from workers, enabling errors and deliberate falsifications. Many workers go to medical providers and the worker does not have accurate information concerning exposure and radiological intake history.

The public as well as radiation workers need to keep in mind that, despite what they may have been taught:

- The cancer risk is not reduced when radiation doses are received in small increments, as the nuclear industry has long assumed. [42]

- Despite the repeated refrain that the harm from doses below 10 rem cannot be discerned, multiple and diverse studies from human epidemiology continue to find elevated cancer risks below 10 rem and from low-dose-rate exposure. [43]

- The adverse health effects of ionizing radiation are not limited to the increased risk of cancer and leukemia. Ionizing radiation is also a contributor to a wide range of chronic illnesses including heart disease and brain or neurological diseases.

The public and radiation workers take cues from their management that they should not be concerned about the tiny and easily shielded beta and alpha particles. DOE-funded fact sheets often spend more verbiage discussing natural sources of radiation than admitting the vast amounts of radioactive waste created by the DOE. The tone and the meta-message from the DOE, the nuclear industry, is that if you are educated about the risks, then you'll understand that the risks are low. Yet, these agencies continue to deny the continuing accumulation of compelling and diverse human epidemiological evidence that the harm of ingesting radionuclides is greater than they've been claiming.

The biological harm that ionizing radiation may cause to DNA is mentioned sometimes but it is emphasized that usually the DNA simply are repaired by the body. And the training to radiation workers will mention that fruit flies exposed to radiation passed genetic mutations to their offspring but workers are told that this phenomenon has never been seen in humans even though, sadly, the human evidence of genetic effects has continued to accumulate. Birth defects and children more susceptible to cancer are the result.

Gulf War veterans who inhaled depleted uranium have children with birth defects at much higher-than-normal rate. The same kinds of birth defects also became prevalent in the countries where citizens were exposed to DU. There are accounts to suggest that the actual number of birth defects resulting from the World War II atomic bombs dropped on Japan and by weapons testing over the Marshall Islands have been underreported. The Department of Energy early on made the decision not to track birth defects resulting from its workers or exposed populations. But people living near Hanford and near Oak Ridge know of increased birth defects in those communities.

In radworker training, there may be discussion of the fact that international radiation worker protection recommends only 2 rem per year, not 5 rem per year. There is no mention of recent

---

[42] Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015 This cohort study included 308,297 workers in the nuclear industry.

[43] US EPA 2015 http://www.regulations.gov/#!documentDetail;D=NRC-2015-0057-0436 . For important low-dose radiation epidemiology see also John W. Gofman M.D., Ph.D. book and online summary of low dose human epidemiology in "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis," Committee for Nuclear Responsibility, Inc., 1990, http://www.ratical.org/radiation/CNR/RIC/chp21.txt And see EDI's April 2016 newsletter for Ian Goddard's summary and listing of important human epidemiology concerning low dose radiation exposure.

human epidemiology showing the harm of radiation is higher than previously thought and at low doses, below 400 mrem annually to adult workers, increased cancer risk occurs.

Project Pele Draft EIS Incorrectly States International Commission on Radiological Protection (ICRP) is Responsible for Guidance in Radiation Safety

Although not always delineated as "effective" whole-body radiation doses, the dose estimates in millirem (mrem) that are provided in Department of Energy environmental surveillance annual reports for the Idaho National Laboratory are given only in "effective" whole-body dose.

It is vital for the NEPA process for the public to understanding the distortion of "Effective Whole-Body Doses" in millirem presented by the Department of Energy.

The non-physical concept of "effective" whole body doses does not provide meaningful doses for estimating fatal cancer risk because the organ absorbed doses are unstated. In addition, the basis for assigning importance of various organs or tissues to the contribution to cancer mortality is based primarily on the external gamma dose received by survivors of the 1946 atomic bombing of Japan and it tells nothing about the cancer risks when radionuclides are inhaled or ingested and incorporated into the body. Cesium-137 mimics potassium, strontium-90 mimics calcium, plutonium-239 mimics iron, etc.

Even with accounting for the clearance of the radionuclide from the body and accounting for the tendency for the radionuclide to accumulate in certain organs such as the thyroid or in bone tissue — the harm from internal radiation is greater than from external radiation and is not accounted for by the nuclear industry's International Committee on Radiological Protection (ICRP) models because of their reliance on reviewing the radiation harm from external radiation.

Don't blame the ICRP. They are just nuclear weapons industry-funded folks who don't actually understand human biology. Anyone not sticking to the nuclear industry agenda would be booted out, sooner or later. The Draft EIS is incorrect to state that the ICRP is the responsible organization (see page 4-35). The ICRP has no responsibilities what-so-ever.

An "effective" dose in rem builds into the rem estimate various multipliers that lower the rem value based on nuclear promotor's opinions of the cancer mortality effect of radiation to various parts of your body. And this is in addition to the multipliers regarding the type of radiation, the *equivalent* dose, that increase the dose from alpha radiation and neutron exposure over that of gamma exposure.

The Department of Energy tries to tell people they really don't need a healthy thyroid because people don't often die of thyroid cancer. Never mind how important a healthy thyroid is to the developing fetus/embryo in utero.

The "effective" rem dose is lowered before the ICRP's low-balled cancer mortality rate is even applied. I say this because in 1990, John W. Gofman's review of the atomic bomb effects on Japanese survivors predicted 0.0026 fatal cancers per rem, [44] which is over 4 times higher than

[44] John W. Gofman, M.D., Ph.D., Committee for Nuclear Responsibility, Inc., "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis," 1990. See more in the August 2021 Environmental Defense Institute newsletter.

the current Department of Energy fatal cancers per rem value of 0.0006. But even Gofman's prediction would underestimate the cancer risk from internal radiation, such as the iodine-129, strontium-90, cesium-137, americium-241, plutonium-239, and others, which make up most of the radiation dose from INL radiological releases.

Effective whole-body dose in rem (or millirem which is one thousandth of a rem) starts off with an estimate of absorbed dose but then keeps reducing and further reducing the estimated dose on the basis on ICRP opinion of the likelihood of that organ to cause cancer mortality based on external exposure. Then ICRP sums the reduced organ doses, again weights the organs to reduce their importance and thus the black box spits out an "effective" whole body dose.

