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October Idaho Cleanup Project Citizens Advisory Board Meeting Highlights

The Department of Energy's Idaho Cleanup Project (ICP) Citizens Advisory Board (CAB) was mostly a virtual meeting, although some CAB members attended the presentations given in Sun Valley on October 21. [1] The public was able to attend via Zoom and public comment could be given by signing up several days in advance of the meeting.

It is to be the last meeting to be attended Fred Hughes of Fluor Idaho, the head of the current cleanup contractor for the Department of Energy, as the transition to the new cleanup contractor, the Idaho Environmental Coalition, LLC (IEC) of Tullahoma, Tennessee, began in October. The Idaho Environmental Coalition includes Jacobs, North Wind Portage, Navarro Research and Engineering, Oak Ridge Technologies and Spectra Tech. The ninety-day transition period to the new cleanup contractor means the new cleanup contractor should be in place by the start of next year.

Fred Hughes indicated there had been several first aid cases and Department of Energy reportable occurrences but few details were provided.

Transuranic Waste

Fewer shipments of transuranic waste drums to the Waste Isolation Pilot Plant (WIPP) in New Mexico were completed than hoped, 104 shipments of the hoped for 150 shipments for the year, due to WIPP not being able to accommodate as many shipments as the ICP cleanup project wanted to ship. The shipments of remote-handled waste to WIPP are further behind as WIPP has not yet focused on resuming the higher-radioactivity shipments of remote-handled waste. Work on the waste certification process continues to be difficult, as the most difficult waste to certify at the Idaho National Laboratory has been left for the tail-end of the project.

Buried waste exhumations of only a small fraction of the buried waste, the "targeted waste," are nearing completion at the Radioactive Waste Management Complex (RWMC). Work continues in nineth Accelerated Retrieval Project enclosure at ARP IX, with 0.14 acres remaining of the 0.69 ARP IX acres over the burial ground. Exhumation at ARP IX is difficult, as the buried drums are not intact. DOE hopes to complete ARP IX exhumation by March 22, 2022 and then plans to proceed to cap the burial grounds. **Unfortunately, removing all of the**

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[1] Idaho Cleanup Project Citizens Advisory Board meetings, see https://www.energy.gov/em/icpcab/listings/cab-meetings. See the October 21, 2021 meeting agenda and presentations at https://www.energy.gov/em/icpcab/articles/icp-cab-meeting-materials-october-2021

"targeted waste" from the Accelerated Retrieval Projects will leave over 90 percent of the buried transuranic waste remaining buried.

The remaining americium-241 not being exhumed from the burial ground at RWMC dominates the estimated threat to the aquifer. The important metric is how much of the americium-241 that was buried (after a few initial or early retrievals) and how much will remain buried after the "targeted waste" is exhumed.

In fact, over 90 percent of the americium-241 is remaining buried. An estimated 215,000 curies will remain buried after targeted waste is removed according to composite analysis calculations of 230,000 curies of americium-241 having been buried. [2] [3] [4]

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. For simplicity and due to the significance of the americium-241 to the estimated migration of radionuclides from the burial ground, the amount of americium-241 that is not being exhumed from the burial ground is explained but the lion's share of other transuranic radionuclides, like plutonium-239, are also remaining buried.

It should be noted that the soil and gravel cap over the burial grounds requires an enormous volume of fill required which was significantly increased due to the tall vertical stack of nitrate-laden uranium waste in drums remaining buried there, called "Pad A." The Department of Energy handles Pad A by avoiding discussion of it and also by avoiding discussing just how much this added to the volume of fill required for the gravel a soil cap of the burial grounds at RWMC. And I have confirmed with the soil cap designer at a previous meeting that no means has been considered to prevent the buried waste from smoldering when oxygen is depleted by the deep soil cap.

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[2] 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

[3] 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/

[4] 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

CERCLA Cleanup Progress

The CERCLA cleanup activities continue across the Idaho National Laboratory and including the Naval Reactors Facilities (NRF) area. Highlighted are continuing failure to meet previous goals and so the continuing treatment of the extensive aquifer contamination at Test Area North with “in situ bioremediation.” Injecting the treatment helps break down chemical waste but does nothing about radioactive contamination. And the radiological and chemically contaminated water that has already proceeded to flow downgradient in the aquifer and will continue to do so, because of the Department of Energy sanctioned and U.S. Geological Survey’s keen oversight of the dumping of waste at the INL’s Test Area North. Interestingly, the US Geological Survey does not monitor the aquifer downgradient of TAN, preferring to hover over the TAN wells and not trend wells located several miles downgradient.

