Public Comment Submittal on the Department of Energy Scope of an Environmental Impact Statement for a Versatile Test Reactor, ID: DOE-HQ-2019-0029-0001

Comment submittal by Tami Thatcher, September 2, 2019

Public Comment Period August 5 to September 4, 2019, [1] send comments to VTR.EIS@nuclear.energy.gov

The Department of Energy has announced a public scoping period for DOE/EIS-0542, which evaluates the potential environmental impacts of alternatives for a versatile reactor-based fast-neutron source facility (VTR) and associated facilities for preparation, irradiation, and post-irradiation examination of test and experimental fuels and materials. The DOE/EIS-0542: Notice of Intent is at https://www.energy.gov/nepa/downloads/doeeis-0542-notice-intent

The VTR would be a small (approximately 300 megawatt thermal), sodium-cooled, pool-type, metal-fueled reactor based on the GE Hitachi PRISM power reactor. DOE projects approval for the start of operations to occur as early as the end of 2026.

Under the INL VTR Alternative, DOE would site the VTR at the Materials and Fuels Complex (MFC) at INL and use existing hot-cell and other facilities at the MFC for post-irradiation examination. This area of INL is the location of the Hot Fuel Examination Facility (HFEF), the Irradiated Materials Characterization Laboratory (IMCL), the Experimental Fuels Facility (EFF), the Fuel Conditioning Facility (FCF), and the decommissioned Zero Power Physics Reactor (ZPPR).

The Department of Energy's Environmental Impact Statement (EIS) must evaluate its alternatives for a versatile reactor-based fast-neutron source facility and associated facilities with more realistic assumptions regarding the continued buildup of radionuclides in our food, water and air. The EIS must evaluate not only the least severe accidents that are considered "credible" but also the severe accidents that it may deem in theory to be "incredible." And the EIS cannot continue to poison workers and the public, and especially our children but deny the harm by using outdated and wrong radiation health models. The Department of Energy must address the existing buried waste at the INL as well as the high-level waste that DOE intends to "reclassify" so that it never leaves Idaho. The DOE must address its unsolved spent nuclear fuel and radioactive waste problems in the EIS as well as the creation of more spent fuel and radioactive waste by the VTR.

The Department of Energy includes as "Potential Environmental Issues for Analysis" the following (this is a partial list):

- Item 1: "Potential effects on public health from exposure to radionuclides under routine and credible accident scenarios including natural disasters: Floods, hurricanes, tornadoes, and seismic events."

[1] ID: DOE-HQ-2019-0029-0001. Department of Energy: Notice of Intent To Prepare an Environmental Impact Statement for a Versatile Test Reactor. https://www.regulations.gov/docket?D=DOE-HQ-2019-0029

- Item 2: “Potential impacts on surface and groundwater, floodplains and wetlands, and on water use and quality.”
- Item 3: “Potential impacts on air quality (including global climate change) and noise.”
- Item 4: “Potential impacts on waste management practices and activities.”

My comments for adding necessary depth and realism for each of these are provided below.

Item 1: “Potential effects on public health from exposure to radionuclides under routine and credible accident scenarios including natural disasters

For Item 1, first of all, many of the reactor meltdowns that have occurred worldwide have been deemed “incredible.” Three Mile Island Unit 2’s meltdown in 1979 was incredible. The Chernobyl nuclear power plant accident in the Ukraine was incredible. The Fukushima Daiichi Nuclear Power Plant meltdowns in Japan were incredible. So, for the Department of Energy to address only those reactor accidents that it deems “credible” is to leave out the most important severe reactor accidents and their horrendous consequences. The assessment of which accidents are “credible” has all too often been indefensibly overly optimistic because of the many ways that an accident can be caused.