This method for estimating the effective whole-body dose had actually originally been called **the doubly-weighted organ doses model** or construct, according to a 2017 article by Fisher and Fahey on *Appropriate Use of Effective Dose in Radiation Protection and Risk Assessment*. [45] For additional information about how misleading the "effective dose" is, read *Burdens of Proof* by Tim Connor, Energy Research Foundation, 1997 regarding the multiple failures to attribute Hanford radiological releases to the thyroid cancers in the region.

As far back as 1977, the U.S. Environmental Protection Agency recognized that continued exposure over substantial portions of a lifetime near 100 mrem per year should be avoided, read more in the TENORM report. [46] In 1977, it was assumed by the ICRP that the risk of fatal cancers was 0.0001 per rem (or 1.0E-5 per millisievert in SI units). Various radiation regulations were based on this assumption. It was recognized by 1994 that the fatal cancer risk was higher, at 0.0005 per rem. Even the ICRP currently recognizes that the fatal cancer risk from ionizing radiation is now at least 0.0006 per rem.

The 100 millirem (mrem) per year all pathways radiation dose limit is greatly emphasized by the Department of Energy as the dose they consider allowable. Air permits may be regulated by the U.S. Environmental Protection Agency or by the states, but in either case, the EPA and the state, such as the State of Idaho, will often emphasize that the state cannot regulate Department of Energy radiological emissions. In Idaho, the State of Idaho Department of Environmental Quality will issue an air permit to the Department of Energy based entirely on the DOE's stated radiological release guesses or estimates, the Department of Energy contractors monitoring or lack thereof, and the State will agree to rapid records destruction of radiation monitoring of open-air radioactive waste evaporation ponds that is fully intended to cover up any radiological releases in excess of agreed to quantities. This is precisely the situation at the Idaho National Laboratory's Advanced Test Reactor air permit with the State of Idaho. Even if the Idaho DEQ

[45] Darrell R. Fisher and Frederic H. Fahey, *Health Phys*., "Appropriate Use of Effective Dose in Radiation Protection and Risk Assessment," August 2017, PMID: 28658055 and https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5878049/

[46] National Research Council, Committee on Evaluation of EPA Guidelines for Exposure to Naturally Occurring Radioactive Materials. Evaluation of Guidelines to Exposures to Technologically Enhanced Naturally Occurring Radioactive Materials. Washington DC, National Academies Press, 1999. See page 108. https://www.nap.edu/catalog/6360/evaluation-of-guidelines-for-exposures-to-technologically-enhanced-naturally-occurring-radioactive-materials and chapters at https://www.nap.edu/catalog/6360/evaluation-of-guidelines-for-exposures-to-technologically-enhanced-naturally-occurring-radioactive-materials#toc

can, it is typically staffed by people who fall in line and go along with whatever the Department of Energy wants.

In the Department of Energy's environmental monitoring reports, it is greatly emphasized that the DOE's derived concentration standards (DCGs) are safe as they imply a dose of 100 mrem per year. By now, you may be starting to understand why 100 mrem per year would actually guarantee a health catastrophe to the health of people, especially children.

Before the late 1990s, radiation risks to females were generally treated as roughly equal to the radiation risks to males. But by the late 1990s, studies of the survivors of the atomic bombing of Japan in 1945 by the International Commission on Radiation Protection (ICRP) had higher radiation risk harm to women than men, for the same dose. And the studies showed higher cancer risk to children, especially female children, than to adults for the same dose. The National Research Council BEIR VII report issued in 2006 found even higher risks to women and children. See Institute for Energy and Environmental Research (IEER.org) report, *Science for the Vulnerable*, for additional insight. [47] (Read more in the August 2020 Environmental Defense Newsletter.)

The Department of Energy's DCG from gross alpha radioactivity in air for a 100 mrem per year dose are getting closer to the DCG for gross alpha radioactivity in air and are actually being exceeded from time to time in southeast Idaho. The most restrictive DCG is for americium-241 at 20 E-15 microcuries per milliliter (E-15 uCi/mL). With gross alpha radioactivity air usually below 4 E-15 uCi/mL, it is notable that values such as 7.2 E-15 uCi/mL occur (see Blackfoot monitoring in 2012). The increasing gross alpha radioactivity in air values are within a factor of three or four of the DCG.

There are large fluctuations in the concentrations of gross beta radioactivity in air in southeast Idaho and these fluctuations appear to be due to the INL's airborne radiological releases, despite statements to the contrary by the Department of Energy's environmental surveillance contractor. In 1998, the gross beta radioactivity in air concentrations ranged from 8 to 38 E-15 uCi/mL. In contrast, in 2002, gross beta concentrations ranged from 8 to 129.4 E-15 uCi/mL. The Department of Energy's environmental surveillance contractor continues to assert that no detected radioactivity could be attributed to the INL, stating: "In general, gross alpha and gross beta activities show levels and seasonal variations not attributable to INEEL releases. Seven of the weekly gross beta results showed statistical differences between boundary and distant locations. In all cases the differences were attributed to natural variation or to inversion conditions." And as typical of every INL annual environmental surveillance report no matter what they detect in their monitoring, they state: "In summary, the results of the monitoring programs for 2002 presented in this report indicate that radioactivity from current INEEL operations could not be distinguished from worldwide fallout and natural radioactivity in the region surrounding the INEEL."

[47] Arjun Makhijani, Ph.D., Brice Smith, Ph.D., Michael C. Thorne, Ph.D., Institute for Energy and Environmental Research, *Science for the Vulnerable Setting Radiation and Multiple Exposure Environmental Health Standards to Protect Those Most at Risk*, October 19, 2006.

The escalating levels of radioactivity in southeast Idaho are addressed by DOE's environmental surveillance program by torturing until submission any "outliers" and using radioactive blanks in order to achieve large negative values to reduce the annual averages.

With intermittent releases puffed out by INL nuclear facilities and evaporation ponds, why would anyone be surprised that the values fluctuated? But the DOE's environmental surveillance program is continually surprised by fluctuating values and it actively seeks to discard the "aberrant" samples showing high concentrations of radioactivity.

The Department of Energy embraces only the effective whole-body dose while ignoring the far higher organ doses, such as the absorbed dose to the thyroid from Idaho National Laboratory releases of iodine-131, iodine-129, americium-241 and other radionuclides.