The new burial dump for CERCLA waste, the Idaho CERCLA Disposal Facility (ICDF) located at the INL’s Idaho Engineering and Technology Center (INTEC), is being expanded considerably to accommodate more waste and other than CERCLA waste. An “Explanation of Significant Differences” or ESD is being created to document the revisions. The ICDF is being expanded from about 45 acres to about 97 acres. As the waste continues to be created and there remain many buildings to demolish in the future, there is no reason to believe that it won’t be expanded again and again. Also, the evaporation ponds adjacent to the ICDF are apparently unlined and accepting radiological waste from ongoing operations. This has not been discussed at the ICP CAB meetings, however. And the Idaho Department of Environmental Quality no longer worries about percolation ponds or radionuclide emissions via air permits. Now the practice is to allow the Department of Energy unfettered polluting of Idaho skies and, well, the DOE says it will monitor what happens to the aquifer. Unbelievable? Read the Idaho DEQ pond permits for the Idaho National Laboratory at deq.idaho.gov.

Spent Nuclear Fuel

Work continues for the planned movement of Peach Bottom spent nuclear fuel to Generation II vaults next year. The fuel resulted from Department of Energy gas-cooled reactor research decades ago. The Peach Bottom fuel has a graphite matrix and the degree to which moisture intrusion is a problem is downplayed. The Peach Bottom fuel storage in the first generation of below grade spent fuel storage vaults has experienced moisture intrusion, and the plan is to move the Peach Bottom spent fuel in Generation I vaults to available nearby Generation II vaults.

The Advanced Test Reactor continues to generate spent fuel, much of it stored at the Advanced Test Reactor Complex. Spent fuel is being removed from INTEC’s CPP-666 wet storage basin. Transfers of Advanced Test Reactor fuel stored at CPP-666 have experienced transfer equipment mechanical problems at the INTEC basin. The Experimental Breeder Reactor (EBR) II fuel in the CPP-666 basin is being taken to the INL’s Materials and Fuels Complex (MFC), and placed at the Radioactive Scrap and Waste Facility (RSWF) which buries the spent fuel and other radioactive material in neat rows and hopes the metal containers don’t corrode.

Wet or wintery weather impedes the transfer of casks to or from the outdoor buried waste at the RSWF. Ninety-one wet-to-dry transfers from the CPP-666 basin are planned for 2022.

The October long-term storage presentation stated that INL has approximately 305 metric tons of heavy metal (the metric tons of uranium or plutonium originally present in the fuel before its use). Apparently, this value includes naval spent fuel at the Naval Reactors Facilities as the metric tons of DOE-EM managed spent fuel at the INL was stated as 243.57 metric tons heavy metal in the same meeting's ICP overview presentation, and DOE-EM managed fuel excludes the naval fuel. Storage of spent nuclear fuel at INTEC is extensive and spent fuel is also stored at the Materials and Fuels Complex.

There are about 220 different types of spent nuclear fuel at the Idaho National Laboratory and this wide diversity of spent nuclear fuel designs complicate packaging it to be "road ready" for the January 1, 2035 Idaho Settlement Agreement milestone to remove the naval spent fuel and other Department of Energy spent nuclear fuel from the state. Only the Fort St. Vrain and the Three Mile Island fuel is stored under an NRC license. The rest, even if from a commercial nuclear power plant like Three Mile Island Unit 2 fuel debris, is only under Department of Energy oversight.