The EIS must include severe accident consequences even if DOE considers the accidents to be incredible. And while the VTR is characterized as a “small” reactor (approximately 300 megawatt thermal), other DOE materials testing reactors have posed high hazards because of the high enrichment and high burnup, the lack of a containment, lack of filtered release, the lack of well-designed and well-tested safety systems, and the uniqueness of the design that makes design and computational errors harder to detect. The EIS must also include the very lax regulatory environment of the Department of Energy which is even worse than the U.S. Nuclear Regulatory Commission. If this reactor was designed to proper seismic design standards for a reactor, it would be the first time in the history of the INL that this would be the case. Even when adequate seismic design hazards are identified, it requires more diligence than the DOE can muster to actually ensure that all safety equipment and structures are actually adequately designed to meet the designated seismic criteria. The EIS cannot simply assume that all equipment will be adequately designed.

Second, when the severe reactor accidents for the VTR are considered, the economic consequences must also be included. In the past, the DOE has left out consideration of economic consequences of an accident because they knew how unpopular their projects would be if the public understood that they were literally risking the farm, their property and their livelihoods as well as their lives and health and the health of their children. And it is not acceptable to simply assume that people evacuate and don’t eat contaminated food, drink contaminated water and breath contaminated air after the accident.

Third, the radiation health models that ignore non-cancer health effects, that underestimate the cancer and non-cancer health effects are known to underestimate the health harm of routine and accident ionizing radiation exposure. The inadequacy of the health modeling could have been improved by conducting epidemiology at U.S. nuclear power plants, but no funding for the study was provided.

While the penetrating power of an alpha particle is low, the energy imparted to tissue when in the body is very high. Many alpha emitters such as plutonium and uranium decay not only by alpha decay but also by beta and gamma emission. Beta particle monitoring is often particularly inaccurate. Gamma ray monitoring is based on badges worn on the collar but the source of radiation may be beneath the workers feet as is the case when workers work over spent nuclear fuel pools. Workers at INL have also had neutron dose from the Materials Test Reactor neutron beam ad from concentrated fissile materials. Historical monitoring of neutron dose was inadequate.

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

- The cancer risk is not reduced when radiation doses are received in small increments, as the nuclear industry has long assumed. [2]
- 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. [3]
- 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.

[2] 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.

[3] 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.

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 were citizens were exposed to DU. There are accounts to suggest that the actual number of birth defects resulting from the World War II atomic bombs dropped on Japan and by weapons testing over the Marshall Islands have been underreported. The Department of Energy early on made the decision not to track birth defects resulting from its workers or exposed populations. But people living near Hanford and near Oak Ridge know of increased birth defects in those communities.

In radworker training, there may be discussion of the fact that international radiation worker protection recommends only 2 rem per year, not 5 rem per year. There is no mention of recent human epidemiology showing the harm of radiation is higher than previously thought and at low doses, below 400 mrem annually to adult workers, increased cancer risk occurs.

There is no mention of the oxidative stress caused as ionizing radiation strips electrons off atoms or molecules in the body at energies far exceeding normal biological energy levels. And there is no discussion explaining the harm of inhaling or ingesting radioactive particles of fission products such as cesium-137, strontium-90, or iodine-131; of activation products such as cobalt-60; or transuranics such as plutonium and americium; or of the uranium itself.

The volatile or gaseous radionuclides, some of which can't be contained even with air filters — include technetium-99, tritium, carbon-14, iodine-129, argon-39, krypton-85, and radon-222 as the volatile radionuclides dominating the proposed Greater-Than-Class C radioactive waste disposal for the Andrews County, Texas facility. Often radionuclides with low curie levels dominate the disposal harm. **So, when DOE states an overall curie level without stating which radionuclides and their specific curie levels, neither the radiotoxicity nor the longevity of the radioactive waste has been indicated.**

Uranium and thorium and their decay products may be natural but in concentrated form in drinking water, soil or air, they are harmful. Radioactive waste disposal classification has often left out concentration limits for these radionuclides. Massive amounts of depleted uranium are considered Class A radioactive waste but won't be safe at the end of 100 years but will actually be more radioactive through decay progeny.

Plutonium-238, plutonium-239, and other transuranic radionuclides in radioactive waste in what appear to be low curie amounts can pose health harm and often dominant radionuclide ingestion doses from migration of the waste to groundwater. GTCC waste includes large amounts of transuranic waste. Only defense-generated transuranic waste approved for acceptance at WIPP can be shipped to WIPP for disposal.