Project Pele Draft EIS Wrong To Use ICRP's Treatment of Heritable Disease

While the International Commission of Radiological Protection (ICRP) continues to say that "Radiation induced heritable disease has not been demonstrated in human populations," Chis Busby writes that evidence of genetic effects *has* been found in humans and at very low radiation doses. [48] [49]

Robin Whyte wrote in the *British Medical Journal* in 1992 about the effect in neonatal (1 month) mortality and stillbirths in the United States and also in the United Kingdom. The rise in strontium-90 from nuclear weapons testing from 1950 to 1964 has been closely correlated, geographically, with excess fetal and infant deaths. The doses from strontium-90 due to atmospheric nuclear weapons testing were less than 50 millirem (or 0.5 millisievert), according the Chris Busby. Radioactive fallout from atmospheric nuclear weapons testing would not only include strontium-90, it would include iodine-131, tritium, cesium-137, and other radionuclides, including plutonium. [50] The extent of the nuclear weapons testing immorality continues to astound me and I applaud the work being done to reduce the risk of human extinction from nuclear weapons. [51]

The ICRP maintains that human evidence of genetic effects due to radiation does not exist. The ICRP then uses the study of external radiation on mice to estimate the heritable risks for humans. One study was conducted using internal radionuclides on mice and the study noted that

---

[48] Chris Busby, *The Ecologist*, "It's not just cancer! Radiation, genomic instability and heritable genetic damage," March 17, 2016. https://theecologist.org/2016/mar/17/its-not-just-cancer-radiation-genomic-instability-and-heritable-genetic-damage

[49] Chris Busby, Scientific Secretary, European Committee on Radiation Risk, Presentation, *Radioactive discharges from the proposed Forsmark nuclear waste disposal project in Sweden and European Law*, September 8, 2017. Online pdf 646_Nacka_TR_M1333-11_Aktbil_646_Christopher_Busby_presentation_170908

[50] R. K. Whyte, *British Medical Journal*, "First day neonatal mortality since 1935: re-examination of the Cross hypothesis," Volume 304, February 8, 1992. https://www.bmj.com/content/bmj/304/6823/343.full.pdf

[51] Jackie Abramian, ForbesWomen, "After Her Nuclear Disaster Dress Rehearsal, Cynthia Lazaroff Has A Wake-Up Call For Our World As We Sleepwalk Into Nuclear Extinction," September 21, 2021. https://www.forbes.com/sites/jackieabramian/2021/09/21/after-her-own-nuclear-disaster-dress-rehearsal-cynthia-lazaroff-has-a-wake-up-call-as-our-world-sleepwalks-into-nuclear-extinction/?sh=6a22151d62e2 Lazaroff has founded NuclearWakeupCall.Earth due to her concern over nuclear weapons. "There are nearly 13,500 nuclear warheads in current arsenals of nine nuclear-armed states. That the U.S. has more nuclear warheads than hospitals should be a wake-up call," says Lazaroff.

"detailed research on internal radiation exposure has hardly ever been reported in the past." [52] **This limited study of microcephaly in mice found that far lower doses of <u>internal radiation</u> caused the same effect as higher doses of <u>external radiation</u>.**

Project Pele Draft EIS Not Protective of Radiation Workers or the Public

Epidemiology of thousands of radiation workers found elevated cancer risk occurring at an average 200 mrem/yr. [53] An INL-specific study found radiation and nonradiation workers at the site had higher risk of certain cancers. [54] The US Nuclear Regulatory Commission and the Department of Energy maintain that their 5 rem/yr worker exposure limit is protective despite compelling scientific evidence to the contrary. [55]

The NRC cancelled funding of what would have been the first meaningful epidemiology study of health near US nuclear facilities. They claimed it would cost too much (at $8 million) and take too long. [56]

The US NRC prefers reliance on the 1980s epidemiology study that mixed children and adults and populations near and far from nuclear plants and predictably found no harm. [57] The NRC

---

[52] Yukihisa Miyachi, J-STAGE, "Microcephaly Due to Low-dose Intrauterine Radiation Exposure Caused by 33P Beta Administration to Pregnant Mice," 2019 Volume 68 Issue 3 Pages 105-113. https://www.jstage.jst.go.jp/article/radioisotopes/68/3/68_680303/_article/-char/en

[53] Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015] (And please note that studies of high leukemia risk in radiation workers and of ongoing studies to assess health effects of high and low-linear energy transfer internal radiation must also be studied in addition to this one on external radiation.)

[54] "An Epidemiology Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U.S. Department of Energy Facility, January 2005. http://www.cdc.gov/niosh/docs/2005-131/pdfs/2005-131.pdf and http://www.cdc.gov/niosh/oerp/ineel.htm and Savannah River Site Mortality Study, 2007. http: /www.cdc.gov/niosh/oerp/savannah-mortality/

[55] "Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII – Phase 2, The National Academies Press, 2006, http://www.nap.edu/catalog.php?record_id=11340 The BEIR VII report reaffirmed the conclusion of the prior report that every exposure to radiation produces a corresponding increase in cancer risk. The BEIR VII report found increased sensitivity to radiation in children and women. Cancer risk incidence figures for solid tumors for women are about double those for men. And the same radiation in the first year of life for boys produces three to four times the cancer risk as exposure between the ages of 20 and 50. Female infants have almost double the risk as male infants.

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

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

actively ignores the irrefutable studies from Germany that found increased cancer and leukemia rates of children living near each of the plants. [58] [59] [60]

The U.S. NRC knows that if people knew the harm of living near nuclear power plants, just from routine radiological emissions, it would be the end of nuclear energy.

Project Pele's Draft EIS Devotes Considerable Ink to Biased Non-factual Advertising

Project Pele's Mobile Microreactor project is a horrible idea. Transporting the spent fuel from a military mobile microreactor, **if deployed to a military base somewhere around the globe, puts every country in its transportation path at risk of an accident and at risk of becoming an "exclusion zone" where no one can live**. It puts troops and people around the globe at risk. The military knows this and probably would only deploy the reactors to some place like Alaska, if anywhere. The project is really a way to funnel government money to these reactor developers.

Project Pele Siphons Money from Real Climate Solutions

Project Pele siphons scare money away from real climate change solutions. And any meaningful increase in the use of nuclear energy would mean needing a new Yucca Mountain repository every year. [61] The Department of Energy has no repository and no repository program and the Draft EIS tries to hide this because it would reasonably mean that making plans to create far more spent nuclear fuel is of high adverse environmental impact.