The number of metric tons of spent fuel can be an uneven indicator of the storage or disposal difficulty. The U.S. Nuclear Regulatory Commission and the Department of Energy pay little heed to the added design work and added difficulty of disposing of various new fuel types at a repository. The same metric tons of a low-enriched fuel can have far lower criticality risk than higher enriched fuels, enrichment being the amount of uranium-235 in the fuel. A higher number of spent fuel casks or canisters can be required for higher enriched fuels. The criticality risk for a canister of higher burnup light-water reactor spent fuel with enrichment of 3 to almost 5 percent is significantly higher than the roughly 2 percent enriched fuels. The criticality risk in a transportation or storage canister can vary, and depends on fuel design and burnup history, as well as enrichment. But basically, it used to be that containers of spent fuel were designed such that they would be flooded with water and still remain subcritical. This is no longer the case, as the higher burnup fuels used in the commercial nuclear power industry now have to be loaded in borated water, and in many cases, will go critical if water enters the container.

The trend over time of criticality risk is not intuitive. For commercial reactor spent nuclear fuels of higher enrichment (3 to 5 percent), while the criticality risk of the fuel is high in the first 100 hours after shutdown and remains at its highest during the first year, the reactivity, or k-effective, declines somewhat during the first 100 years. However, after about 100 years, the k-effective climbs steadily, peaking at about 25,000 years after its use in a reactor before starting to decline again. [5]

[5] Energy Workshops, *2018 SFWST Annual Working Group Meeting, Las Vegas, Nevada May 22 to May 24*, 2018. https://energyworkshops.sandia.gov/nuclear/2018-sfwst-rd-team-meeting/ See presentation #05 on direct disposal of spent nuclear fuel, page 4 the figure of K-effective versus time, and see page 10 for regulations that dismiss fallout effects on groundwater for criticality events after 10,000 years if less than 1.0E-4 annual probability at

The commercial spent fuel debris from the Three Mile Island Unit 2 (TMI-2) 1979 reactor accident in Pennsylvania is stored in NRC-licensed unsealed canisters at the INL's INTEC. These unusual filtered canisters relieve hydrogen and various radionuclides such as iodine-129.

The existing Foster-Wheeler design for a spent nuclear fuel repackaging facility that was never built at the INL is being reviewed to see if the design can be improved based on improved knowledge over the last 15 years since the design was created. The capability of this spent fuel repackaging facility would only be for the fuels in the manner currently at the INL. It would not be designed to accommodate the commercial spent nuclear fuel as now packaged in larger seal-welded canisters for which no technology has been developed to open and repackage. The casks or canisters at the INL that would require repackaging are not seal welded.

It should be noted that the light-water reactor spent fuel that has been placed in weld-sealed canisters are large assemblies of 3 to 5 percent enriched, higher burnup fuel. The proposed commercial power venture called the NuScale Small Modular reactor is expected to use a half-height fuel assembly. The spent fuel from the NuScale reactor, if the facility operates, is not accommodated by the existing INL spent fuel repackaging facility design nor would a modified facility for INL spent fuel repackaging be likely to accommodate it. So, the NuScale spent nuclear fuel could be placed in dry storage welded-closed canisters in its spent fuel pool, but if it would need repackaging of aging canisters as the decades go by, waiting for a non-existent disposal facility, the DOE's spent fuel repackaging facility would not be able to accommodate it, even if it were still in service.

And while NRC-approved Foster-Wheeler design of a spent fuel repackaging facility for the INL's existing non-naval fuel is not considered final, no funding has been allocated for building a spent nuclear repackaging facility despite that fact that to design and build one would already take too long to meet the Idaho Settlement Agreement.

But it is a tiny step in the right direction that plans are being made for a concrete pad called a "staging facility" for the INL's Department of Energy-owned spent fuel after it is repackaged. The length of time that fuel would be storage at the "staging facility" would depend on if and when another state accepts the storage or disposal of the spent nuclear fuel.

Calcine

The high-level waste called calcine is stored partially above and below grade in a variety of vintages of bin sets. The 4,400 cubic meters of calcine is a powdery, highly soluble, highly radioactive waste resulting from the processing of naval and DOE research fuels at INTEC. The metal containers are inside concrete vaults of dubious concrete integrity. The metal containers are seismically vulnerable and are also vulnerable to flooding, should the water enter the concrete vault, causing "floating" of the metal containers that would be expected to cause metal storage container piping breaks. The calcine storage at INTEC (as well as the spent nuclear fuel

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https://energyworkshops.sandia.gov/wp-content/uploads/2018/05/05-Direct-Disposal-of-Spent-Nuclear-Fuel-in-Dual-Purpose-Canisters-RD-Path-Forward-SAND2018-5437-PE.pdf at INTEC) is stored in a flood plain and susceptible to a Mackay dam break. The poorly designed, poorly maintained and hundred-year-old Mackay dam is a hazard over time, especially when the water levels in the dam are high.