Cancer rates for uranium are typically based on natural forms for uranium and not chemically altered forms that may be more soluble in the human body. The internal radiation cancer harm is not based on solid epidemiological evidence and there are experts from Karl Z. Morgan to Chris Busby to Jack Valentine that understand that the accepted models may understate the cancer harm by a factor of 10, 100 or more. The nuclear industry continues to ignore the epidemiological evidence that implies tighter restrictions are needed. As you see the cancer mortality risk per picocurie in Table 9, you have to wonder why the disposal of uranium was unregulated and later inadequately regulated for many decades. Uranium dispersal from reactor accidents is typically ignored.

Table 9. Survey of selected radionuclide inhalation and ingestion lifetime cancer mortality risk.

Radionuclide	**Lifetime Cancer Mortality Risk per pCi** **Inhalation**	**Lifetime Cancer Mortality Risk per pCi** **Ingestion**	**Notes**
Cesium-137	8.1E-12	2.5E-11	Strong gamma emission used in aerial surveys. Mimics potassium in the body. Studies of the Chernobyl accident indicate that it is associated with increased risk of blood disorders, cardiac arrhythmias, autoimmune diseases, neuromuscular diseases, reproductive problems and cancer.
Stronium-90	1.0E-10	7.5E-11	Mimics calcium in the body and is a tooth and bone seeker.
Iodine-129	6.2E-12	3.3E-11	Long-lived and mobile fission product found to dominate long-term harm when inhaled or ingested. Collects in thyroid
Technetium-99	1.3E-11	2.3E-12	Long-lived and mobile fission product found to dominate long-term harm when inhaled or ingested. Tc-99 collects in thyroid

Radionuclide	Lifetime Cancer Mortality Risk per pCi Inhalation	Lifetime Cancer Mortality Risk per pCi Ingestion	Notes
Americium-241	2.4E-8	9.5E-11	Bone seeker, see plutonium-239. Don't be misled by the 432 year half-life because it has many longer lived decay progeny.
Curium-242	1.4E-8	3.2E-11	See plutonium-239
Curium-242	2.3E-8	7.5E-11	See plutonium-239
Neptunium-237	1.5E-8	5.8E-11	See plutonium-239
Plutonium-238	3.0E-8	1.3E-10	See plutonium-239
Plutonium-239	2.9E-8	1.3E-10	ANL fact sheet says laboratory studies with experimental animals exposed to high levels of plutonium can cause decreased life spans, diseases of the respiratory tract, and cancer. Once in the blood stream, plutonium is highly retained in the body, especially in bone and the liver. Plutonium is associated with cardiovascular disease, leukemia, lung cancer, breast cancer, childhood cancers, infant mortality and transgenerational mutations. Uranium, plutonium, americium decay progeny ultimately result in an isotope of lead.
Uranium-234	1.1E-8	6.1E-11	See uranium-238. Uranium-234 is a decay product of uranium-238 and has a much higher specific activity, in curie per gram, than either U-235 or U-238.
Uranium-235	9.5E-9	6.2E-11	See uranium-238
Uranium-236	9.9E-9	5.8E-11	See uranium-238
Uranium-238	8.8E-9	7.5-E-11	Bone, kidney.

Radionuclide	Lifetime Cancer Mortality Risk per pCi Inhalation	Lifetime Cancer Mortality Risk per pCi Ingestion	Notes
			ANL Fact Sheet states: "reproductive effects in laboratory animals and developmental effects in young animals…" Uranium is associated with cancer, miscarriage, still births, childhood cancers, birth defects, infertility, brain disorders, kidney disease and trans-generational mutations. Spent nuclear fuel is usually over 90 percent unfissioned uranium. Uranium is released in reactor accidents and nuclear weapons testing, yet is rarely mentioned or monitored.
Radium-226	2.4E-8	2.9E-9	Radium-226 is a decay product of uranium-238 or plutonium-238 or uranium-234 or thorium-230. Mimics calcium in the body and is stored in bone and teeth

Table source of information: Argonne National Laboratory, EVS, Human Health Fact Sheet, August 2005 at https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf Source used by ANL was Federal Guidance Report 13, U.S. Environmental Protection Agency, 402-R-99-001, September 1999.