Project Pele's Draft EIS Included Listing of References That Were Not Publicly Available

The Draft EIS included references that were not publicly available. The solution is not to delete the references, but to make the references available to the public so that the Draft EIS can actually be reviewed.

Several days after I sent a request to the Project Pele office and several days from after the public meeting, I was sent three of the documents referenced that should have been publicly available, including INL external report INL/EXT-21-62873. [62] Documents that are approved for

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

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

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

[61] Edited by Allison M. Macfarlane and Rodney C. Ewing, *Uncertainty Underground Yucca Mountain and the Nation's High-Level Nuclear Waste*, The MIT Press, 2006. Page 4.

[62] Idaho National Laboratory for the U.S. Department of Energy operated by Battelle Energy Alliance, *Pele Microreactor Hazards and Impacts Information in Support of National Environmental Policy Act Data Needs*, INL/EXT-21-62873, September 2021.

external release should have been available, at least, on the Idaho National Laboratory's technical document online library but were not.

Project Pele Draft EIS Relies on Lax and Ineffective Department of Energy Oversight

No U.S. Nuclear Regulatory Commission licensing will be required for any aspect of the DOD's mobile reactors.

The stated goal to operate the reactors with radiation doses "as low as reasonably achievable" is completely meaningless, especially when the military is involved. For military training, they are already releasing unnecessary radioactive material to the skies of southeast Idaho and knowingly poisoning nearby communities with deliberate, completely unnecessary radionuclide releases that they would not have their own families live in.

While the safety characteristics of any particular fuel and reactor design can affect the operating safety of the reactor, and the fuel storage system outside of the reactor can affect the safety of stored spent nuclear fuel. The reactor and the spent fuel will always be vulnerable to terrorism. Even the fission products released from a 1 to 5 Megawatt-electric (MWe or simply MW) nuclear reactor can be devastating for distances of 50 miles or more from the reactor as the radionuclides spread by the wind.

Isolation of the spent nuclear fuel will require currently unfunded repackaging of the spent fuel and unfunded development of the capability to isolate spent nuclear fuel's radioactive toxic mix of plutonium, cesium, strontium, and other radionuclides. **The capability to isolate the radionuclides from water and air for millennia currently does not exist and in reality, does not appear feasible.** The radionuclides in spent fuel remain toxic for millennia and threaten all life on the planet, although this never appears to bother nuclear proponents.

No one will have a choice of living in a community or neighborhood away from the threat of a nuclear power generating reactor catastrophe when these mobile reactors are unleashed. Citizens will have no say over the nuclear reactors moving to their communities.

DOE oversight is notoriously inadequate and often fails to protect workers, the public and the environment. This Draft EIS is pretending that Department of Energy regulatory oversight of the mobile microreactor will mean prudent, effective oversight but the history of the Department of Energy nuclear oversight proves otherwise. See the 2014 accidents at the Waste Isolation Pilot Plant (WIPP) and the 2011 plutonium inhalation event at the Idaho National Laboratory's Materials and Fuels Complex, which were both found to illuminate the fact that both DOE operations had multiple failed safety programs and failed to implement DOE regulations.

Department of Energy nuclear facilities, including its reactors, are notorious for the practice of lacking as-built drawings and of failure to maintain facility drawings as design changes are made. This alone increases the likelihood of an accident at a DOE-regulated facility. But there are other reasons for the increased accidents risks because of DOE's ability to keep plant problems secret in order to avoid public scrutiny and DOE's loose way of ignoring existing requirements.

DOE is ignoring state and federal laws regarding protections for the State of Nevada where the Yucca Mountain repository was to be sited, the State of New Mexico where the Waste Isolation Pilot Plant (WIPP) is located, and many states as DOE proclaimed that it could reclassify high-level waste to low-level waste, at whim. And the DOE is ignoring its legal settlement with the State of Idaho to remove the spent nuclear fuel stored at the Idaho National Laboratory. The Department of Energy has sought to unravel the Idaho Settlement Agreement, rather than do the work to comply with it.

DOE's failure to adequately design facilities for and inspect those facilities and the spent nuclear fuel they hold is long standing and has required state and federal intervention to get DOE to begin to address its problems. EBR II spent nuclear fuel corroded in an INL spent fuel pool while the DOE had not inspected the fuel or taken timely actions to address the deteriorating fuel, even as the strontium levels workers were exposed to were recognized. DOE's messes often require federal and state intervention, but by then, the messes are so large that that little cleanup is accomplished even with billions of dollars of cleanup money annually, for the INL, Hanford, Savannah River Site and others.

Reliance on institutional controls to forever repackage spent nuclear fuel in Idaho violates NEPA. There is no repository despite winks and hints that Yucca Mountain would be opening soon. The consequences of spent nuclear fuel blowing in the wind are devastating, cannot be remediated and the importance of our land and our lives is frequently diminished because we live in the "low population zone."

DOE ignores scientific evidence, the diverse compelling human epidemiology of more health harm from radiation so that it can avoid costs and inconvenience of tighter worker and public radiological protection

Workers harmed by the Department of Energy's operations are often denied illness compensation by the Energy Employee Occupational Illness Compensation Program while the program slowly conducts investigations into the inadequacies of the INL radiological protection programs.

Historical Proof of Inadequate Department of Energy Regulatory Oversight

The Department of Energy's track record, specifically at the Idaho National Laboratory's Materials and Fuels Complex, is to cover up safety deficiencies, especially those deficiencies associated with offsite radiation dose to the public. At MFC, seismic studies were "lost" for years, the safety analysis documentation remained unfinalized for years because no one could agree on how to finagle the radiation doses to be low enough, the DOE officially approved safety documentation as 10 CFR 830 compliance when it knew the documentation was not at all compliant.

Then in 2005, Battelle Energy Alliance took over the contract, pointed to the skeleton in the closet, and DOE admitted that the nuclear facility safety documents were not 10 CFR 830 compliant. DOE agreed that it would take many more years to actually make the safety bases for MFC anywhere near code-of-federal regulations compliant.

Despite the Department of Energy signing off on the Materials and Fuels Complex safety bases as code-of-federal regulations compliant about 20 years ago, when it was not compliant, the DOE also bolstered its argument by saying nothing bad was going to happen because of the strong safety culture at MFC.