Transfer of some of the calcine from older, more seismically vulnerable bin sets, has now been successfully demonstrated.

The Idaho Settlement Agreement milestone requires the Department of Energy to have the "calcine ready for disposal outside the State of Idaho by December 31, 2035." The Settlement Agreement also required the DOE to document the method they would use to package the calcine. As required of the Settlement Agreement, the DOE officially documented in the NEPA Record of Decision in 2008 that they had selected Hot Isostatic Press as the treatment option for the calcine, and the RCRA Part B permit for the Hot Isostatic Press treatment process was submitted to the State of Idaho in 2012. [6] But the Department of Energy is basically back to square one and undecided on how it would repackage the calcine, now claiming that the technical risk of the high pressure and high temperature Hot Isostatic Pressing is too high.

In a 2016 and 2020 "analysis of alternatives" or "AoA," some of the pros and cons of different calcine packaging options have been reviewed. The Department of Energy's official decision remains hot isostatic pressing and there is apparently no deadline for the DOE to determine what it will actually recommend doing. The 1995 Idaho Settlement Agreement milestone for having the calcine be road-ready will certainly not be met, and the DOE will likely try to short cut the cost of repackaging the calcine as it avoids discussing truthfully the current radiological risks posed by the calcine stored at INTEC.

The ICP CAB meeting calcine presentation identifies the "Cold Crucible Induction Melter (vitrification) technology as being under consideration. Vitrification does not achieve as high a volume reduction but is considered to be a mature technology and a technology that is considered acceptable for treatment of high-level waste. Strangely enough, the DOE said it is considering a vitrification facility to be located adjacent to the INL site using a private/public partnership, or using an off-site commercial treatment (and how do you transport the calcine to it?) or DOE-built capacity on-site.

And, while the DOE is admitting that "stakeholders" — meaning citizens who care about Idaho — would oppose it, the DOE is also considering direct disposal of the calcine at the INL. After all, the Department of Energy knows it can manipulate a disposal performance assessment to get any answer they want, to make migration of the contamination appear to be years away and acceptable, no matter the reality.

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[6] Idaho Cleanup Project Citizens Advisory Board, June 2019 meeting in Fort Hall, https://www.energy.gov/em/icpcab/downloads/icp-cab-meeting-materials-june-2019 , Independent Analysis of Alternatives for Disposition of the Idaho Calcined High-Level Waste Inventory at https://www.energy.gov/sites/prod/files/2019/06/f64/Volume%201%20Calcine%20AoA%20Final%2004-19-16%20w_signatures.pdf

Not mentioned is how much off-gassing of radionuclides occurs during vitrification or hot isostatic pressing. One thing is certain: treatment of the calcine will be costly, a few billion dollars, which is a large reason why the Department of Energy is putting it off and will likely seek to avoid repackaging all together. Another thing is certain: **Leaving the calcine as it is, is a tremendous radiological risk to southeast Idaho, the risk of radioactivity spread into the aquifer and/or made airborne, contamination that is life-span shorting, cancer-causing, birth defect causing, and can never be remediated.**

It is vitally important, to prevent a radiological catastrophe to southeast Idaho, that the calcine be placed in less vulnerable storage than it currently is at the INL's INTEC. This at least buys time, putting off catastrophe. The calcine bin sets are flooding vulnerable and seismically vulnerable. The concrete vaults are not leak tight to the soil and aquifer below and can crack, exposing the calcine to the wind. The calcine's metal containers are seismically vulnerable to breaking the concrete and also piping that extends from the containers. Flooding the concrete vault may "float" the metal calcine containers and break the piping that extends from these containers, and breaching the containers.