Picocurie is 1.0E-12 curies. Lifetime cancer mortality risk ignores cancers that were caused but not the cause of death, ignores non-cancer illnesses such as increased risk of heart disease, and ignores genetic effects.

Alpha emitters (from most uranium, plutonium and curium radionuclides) are more able to cause double-strand DNA breaks that are misrepaired.

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

The DOE along with the Idaho Department of Environmental Quality are pretending they don't know the source of radiological contamination — even when they do know. The public drinking water laws require periodically monitoring for gross alpha levels in drinking water. If the levels of gross alpha are high enough, often even, then the evaluation of uranium and radium levels are required. But often, in Idaho's public drinking water, the intermittently elevated levels of gross alpha are not explained by naturally occurring uranium and thorium. The regulations actually make it impossible to answer what radionuclides are in the water because methods to use gamma spec analysis have not been delineated for public drinking water use. Public water drinking municipals lose profits when laboratory sampling requirements are increased.

The intermittently elevated levels of gross alpha in the southwestern portion of the state have been identified in public drinking water sampling and some studies have been conducted. But from what I see, no analysis has seriously tried to answer what the source of the radioactivity is. I say this because no trending over time of radionuclides has been conducted. No identification of all radionuclides in soil and water has been published. No assessment of the potential sources of the radioactivity have been identified. Basically, the Idaho DEQ actively fails to be curious about and seek the answers. Is it the airborne FUSRAP radionuclides? Is it from historical INL aquifer injection wells and percolation ponds that disposed of large amounts of "low-level" waste?

After contacting the Idaho Department of Environmental Quality to ask why the drinking water on the southwestern side of the state is so radioactive, the Idaho DEQ could not identify anyone at the agency who understood the issue. But the Idaho DEQ did say that there was a report on its website that looked at the issue. It was implied that the report solved the mystery.

The report "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," in 2011 [4] does look at the issue — but does not identify the source of the elevated radioactivity. The report confirms the widespread occurrence of sometimes very high uranium concentrations, up to 100 micrograms/liter. The report does conclude that the source is not from agricultural fertilizer. The report suggests that the source is a near-surface source of contamination.

The mystery is not solved by the report and the report does not conclude that the source of the elevated uranium is natural. The report simply concluded that more work was needed — and there is no evidence that any work has continued since 2011.

There is another effort afoot to study the issue by Boise State University but so far it has not provided any answers. [5] It states that "The Treasure Valley Aquifer System (TVAS) in western Idaho contains documented uranium and arsenic concentrations, up to 110 microgram/liter and

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[4] Brian Hanson, Dr. Shawn Benner, Dr. Mark Schmitz, Dr. Spencer Wood, Department of Geosciences, Boise State University., "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," Submitted to the Idaho Department of Environmental Quality, April 2011. http://www.deq.idaho.gov/media/563327-uranium_treasure_valley_0411.pdf listed at http://www.deq.idaho.gov/regional-offices-issues/boise/water-quality-plans-reports/

[5] Gus Womeldorph and Shawn Benner, Boise State University, "A Study of Uranium and Arsenic in the Treasure Valley Aquifer System, Southwestern Idaho, Year 1, 2017-2018," 2018 at https://www.idwr.idaho.gov/files/publications/201807-GWQ-GW-Study-of-Uranium-in-TV-Aquifer-System.pdf

120 micrograms/liter, respectively…" And "The contaminants historically show elevated concentrations with high spatial variability throughout the region."

See also our Environmental Defense Institute February newsletter article "What's Up With The Radionuclides in Drinking Water Around Boise, Idaho?" [6]

The CERCLA cleanup at the Idaho National Laboratory is leaving behind roughly 55 "forever" radioactively contaminated sites of various sizes, and about 30 "forever" asbestos, mercury or military ordnance sites. [7] [8] The areas contaminated with long-lived radioisotopes that are not being cleaned up will require institutional controls in order to claim that the "remediation" is protective of human health. People must be prevented from coming into contact with subsurface soil or drinking water near some of these sites — forever.