But at INL's MFC, the condition of safety processes, safety equipment, and safety attitude was still so poor that managers at MFC ignored written warnings of high hazard to workers and MFC managers directly caused the plutonium inhalation event in 2011. After conducting 6 years of safety bases updates, the MFC managers actively ignored repeated warnings of worker radiological safety risks – and the preventable accident was not prevented and 16 workers (and actually more) were harmed by the 2011 plutonium inhalation event at MFC.

And the best the contractor, Battelle Energy Alliance, could do was blame workers despite even the DOE investigation report blaming management. The contractor also produced fraudulent lung count results to lie about the magnitude of the accident.

And because it was clearly Battelle Energy Alliance management's fault and there were multiple inadequate safety programs, BEA was quick to (1) falsify the urine and fecal sample results and the lung count results and (2) to attempt to coerce workers to sign that they had received information about their radiation dose when in fact, they hadn't. Radiation dose information from DOE contractors is not to be believed when high doses would get the contractors hands slapped (with fines). BEA blamed the workers even when DOE's own accident investigation found no fault by the workers who were contaminated.

And these events follow years of hiding adverse findings about seismic safety at MFC and the DOE's other test reactor, the Advanced Test Reactor as well as other safety problems that often were not reported.

There may be one agency worse at nuclear reactor safety regulation than the U.S. Nuclear Regulatory Commission and that is the Department of Energy, which has set its sights on overseeing safety for the mobile microreactor presumably because of military missions that aren't being discussed. And now we have the U.S. Nuclear Regulatory Commission Chairman Kristine Svinicky actually bragging about how the NRC is hiring former Department of Energy personnel and placing them in high positions in the NRC.

Project Pele Draft EIS Treatment of Cumulative Impacts Is Inadequate

The Draft EIS cumulative impacts evaluation is arbitrary and misleading and fails to address the buildup of radionuclides in our air, water and soil and fails to acknowledge the inadequacy of the environmental surveillance programs.

People might eventually catch on that Idaho is getting more and more radiologically polluted — but with all the deliberate omissions and dis-information, probably not before it's too late.

Table 6 shows rapidly escalating INL radiological releases, yet the past releases have not been fully disclosed, nor has the needed epidemiology been conducted, having been deemed unnecessary based on failure to disclose the full extent of radiological releases.

Table 6. Estimated annual air pathway dose (mrem) to Idaho communities from normal operations to the maximally exposed offsite individual from proposed projects, including the estimated dose from expanding capabilities at the Ranges based on DOE/EA-2063.

Current and Reasonably Foreseeable Future Action	Estimated Annual Air Pathway Dose (mrem)
National Security Test Range	0.04[e]
Radiological Response Training Range (North Test Range)	0.048[d]
Radiological Response Training Range (South Test Range)	0.00034[a]
HALEU Fuel Production (DOE-ID, 2019)	1.6[a]
Integrated Waste Treatment Unit (ICP/EXT-05-01116)	0.0746[h]
New DOE Remote-Handled LLW Disposal Facility (DOE/ID 2018)	0.0074[a]
Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling (DOE/EIS 2016)	0.0006[c]
TREAT (DOE/EA 2014)	0.0011[a]
DOE Idaho Spent Fuel Facility (NRC, 2004)	0.000063[a]
Plutonium-238 Production for Radioisotope Power Systems (DOE/EIS 2013)	0.00000026[b]
Total of Reasonably Foreseeable Future Actions on the INL Site	1.77[g]
Current (2018) Annual Estimated INL Emissions (DOE2019a)	0.0102[f]
Total of Current and Reasonably Foreseeable Future Actions on the INL Site [**DOE WOULD INCREASE INL'S AIRBORNE RELEASES BY OVER 170 TIMES**]	1.78[g]

Table notes:

a. Dose calculated at Frenchman's Cabin, typically INL's MEI for annual NESHAP evaluation.

b. Receptor location is not clear. Conservatively assumed at Frenchman's Cabin.

c. Dose calculated at INL boundary northwest of Naval Reactor Facility. Dose at Frenchman' Cabin likely much lower.

d. Dose calculated at INL boundary northeast of Specific Manufacturing Capability. Dose at Frenchman's Cabin likely much lower.

e. Sum of doses from New Explosive Test Area and Radiological Training Pad calculated at separate locations northeast of MFC near Mud Lake. **Dose at Frenchman's Cabin likely much lower. PLEASE NOTE THAT THE PUBLIC AT MUD LAKE IS CLOSER TO THE RELEASE THAN TO FRENCHMAN'S CABIN.**

f. Dose at MEI location (Frenchman's Cabin) from 2018 INL emissions (DOE 2019a). The 10-year (2008 through 2017) average dose is 0.05 mrem/year. **PLEASE NOTE THAT MANY RADIOLOGICAL RELEASES ARE IGNORED AND NOT INCLUDED IN THE RELEASE ESTIMATES IN NESHAPS REPORTING.**

g. This total represents air impact from current and reasonably foreseeable future actions at INL. It conservatively assumes the dose from each facility was calculated at the same location (Frenchman's Cabin), which they were not.

h. Receptor location unknown, according to the Department of Energy, the agency that is supposed to know the receptor location.

The Draft EIS fails to address the existing contamination levels in communities and drinking water. The Draft EIS fails to acknowledge that current INL radiological airborne monitoring is woefully inadequate because (1) emissions from the INL are usually based on estimates and not the reality, (2) the current environmental monitoring programs are designed to be inadequate, (3) the reports are tardy by nearly a year and are increasingly tardy, and (4) the quarterly and annual environmental monitoring reports are not reliable and are prone to "lost samples" or "air monitor not functioning" excuses.

Historical and current radiological monitoring programs omit INL releases, and are designed to hide, not reveal, the level and the source of radiological contamination.

The Draft EIS fails to truthfully discuss the multitude of INL CERCLA cleanup sites that cannot be released in 2095, as it goes about creating more CERCLA sites at the INL.

DOE expects to continue increasing the "normal background" radiation levels both on and off the Idaho National Laboratory site until our communities all receive unhealthy levels of radionuclide ingestion and inhalation.

"Normal background levels" are already elevated above what was naturally occurring and continue to rise. By selecting a contaminated area to determine "normal background," it appears to me that this is how some radiological facilities can claim to operate within "normal expected background" no matter what radiological release incident just occurred.

The DOE continues to not disclose what it considers "normal background levels" on and off the INL or to trend how the "normal background levels" have changed over time.