My public comments made to the October ICP CAB

(This written description is based on my notes and edited for clarity and may not match exactly what I stated at two 5-minute comment periods.) I noted that the Department of Energy's environmental surveillance website Idahoeser.com, that the webservers had not been responding for weeks. [Later in the meeting, the DOE acknowledged that the surveillance contractor had changed and that the new web address was IdahoEser@inl.gov.]

The ICP CAB has heard presentations on the various types of spent nuclear fuel stored at INTEC, that is stored in various ways. Some of the spent fuel is lower enrichment (in uranium-235), of about 2 or 3 percent uranium-235. Many of the fuels are far higher enrichment. The criticality risk depends on the enrichment (and fuel design and fuel operating history) and does not decrease as the fuel ages. The thermal heat load is reduced as the fuel ages but not the criticality risk. Degradation of spent nuclear fuel storage casks or canister internals that separate the fuel and may have neutron poison properties affect criticality risk, as does the introduction of a moderator, such as water. INTEC is in a flood plain, susceptible to failure of the Mackay Dam. The calcine is also stored at INTEC in a flood plain with seismic vulnerabilities as well as flooding vulnerabilities. The assessment of criticality issues is fuel dependent, fuel operation history and container integrity dependent. The Department of Energy's safety assessment of calcine and spent nuclear fuel for the INL is generally not available to the public, as U.S. Nuclear Regulatory Commission safety reports would be.

Environmental monitoring if the radiological emissions from the Idaho National Laboratory includes monitoring gross alpha concentrations in ambient air. These levels used to be 3.0E-15 microcuries/milliliter. But the maximum concentrations detected have kept increasing to 5,6 and even over 20 E-15microcuries/milliliter. So, the Department of Energy's environmental surveillance program has found ways to keep the annual averages from increasing. One way is to shutdown the air monitors when conditions are thought to be more highly radioactive. Another way is to obtain results inconsistent with historical monitoring that are unusually large negative results. These large negative concentration levels are then averaged in and they reduce the annual average values. The large negative radioactivity concentrations reflect the use of "blanks" that are significantly more radioactive than the sample. The unusually large negative values indicate how radioactive the blanks are, (yet no one seems to wonder why the blanks are so radioactive.)

The Department of Energy's historical dose assessment did not include the INL's americium-241 releases, prior to 1989. The INL's estimated airborne waste (effluents) have reported in varying ways estimates of plutonium, americium and other radionuclides. These estimated airborne releases are used to estimate the whole-body (effective) millirem dose. But the whole-body dose does not scale to the thyroid organ dose. In fact, the thyroid absorbed dose can be far higher than indicated by the whole-body dose and far higher than would be received from naturally-occurring background radiation. The DOE needs to provide thyroid organ absorbed doses from INL's releases. Whole-body effective dose in rem or millirem is keyed to the judgement of the importance of a tissue or organ only to the perceived risk contribution of a fatal cancer. It is not keyed to hereditary effects or thyroid organ cancer incidence or thyroid nodules or thyroid dysfunction. (The INL releases significant amounts of iodine-131 with its 8-day half-life, iodine-129 with its 16-million-year half-life, amercicium-241 and other radionuclides and the counties surrounding the INL have for many years had nearly double to rate of thyroid cancer incidence compared to the rest of Idaho and the rest of the country.)

The Idaho Department of Environmental Quality's INL surveillance program had in 2019 failed to call out the far higher than normal strontium-90 levels detected. And its new treatment of air samples had greatly reduced the plutonium and americium detected concentrations. Both the Department of Energy's and the Idaho Department of Environmental Qualities radiological monitoring programs have a lot of work to do, to restore credibility.

Idaho Cleanup Project Citizens Advisory Board Meeting on the Integrated Waste Treatment Unit

The 900,000 gallons of liquid waste, now estimated as 850,000 gallons due to evaporation, known as the "sodium-bearing waste" was to have been converted to a calcine-like dry material by 2012 but the treatment facility, the Integrated Waste Treatment Facility, has continued to be plagued with design problems. The IWTU has yet to treat any of the radioactive high-level waste known as sodium-bearing waste. Equipment such as the process gas filter, PGF, have required extensive redesign.