The Department of Energy downplays the mess and usually doesn't specify how long the controls are required when the time frame is over thousands of years: they just say "indefinite." In some cases, the DOE earlier had claimed that these sites would be available for human contact in a hundred or so years. [9] [10] You can find a summary that includes the "forever" sites at https://cleanup.icp.doe.gov/ics/ic_report.pdf

Institutional control of "forever" contamination means they put up a sign, maybe a fence or a soil cap — and assume it will be maintained for millennia. "Don't worry about the cost. And besides," they always add, "you and I won't be here." The DOE acknowledges that the soil cap they plan to put over the RWMC will require maintenance, basically annually, for millennia.

DOE continues to find more contaminated sites and expectations are not always met by remediation. [11] And the DOE has never stopped burying long-lived radioactive waste over the Snake River Plain aquifer.

Frequently cited stringent EPA standards such as 4 rem/yr in drinking water are emphasized. But cleanup efforts often won't come close to achieving the advertised standards.

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[6] Environmental Defense Institute February 2018 newsletter article by Tami Thatcher "What's Up With The Radionuclides in Drinking Water Around Boise, Idaho?"at http://environmental-defense-institute.org/publications/News.18.Feb.pdf

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

[8] ibid. INL Waste Area Group Institutional Controls Report. I counted the "forever" radioactive sites as those with termination date for institutional controls stated as "indefinite" or as "not specified." I counted the chemical sites for asbestos, PCPs, mercury or ordnance similarly. The size of the mess actually ranges from some small number of curies to the huge waste inventory at the RWMC.

[9] Department of Energy Idaho Operations Office, *Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site*, Fiscal Years 2010-2014, DOE/ID-11513, December 2015.

[10] Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA-04: TRA-712 Warm Waste Retention Basin System (TRA-712 and TRA-612), NSI-26002. Signed by the Department of Energy in August of 2015. See Idaho National Laboratory Federal CERCLA Cleanup documents at www.ar.icp.doe.gov

[11] US Department of Energy, "Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site," Final, DOE/EA-1793, December 2011. http://energy.gov/sites/prod/files/EA-1793-FEA-2011.pdf

Item 3: "Potential impacts on air quality (including global climate change) and noise."

For Items 2 and 3, we here in Idaho have been experiencing the continuing pollution of our water and air with long-lived radionuclides resulting from the Idaho National Laboratory and other waste disposal operations. The monitoring of both water and air has been inadequate. Even so, there are unacknowledged buildups of radionuclides in our water and air that are not the result of historical nuclear weapons testing.

The State of Idaho made this law change, effective spring of 2019 after the adjournment of the Idaho Legislature, to IDAPA 58 – Department of Environmental Quality, 58.01.01 – Rules for the Control of Air Pollution in Idaho, Docket No. 58-0101-1801. [12]

The law had included since 1995 a provision for radionuclides. But this section of the clean air law **has now deleted** the following text:

> *xvi. Radionuclides, a quantity of emissions, from source categories regulated by 40 CFR Part 61,Subpart H, that have been determined in accordance with 40 CFR Part 61, Appendix D and by Department approved methods, that would cause any member of the public to receive an annual effective dose equivalent of at least one tenth (0.1) mrem per year, if total facility-wide emissions contribute an effective dose equivalent of less than three (3)mrem per year; or any radionuclide emission rate, if total facility-wide radionuclide emissions contribute an effective dose equivalent of greater than or equal to three (3) mrem per year.(5-1-95)*

Given the increasing levels of airborne radiological contamination occurring on the lower west Boise-side and the lower east Idaho National Engineering-side of Idaho, this law change certainly is not about protecting human health and the environment.

The source of increasing radioactive contamination on the Boise side of the state is not being investigated by the Idaho Department of Environmental Quality. The ongoing importation of radioactive waste from around the country to the US Ecology Idaho Grandview site appears to have a role in the increasing airborne radiological contamination. Some of this radioactive waste is from Formerly Utilized Sites Remedial Action Program (FUSRAP) sites around the United States contaminated from the early years of nuclear weapons production and the atomic energy program.