The INL's past practices of inflating "normal background levels" meant that employees worked in contaminated areas that when assessed independently during CERCLA cleanup investigations in 1995, these facilities had to be disposed of as radiological waste. Various INL areas had been highly contaminated for decades, and yet not monitored or controlled as such. See the Administrative Record for CERCLA cleanup at the Idaho National Laboratory at https://ar.icp.doe.gov .

Project Pele Draft EIS Does Not Adequately Characterize Past INL Radiological Releases

At the Idaho National Laboratory, formerly the Idaho National Engineering and Environmental Laboratory, the Idaho National Engineering Laboratory, and the National Reactor Testing Station, historical releases were monitored yet not actually characterized as to what and how many curies were released. When asked by the governor in 1989 to provide an estimate of the radionuclides released from routine operations and accidents, the Department of Energy issued the "INEL Historical Dose Evaluation." [63] [64] It has been found to have underestimated serious releases by sometimes 10-fold. Furthermore, the past environmental monitoring used all

[63] US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html

[64] Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense-institute.org/publications/EDIXConsentFinal.pdf

along to claim no significant releases had occurred were not used in the INEL Historical Dose Evaluation. The environmental records that could have been used against the Department of Energy or its contractors were destroyed.

The Center for Disease Control commenced reviewing the DOE's radiological release estimate that were the basis for denying that any epidemiological study was needed in Idaho communities near the site. The CDC in 2007 issued its review of the 1989 study and found many releases, some of the largest ones, underestimated by a factor of 7. [65] Errors causing underestimation of the INL releases continue to be found as energy worker compensation studies have continued. The INL was originally called the National Reactor Testing Station, later called the Idaho Engineering Laboratory, and then the Idaho National Engineering and Environmental Laboratory before being named the Idaho National Laboratory.

The estimates of the 1991 INEL Historical Dose Evaluation [66] continue to be found in error and to significantly underestimate what was released. [67] [68] [69] Theoretical and idealized modeling of the releases were used for estimating the releases for the 1991 INEL HDE without using environmental monitoring to confirm the estimates — except for the 1961 SL-1 accident in which the environmental monitoring showed that the **theoretical modeling had underestimated the release**. In fact, many of the environmental monitoring records were deliberately destroyed before the 1991 report was released. [70] INL airborne releases included a long list of every fission product that exists including iodine-131, long-lived I-129, tritium, strontium-90, cesium-37, plutonium, and uranium.

The source documents for the INEL HDE are in fact part of the Human Radiation Experiments collection of DOE documents. Why? Because there was enough information available for the DOE to know that showering nearby communities and their farms and milk cows with radiation really was likely to be harmful to their health. The INL (formerly the NRTS, INEL and INEEL) takes up dozens of volumes of binders in the DOE's Human Radiation

---

[65] Center for Disease Control, CDC Task Order 5-2000-Final, Final Report RAC Report No. 3, by Risk Assessment Corporation, October 2002. https://www.cdc.gov/nceh/radiation/ineel/to5finalreport.pdf

[66] US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis-collection/index.html p. 40

[67] Risk Assessment Corporation, "Identification and Prioritization of Radionuclide Releases from the Idaho National Engineering and Environmental Laboratory," October 8, 2002, https://www.cdc.gov/nceh/radiation/ineel/to5finalreport.pdf See p. 117, 118 for SL-1.

[68] SENES Oak Ridge, "A Critical Review of Source Terms for Select Initial Engine Tests Associated with the Aircraft Nuclear Program at INEL," Contract No. 200-2002-00367, Final Report, July 2005. http://www.cdc.gov/nceh/radiation/ineel/anpsourceterms.pdf See p. 4-67 for Table 4-13 for I-131 estimate for IET's 10A and 10B and note the wrong values for I-131 are listed in the summary ES-7 table.

[69] CDC NIOSH, "NIOSH Investigation into the Issues Raised in Comment 2 for SCA-TR-TASK1-005," September 3, 2013. https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-inlspcom2-r0.pdf See p. 3 stating various episodic releases underestimated by the INEL HDE: IET 3, IET 4 and IET 10.

[70] Chuck Broscious, Environmental Defense Institute Report, "Destruction and Inadequate Retrieval of INL Documents Worse than Previously Reported," Revised September 1, 2018. http://environmental-defense-institute.org/publications/DocDestruction.pdf

Experiments collection and that isn't including the boxes of documents no one can get access to or the records that were deliberately disposed of. [71]

DOE and the CDC still not disclosing the full extent of historical releases, including the magnitude of the 1961 SL-1 release which affected communities including Atomic City and Mud Lake.

Communities near the INL, include Atomic City to the south and Mud Lake to the north and Osgood west of the MARVEL project have been adversely affected already and isn't the harm done to those poor people enough?

The Atomic Energy Commission, predecessor of the Department of Energy, 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. [72] The derived release fractions based on trying to fit the AEC claims to a computer derived release fraction show that the AEC claimed low curie amount releases are fiction. Never before or since has a reactor fuel had such 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

[71] February 1995, the Department of Energy's (DOE) Office of Human Radiation Experiments published *Human Radiation Experiments: The Department of Energy Roadmap to the Story and Records* ("The DOE Roadmap"). See also the INL site profile on Occupational Environmental Dose: http://www.cdc.gov/niosh/ocas/pdfs/tbd/inl-anlw4-r2.pdf) Most of the documents in the DOE's Human Radiation Experiments collection remain perversely out of public reach. Documents are said to be stored at the INL site, out of state in boxes, [Good luck with getting these documents via the Freedom of Information Act] and in the National Archives. I found that retrieving documents from the National Archive would require extensive fees for searches and copying. Where is the transparency in creating a document collection that cannot be viewed by the public?

[72] 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

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. [73] [74] [75]

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)

Draft EIS Fails to Acknowledge that the Department of Energy is Still Lying About the Causes and Consequences of the 1961 SL-1 Accident

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. [76] [77] [78] [79]

On page 3-44 of the Draft EIS, the EIS displays utter lack of understanding of the causes of the 1961 Stationary Low-Power-1 reactor accident.

> "This section discusses the accident history at the INL Site specific to nuclear reactor accidents. Accident details are only presented when the accident injured personnel or involved a gas-cooled reactor. One event included an incident involving fuel melting at the EBR-I, but the event did not injure personnel and EBR-I was a sodium-cooled reactor.