The Department of Energy is continuing to pay $6000 a day in fines, according to an article in *The Idaho Falls Post Register*. [7] The fines are being paid to the State of Idaho. The article is incorrect, however, because while the Idaho Settlement Agreement milestone to treat the

[7] Keith Ridler, Associated Press, *The Idaho Falls Post Register*, "Another test startup on tap for IWTU," October 22, 2021.

sodium-bearing waste by December 1, 2012 was missed, the fines are not the result of the 1995 Idaho Settlement Agreement. The Idaho Department of Environmental Quality is levying fines for DOE's failure to comply with its commitment to close the storage tanks by 2018 as agreed to under the schedule negotiated with the Idaho Department of Environmental Quality under the Hazardous Waste Management Act.

The fines collected by 2018 were $3.6 million and have continued to pile up. The fines can be used to fund environmental projects in the state. [8] Remediation of Department of Energy radiological contamination, however, cannot be funded by the fines collected by the State of Idaho.

The ICP overview slides given at the October 21 Idaho Cleanup Project Citizens Advisory Board meeting [9] state that the sodium-bearing waste resulted from decontamination of spent fuel reprocessing facilities. But waste from other activities at the INL has also been added to the tank waste, which they see as the foot into arguing that the waste is defense transuranic waste that WIPP could accept. Redesign and testing of the IWTU has continued since 2012. And now, instead of an eleven-month campaign to treat the waste, the Department of Energy has acknowledged that if all goes well, they expect it to take from 3 to 7 years to treat the sodium-bearing waste.

The DOE is expecting to start radiological operations at the IWTU early next year. While non-radioactive "simulant" has been used for testing the IWTU, the early runs will be a 10 percent radiological and 90 percent simulant composition, to progress to then a 50/50 waste and simulant composition, and then finally to full radiological composition.

The number of canisters of treated dry sodium-bearing waste has increased from roughly 700 canisters to 1200 canisters and more storage at INL for the treated sodium-bearing waste canisters will be needed. There has been confusion about the number of expected canisters from treating the liquid sodium-bearing waste. Even the written presentation avoids stating the total number of canisters, stating instead that the "Current vault storage capacity (37) is not enough to contain all the vaults for the IWTU mission (78)." Unstated is that each vault holds 16 canisters.

The DOE admitted at the ICP CAB meeting that the sodium-bearing waste is still classified as high-level waste. The DOE has in various documents avoided referring to the sodium-bearing waste as high-level waste. The DOE has hoped for many years to reclassify the sodium-bearing waste to be "transuranic waste" that could be disposed of at WIPP. Currently, WIPP's licensing approval prohibits waste resulting from tank waste from spent nuclear fuel

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[8] *Exchange Monitor*, "DNFSB Cites Concerns With IWTU Safety Basis," April 24, 2018. https://www.exchangemonitor.com/dnfsb-cites-concerns-iwtu-safety-basis/

[9] Idaho Cleanup Project Citizens Advisory Board meetings, see https://www.energy.gov/em/icpcab/listings/cab-meetings. See the October 21, 2021 meeting agenda and presentations at https://www.energy.gov/em/icpcab/articles/icp-cab-meeting-materials-october-2021

reprocessing. The containers purchased for the storage of the treated dry sodium-bearing waste are designed to be compatible with WIPP.

Finally, the IWTU is requesting a RCRA hazardous waste permit modification from the Idaho Department of Environmental Quality. Public comment is being accepted until November 9.

The Idaho DEQ's website page for public comment opportunities has links to related documents. No public hearing for the proposed changes has been planned, but I requested a meeting. And it has been signaled on October 29 that the Idaho Department of Environmental Quality will now plan to conduct a meeting for the IWTU modifications, and information will be sent out 30 days in advance of the meeting.

The ramifications of the proposed changes, that of certain aspects of the process gas filter (PGF) are likely to result in more frequent flowing of radioactively laden dry materials (I'll call it sand) to flow beyond the PGF into portions of the process not designed to receive this material. The need for nitric acid flushes appears to be increased. And the storage of the flushed material will be allowed in a nearby tank and also, without adequate description, the flushed nitric acid and radioactive waste will be allowed to be stored at the nearly NWCF, the facility repurposed from calcining.