The last 20 plus years the gyrating levels of gross alpha and gross beta (when sampled) in Boise area drinking water, from Kuna to Boise, and Murphy to Marsing, are not from naturally

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[12] Office of the Administrative Rules Coordinator, Department of Administration, Pending Rules, Committee Rules Review Book, Submitted for Review Before House Environment, Energy & Technology Committee, 65th Idaho Legislature, First Regular Session – 2019. January 2019 at https://adminrules.idaho.gov/legislative_books/2019/pending/19H_EnvEnergyTech.pdf

occurring uranium and thorium in the soil. [13] The report "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," in 2011 [14] does look at the issue — but does not identify the source of the elevated radioactivity. The report confirms the widespread occurrence of sometimes very high uranium concentrations, up to 100 micrograms/liter.

Item 4: "Potential impacts on waste management practices and activities."

Item 4: The nation faces huge unresolved problems of storage and disposal of its spent nuclear fuel, of its high-level waste, of its Greater-Than-Class C low-level radioactive waste, of its depleted uranium waste, of plutonium waste, of low-level waste, of its below regulatory concern radioactive waste that is clouding the Idaho skies from disposal at the U.S. Ecology Grandview RCRA facility, as well as from past uranium mining, milling, and other uranium fuel production activities, and from uranium enrichment plants. To propose making more radioactive waste when the existing radioactive waste problems remain unsolved is foolish. The U.S. Nuclear Regulatory Commission also knows that any reactor accident produces enormous amounts of radioactive waste. After Fukushima, bags of ordinary substances like leaves were radioactive waste that lacked a disposal site. The U.S. NRC's desire is to make ordinary municipal landfills welcoming to radioactive waste disposal.

To continue to point to the Yucca Mountain EIS as the disposal solution is unacceptable, as other Department EIS documents continue to rely on a non-existent facility.

To fail to address the aging management issues and safety issues of pool storage and/or dry storage of spent nuclear fuel over the extended time periods that we may lack a disposal solution is also unacceptable.

The Department of Energy, in addition to not having a spent fuel disposal facility has made a practice of shallow burial of radioactive waste over the Snake River aquifer **and using deceptive public relations statements to create the illusion of a satisfactory cleanup of buried waste.**

I submitted a question to the Idaho Cleanup Project Citizens Advisory Board meeting asking how many curies of americium-241 would remain buried after the final exhumation of the Accelerated Retrieval Projects end. There are many other radionuclides that will remain buried, but I wanted to make the question manageable. The Department of Energy responded with stunning obfuscation.

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[13] Environmental Defense Institute newsletter article for October 2018, "Idaho DEQ Reports Concerning the Elevated Radioactivity in Drinking Water in the Boise Area Don't Identify the Source of the Radioactivity."

[14] Brian Hanson, Dr. Shawn Benner, Dr. Mark Schmitz, Dr. Spencer Wood, Department of Geosciences, Boise State University., "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," Submitted to the Idaho Department of Environmental Quality, April 2011. http://www.deq.idaho.gov/media/563327-uranium_treasure_valley_0411.pdf listed at http://www.deq.idaho.gov/regional-offices-issues/boise/water-quality-plans-reports/

Question submitted to ICP CAB: Now that the Idaho Cleanup (Project) is on the last Accelerated Retrieval Project (ARP IX) to exhume buried waste, how many curies of Americium-241 are remaining buried at the Subsurface Disposal Area (SDA)?

Answer from the Department of Energy*: The performance objective for targeted waste retrieval was established in a record of decision agreed to by the regulators that states: "Completion of targeted waste retrieval will be measured by the volume of targeted waste retrieved. A minimum volume of targeted waste of 6,238 m^3 will be retrieved from a minimum of 5.69 acres…, with the need for additional retrievals, if necessary, determined pursuant to CERCLA." Therefore, the performance objective is based on the volume of targeted waste removed, not the removal of Am-241 curies from the SDA. (*DOE's response are posted on the CAB website: https://www.energy.gov/em/icpcab/recently-asked-questions)

The actual answer is, according to DOE's own documents, 215,000 curies of americium-241 will remain buried over the Snake River Plain Aquifer. This would take 6 Snake River Plain aquifers to dilute to drinking water standards, assuming 2.44E15 liters in the aquifer and the federal drinking water standard of 15 picocuries/liter.