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

[74] 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

[75] 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

[76] 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

[77] 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

[78] 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

[79] 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

> The only nuclear reactor accident that occurred at the INL Site (called the National Reactor Testing Station at the time of the accident) and that met the above criteria involved the Stationary Low-Power Reactor Number One (SL-1) in 1961. The SL-1 reactor was a U.S. Army experimental nuclear power reactor. The purpose of the reactor was to provide electrical power and heat for remote military facilities. The SL-1 reactor generated electricity for the first time on October 24, 1958. The reactor would be operated for periods ranging between 1 and 6 weeks and then shut down for repairs and installation of improvements. During a shutdown that began on December 23, 1960, the control rods were disconnected from the control rod drive mechanisms. In the evening of January 3, 1961, the crew was to reconnect the control rods to the control rod drive mechanisms. While attempting to reconnect the control rods, the center control rod was improperly withdrawn and the reactor underwent a steam explosion and meltdown. Details of the accident are described in the report *Proving the Principle: A History of the Idaho National Engineering and Environmental Laboratory, 1949-1999* (Stacy, 2000). Some emergency planning had been done for the National Reactor Testing Station but the plans had not considered an event like the SL-1 accident. Considerable improvements were made in emergency planning as a result of the SL-1 accident. Current emergency planning for DOE facilities is under the direction of DOE Order 151.1D (DOE, 2016e)."

The fact that the SL-1 accident was caused by extremely poor safety oversight by the Department of Energy (then called the Atomic Energy Commission) and that mismanagement allowed poor design of safety features, in particular by allowing excessive reactivity insertion from withdrawal of a single control rod, allowed poor fabrication of the control rods and other parts of the reactor design, allowed the reactor to be operated despite complete absence of accident analyses during shutdown operations, allowed the reactor to continue operations despite an extensive history of control rod sticking, both during reactor operations and also during shutdown manipulations. The DOE (AEC) allowed SL-1 reactor operations to continue despite fuel swelling so severe that the fuel could not be removed and so fuel examinations simply ceased. The DOE (AEC) had verbally authorized, without documenting any safety evaluation, higher power operations than the existing safety documentation addressed.

That this Project Pele Draft EIS has displayed such a limited understanding of the cause of the SL-1 accident, stating that they conclude that the main lesson from SL-1 was that of not adequately addressing emergency preparations underscores the mistake it is to have the Department of Energy oversee any aspect of safety regarding an uncontained, unfiltered, and inadequately staffed mobile microreactor at a military base or in Idaho.

The extensive history of control rod sticking was downplayed and actually dismissed by the AEC as the cause of the SL-1 accident prior to investigation of the core internals. The reason was that the control rod sticking, and this included during shutdown operations and material swelling had greatly increased in the last few weeks of SL-1 operation. Virtually never discussed is the finding that severity of the SL-1 accident was increased 10-fold due to the reduced heat transfer from the fuel caused by having allowed the coolant water to become greatly subcooled and there was no safety study prior to the accident that had been conducted on this and no stated temperature limit while conducted core changes. The lack of responsible safety oversight by the

Department of Energy, which was shortcutting funding for adequate staffing of the facility in addition to multiple other safety shortcuts caused the accident but the lies about the causes of the SL-1 accident continue to this day, 60 years later.

As anyone who have worked the physically demanding tasks over a reactor top understands, the 84-lb control rod that was stuck, was jerked free, and it was all over. The managers of the SL-1 reactor understood so little about the hazards at the reactor that they insisted that it was not possible that the reactor had caused the damage and they insisted that someone had set a chemical explosive in the facility. Then it was months after the accident that they would learn that the reactor vessel had jumped 9 feet. Thus, there was no need to cut the piping in order to remove the vessel. The piping was already sheared.

Regarding the SL-1 accident, this Draft EIS has referenced a single document, *Proving the Principle: A History of the Idaho National Engineering and Environmental Laboratory, 1949-1999* by S. Stacy, an inadequately reviewed and non-technical document that incorrectly states the distances of rod lift height and includes non-factual propaganda to insinuate that the accident was deliberate. The Project Pele Draft EIS has demonstrated that the Department of Energy does not have the capability or necessary aptitude for overseeing reactor safety.

Certainly, the emergency planning for the SL-1 was inadequate. The unsafe conditions at the SL-1 reactor included having a total of three crewman, alone at an isolated facility at the INL. There was no one to even call for assistance. There was no one to open the locked gate outside the facility. There was no one at the reactor control room to monitor reactivity changes or radiation levels. There was inadequate radiation monitoring equipment. Recent accidents at the INL indicate that little improvement has been made in emergency planning, pertaining to waste drum explosions and inadequate radiological planning and safety. But the cause of the SL-1 accident, having not been grasped by the best and the brightest individuals who have authored or reviewed the Draft EIS for the mobile microreactor displays their tremendous ignorance of reactor safety issues and this alone is proof that the Department of Energy is incapable of responsible safety oversight of any reactor.

The DOE has lied to the public about the SL-1 accident and still publishes false information about the SL-1 accident, and the Project Pele Draft EIS is doubling down on the deception. Seed 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

Reactor fuel melting that resulted in large radiological releases such as have occurred at other DOE facilities such as the Department of Energy's Savannah River Site should have also been addressed, even if the accidents were largely covered up by the Department of Energy.

Project Pele Draft EIS Ignores Repeated INL Accidents Having Inadequate Emergency Response

The draft EIS fails to acknowledge decades of repeated inadequate emergency preparation for site emergencies in terms of training, decontamination, radiological medical treatment, inadequate emergency radiological monitoring during and after the emergency.

Not only was the emergency response to the Department of Energy WIPP accidents inadequate in 2014, and the Department of Energy plutonium inhalation event at INL in 2011, it was inadequate at the INL's Radioactive Waste Management Complex in 2018 when, due to deliberate actions to ignore the known contents of waste drums, four waste drums forcefully expelled their powdery contents within a fabric enclosure. The fire department responded to the event due to activation of a fire alarm and the fire department had no idea a radiological event had occurred. The radiation constant air monitors did not alarm and the facility had no available radiological support with knowledge of what might have happened in the facility and had no radiological support staff with self-contained breathing apparatus training – because it was assumed that no matter the unreasonable risks they were taking, there would not be an event.