In fact, over 90 percent of the americium-241 is remaining buried, of 230,000 curies of americium-241, after completing buried waste exhumation, an estimated 215,000 curies will remain buried according to composite analysis calculations. [15] [16] [17] The buried americium-241 is not the only radionuclide that contributes to contaminant migration, but it was the dominant contributor according to the buried waste performance assessment. A partial inventory of the radionuclides in the buried waste at the Radioactive Waste Management Complex, what will be buried at its replacement facility, in high-level calcine and liquid sodium-bearing waste from reprocessing stored at the INL is provided in Table 2.

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[15] See the July 2017 EDI newsletter for a timeline for the burial ground at the Radioactive Waste Management Complex and other cleanup information at http://www.environmental-defense-institute.org/publications/News.17.July.pdf

[16] U.S. Department of Energy, 2008. Composite Analysis for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11244. Idaho National Laboratory, Idaho Falls, ID and U.S. Department of Energy, 2007. Performance Assessment for the RWMC Active Low-Level Waste Disposal Facility at the Idaho National Laboratory Site. DOE/NE-ID-11243. Idaho National Laboratory, Idaho Falls, ID. Available at INL's DOE-ID Public Reading room electronic collection. (Newly released because of Environmental Defense Institute's Freedom of Information Act request.) See https://www.inl.gov/about-inl/general-information/doe-public-reading-room/

[17] See the CERCLA administrative record at www.ar.icp.doe.gov (previously at ar.inel.gov) and see also Parsons, Alva M., James M. McCarthy, M. Kay Adler Flitton, Renee Y. Bowser, and Dale A. Cresap, Annual Performance Assessment and Composite Analysis Review for the Active Low-Level Waste Disposal Facility at the RWMC FY 2013, RPT-1267, 2014, Idaho Cleanup Project. And see Prepared for Department of Energy Idaho Operations Office, Phase 1 Interim Remedial Action Report for Operable Unit 7-13/14 Targeted Waste Retrievals, DOE/ID-11396, Revision 3, October 2014 https://ar.inl.gov/images/pdf/201411/2014110300960BRU.pdf

Table 2. Calcine bin set and Sodium-Bearing waste radionuclide partial inventory comparison to the waste that will remain buried at RWMC and at the replacement for RWMC.

Radionuclide **(half-life)**	**Calcine Inventory** **(curies)**	**Sodium-Bearing Waste Inventory (curies)**	**Buried (existing)** **RWMC Inventory (curies)**	**Buried (future)** **Replacement RH-LLW Inventory (curies)**
Carbon-14 (5730 year)	0.038	5.7E-4	731	432
Chlorine-36 (301,000 year)	0	?	1.66	260
Iodine-129 (17,000,000 year)	**1.6**	0.01	0.188	0.133
Technetium-99 (213,000 year)	**4600**	94.6	42.3	16.7
Neptunium-237 (2,144,000 year)	**470**	1.74	0.141	0.003
Uranium-232 (68.9 year)	1.6	?	10.6	0.00036
Uranium-233 (159,000 year) Product bred from U-235 and thorium, also decay of Np-237	0.057	0.036	2.12	0.0001
Uranium-234 (245,500 year) Pu-238 decay product	**130**	5.33	63.9	0.0012
Uranium-235 (703,800,000 year)	**3.2**	0.127	4.92	0.005
Uranium-236	**11**	2.23E-5	1.45	0.0001

Radionuclide (half-life)	Calcine Inventory (curies)	Sodium-Bearing Waste Inventory (curies)	Buried (existing) RWMC Inventory (curies)	Buried (future) Replacement RH-LLW Inventory (curies)
(23,400,000 year) Pu-240 decay product				
Uranium-237 (0.0185 year to Np-237)	**1.5**		-	-
Uranium-238 (4,470,000,000 year)	3.1	0.125	148	16.2
Thorium-228 (1.92 year to radium-224) Natural thorium decay and Pu-240 decay product	1.6	?	10.5	-
Americium-241 (423 y decays to Np-237)	12,000	316	**215,000**	0.38
Plutonium-238 (87.7 year)	**110,000**	3900	2080	-
Plutonum-239 (24,000 year)	**48,000**	410	64,100	-
Curium-244	?	1.36	?	?