In fact, the Department of Energy actually avoids any oversight or evaluation of the emergency preparedness of facilities that it recognizes have large deficits. It is for this reason that the Department of Energy has long avoided any oversight assessment of the INL's Materials and Fuels Complex emergency preparedness.

The draft EIS fails to acknowledge that the routine and emergency monitoring will ignore the uranium-235 released by the accident as well as inadequate actinide (plutonium, americium, curium, etc.) monitoring because of intentional environmental monitoring inadequacies to avoid implicating the INL as the source of the contamination. The decay products from plutonium-240 and uranium-236 are thorium decay progeny which the environmental monitoring falsely asserts are from naturally occurring thorium-232. The elevated levels of uranium-234, uranium-235, uranium-236 are intentionally not delineated by the specific isotope so the DOE can falsely claim that the uranium is naturally occurring.

From the 1961 SL-1 accident where radiological monitoring was especially inadequate for emergency responders, to the 2011 plutonium inhalation accident caused by management failure to heed repeated warnings of high worker risks and the multiple failures that caused the event and the multiple failures in responding to the event, to the 2018 four drums of waste that exploded and fire fighters, once again, responded without support of adequate training or radiological support personnel.

The Draft EIS fails to acknowledge that the lack of proper decontamination facilities means that an injured worker is going to radiologically contaminate medical facilities in Idaho Falls.

Project Pele Draft EIS Implies DOE Will Comply with Department of Energy Regulations but Ignores DOE's Lack of Compliance

From the DOE's nuclear weapons testing at the Nevada Testing Station, in the Pacific islands, and elsewhere, the DOE told people they were safe and then covered up epidemiology that showed people had increased rates of leukemia and cancer from the fallout. The DOE

claimed its releases from the INL were too low to cause harm, but when asked to state what it had released to the Idaho skies, the DOE didn't know. Then when the DOE issued a report of estimated releases through its history to 1989, reviews by the Center for Disease Control found the releases had been significantly underestimated. It is also documented that many environmental monitoring records were subsequently destroyed, which would have indicated more contamination that the DOE wanted others to know about. The DOE has lost or destroyed worker radiation dose records throughout its history when the records would show elevated doses. The DOE uses secrecy, document destruction, omission of key information during public presentations, and adherence to providing false information about its plans, and breaks its commitments. The DOE would not have conducted any cleanup at all if other federal agencies had not been able to say that hazardous chemical laws needed to apply to DOE sites, allowing CERCLA cleanup investigations. The DOE has systematically lied about the pervasive long-lived radionuclides at sites likes the INL, omitting what it well knew, that uranium, plutonium and americium were included in soil and perched water. It omitted this information so well that the DOE and the U.S. Geological Survey have often, without justification, omitted the reporting of extensive radiological contamination at the INL, later found by CERCLA investigations.

DOE lied about its radiological releases decades ago from nuclear weapons testing, reactor testing, and reactor accidents and other operations and it continues to misinform the public about its past and about current contamination.

The Department of Energy has a long history of telling workers they are protected from radiological hazards — but workers got illnesses. Nationwide, billions of dollars of illness compensation have been paid out under the Energy Employee Illness Compensation Program Act (EEICOPA) even with two-thirds of INL claims denied.

The Department of Energy has a long history of saying its radiological releases were too small to affect the public — but studies found that the public had higher infant mortality and certain cancers and leukemia.

The Department of Energy has rightfully earned and continues to earn the public's distrust. The Department of Energy must not be allowed to unilaterally reclassify HLW waste because the DOE cannot be trusted to comply with its own regulations should its regulations or DOE Orders be deemed inconvenient or costly.

The Idaho National Laboratory along with other Department of Energy operations at Hanford and Rocky Flats have a long tradition of falsification of lung count results. The last situation requiring lung counts, reported that lung counts were not required, despite lung counts being required. Workers are not informed that their lung count results can be manipulated in order to obtain lowered intake results. I have personally seen irrefutable evidence of fraudulent lung count report manipulations by the Idaho National Laboratory.

DOE Actively Seeks to Undermine State and Federal Laws

The Draft EIS implies by listing various laws that the Department of Energy complies with state and federal laws and complies with meaningful DOE regulations and Orders.

In fact, DOE has for years sought to send radioactive waste to WIPP despite laws prohibiting it.

DOE has for years been seeking consolidated interim storage of spent nuclear fuel and in quantities prohibited by law because the NWPA laws sought to prevent DOE from simply providing above ground storage rather than obtaining permanent disposal.

The DOE has been recognized by the courts as modifying it radioactive waste DOE Orders at whim, which means no EIS that cites a DOE Order can be relied upon.

The DOE has ignored federal law and state legal agreements by unilaterally declaring it can declare its high-level waste is now low-level waste, and with vastly reduced disposal limitations.

The DOE has made a practice of not referring to the sodium-bearing waste at the INL as high-level waste, despite not having made any steps to officially reclassify it as such — because of the legal challenges this may bring. But not calling the waste high-level waste, it can misinform citizens and State of Idaho officials, however.

The Draft EIS Fails to Acknowledge that the DOE has a Record of Not Disclosing Safety Problems Publicly or Accurately and Usually Fails to Publish the Public Comment Submittals

The Department of Energy routinely makes its unusual occurrence reports and other safety information impossible or difficult for the public to obtain. If reported, the public can expect months of delay before information is available publicly.

The DOE has also conducted numerous public comment opportunities, only to refuse to publish those public comments such as the consent-based interim spent nuclear fuel storage meetings conducted a few years ago. [80] [81]

The author, Tami Thatcher, has a degree in Mechanical Engineering from the University of Idaho and worked as an Advisory Engineer for the Idaho National Laboratory, specializing in nuclear reactor risk assessment and nuclear facility safety analyses and also maintained radiation worker certification. She has been studying and writing about issues related to the Idaho National Laboratory's extensive radiological contamination of southeast Idaho since 2007, including issues relating to environmental monitoring, aquifer contamination, CERCLA cleanup, nuclear facility safety, radiation worker protection, and radiation health issues.

[80] Before ending the consent-based siting effort, information found about the Department of Energy's consent-based siting at www.energy.gov/consentbasedsiting and its Integrated Waste Management and Consent-based Siting booklet at http://energy.gov/ne/downloads/integrated-waste-management-and-consent-based-siting-booklet

[81] Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense-institute.org/publications/EDIXConsentFinal.pdf