* Calcine inventory from DOE/EIS-0287; RWMC buried waste inventory from DOE/NE-ID-11243/11244 (figures cited may not be the latest estimates) and RPT-1267; replacement remote-handled facility INL-EXT-11-23102.
****Bold** highlighting of calcine inventory indicates a similar or larger inventory than the buried RWMC waste. The RWMC buried waste is estimated by the DOE to yield 100 mrem/yr doses in drinking water for millennia unless a perfect soil cap limits the estimated doses to be 30 mrem/yr. Importantly, the inevitable spikes in contamination due to flooding have not been accounted for despite RWMC flooding in 1963 and 1969. The dose estimates are not conservative. The assumed dilution factors are not consistent with past INL aquifer contamination migration. Calcine migration Kd coefficients may be different than used for RWMC and may worsen the effect of calcine in the soil.

*** Sodium-Bearing Waste inventory decayed to 2012 from Sandia National Laboratories, "Evaluation of Options for Permanent Geologic Disposal of Used Nuclear Fuel and High-Level Radioactive Waste Inventory in Support of a Comprehensive National Nuclear Fuel Cycle Strategy," FCRD-UFD-2013-000371, SAND2014-0187P; SAND2014-0189P. Revision 1. 2014. For Sodium-Bearing Waste radionuclides not listed in FCRD-UFD-2013-000371, EDF-6495 values from 2007 are provided for C-14, Tc-99, and I-129. Other radionuclides in the Sodium-Bearing Waste, typically of shorter half-life, are not listed in this table.

In addition to this refusal to state the amount of radioactive waste that is remaining buried is **the promotion of untrue claims at the April 25, 2019 Idaho Cleanup Project Citizens Advisory Board meeting in Twin Falls by the Department of Energy and the U.S. Geological Survey that the inter-sedimentary beds of soil beneath the buried waste will stop the contaminants from entering the aquifer.** This simply is not true, or why would the aquifer already have exceeded the federal drinking water standard for carbon tetrachloride?

It is also important to note that the buried waste is heavily laden with chemical solvents of various types and this decreases the sorbing properties of radionuclides like plutonium. [18] The ability of radionuclides such as plutonium-239 to sorb to soil rather than migrate to the aquifer is already overly optimistically modeled in DOE's estimates of contaminant migration, but does not assume the waste is stopped from reaching the aquifer by inter-sedimentary beds.

The EIS must address the continued failure to solve the existing spent nuclear fuel nationwide. At the INL, the buried waste that is not planned to be exhumed and the Department of Energy's modeling of the migration of this waste is not technically sound. Furthermore, the DOE has no plans to remove from Idaho the calcine and sodium bearing waste, following its upcoming "reclassification."

Existing radiological waste problems as well as newly created radiological waste issues at any proposed VTR site alternative need to be addressed. Failing to solve the waste storage and disposal issues ought to be enough reason to **stop making more radioactive waste**, which is the only sure outcome of the VTR project.

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[18] Editors: Arjun Makhijani, Howard Hu, and Katherine Yin, *Nuclear Wastelands – A Global Guide to Nuclear Weapons Production and its Health and Environmental Effects*, By a Special Commission of International Physicians for the Prevention of Nuclear War and The Institute for Energy and Environmental Research, The MIT Press, 1995. P. 253 Scientists found the migration of plutonium at the Savannah River Site had migrated to groundwater within 20 years, not the predicted migration time of hundreds of thousands of years. The presence of solvents is thought to have contributed to the rapid migration of contaminants.