The way that the Department of Energy is downplaying its various patch ups of the IWTU design problems raises many warning flags, despite the glitzy promotional video exiting Fluor Idaho created to highlight its work on the IWTU from 2016 to now. The testing of the process in miniature scale at the Hazen facility has been helpful and yet has been conducted with improper installation of equipment and various problems, according to DOE RCRA permitting documents on the DEQ website.

Department of Defense's Proposed Mobile Microreactors (or Project Pele) Public Comment Meetings in Fort Hall

The U.S. Department of Defense is proposing to build, within three years, Prototype Mobile Micoreactors as part of Project Pele, [10] aptly named after the goddess of volcanos, as volcanos are known for destruction of lives and homes.

The Department of Defense held two public comment meeting sessions in Fort Hall on October 20. The meeting was held live and was also available for listening or viewing virtually.

The 30-minute overview of the proposed project, which was presented at beginning of both sessions was focused on the testing of prototype reactors at the Idaho National Laboratory, not the ultimate stated use for the mobile reactors.

The moderator of the meeting stated that the single expert at the meeting, who presented the Project Pele overview, would not be answering any questions at the meeting.

[10] Pronunciation of Pele might be "pay lay" or "pea lay."

There was little public participation and no public officials or Shoshone Bannock Tribe representatives commenting on the project. There was a small group of union members who spoke in favor of the project.

The mobile reactors are to be sized for transport by truck or airplane and to provide 1 to 5 megawatts of electrical power. 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. Critics say that the nuclear reactors will be targets and that it is unwise to deploy nuclear reactors in theaters of war. [11]

The draft environmental impact statement for the proposed gas-cooled high temperature nuclear reactors is available for public comment at https://www.mobilemicroreactoreis.com. [12]

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

[12] 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.

SCO will host two public hearings regarding the Draft EIS. Meetings will be held in-person and livestreamed for those who are unable to attend the in-person setting. A toll-free number will be available for commenters not at the in-person meeting. Interested parties are invited to join either or both of the public hearings, each with identical presentation content, planned to be held on Wednesday, October 20, 2021 from 3:00 PM to 5:00 PM Mountain time and from 6:00 PM to 8:00 PM Mountain time at the Shoshone Bannock Hotel and Event Center, 777 Bannock Trail, Fort Hall, Idaho 83203. An American Sign Language (ASL) interpreter will be present. The hearings will begin with a presentation providing an overview of the project, information on the NEPA process, and highlights of the Draft EIS content and analysis. Following the presentation, individuals participating both in-person and remotely will be provided an opportunity to provide comments on the Draft EIS. The hearings will conclude after two hours or until there are no additional commenters. Public comments will be addressed in the Final EIS. A court reporter will be present to transcribe all comments.

These meetings will be livestreamed and recorded for later playback. The recording of the public hearings will be available at https://www.mobilemicroreactoreis.com after the meeting have been held. Those attending the hearings in person at the Shoshone Bannock Hotel and Event Center will be required to wear appropriate face coverings and follow social distancing guidelines. Ongoing health concerns as a result of the evolving COVID-19 restrictions could result in changes or cancellation of these public hearings. Further public notification would be made in the event of postponement or cancellation. In the event of in-person event cancellation, online virtual public hearings would still occur on the same dates and times. Written comments can also be submitted through the end of the public comment period. Comments may be mailed to: Mobile Microreactor EIS Comment, c/o Leidos, 2109 Air Park Rd SE, Suite 200, Albuquerque, NM 87106, or e-mailed to PELE_NEPA@sco.mil.

The draft EIS only covers the testing of a Prototype Mobile Microreactor at the Idaho National Laboratory.

The project description given at the meeting is, as I reduce and paraphrase here from my notes, is as follows:

> The proposed fuel for the gas-cooled reactors 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 fuel would be fabricated by BWXT in Lynchburg, Virginia. The mobile reactor would be fabricated at either BWXT Advanced Technologies, LLC or X-energy, LLC team facilities.
>
> The Idaho National Laboratory is under the authority of the Department of Energy, is an existing nuclear site, has current reactor operations experience, has sufficient testing space, an established control zone, and adjacent post-irradiation examination (PIE) facilities. The testing would be conducted at the INL's Critical Infrastructure Test Range Complex (CITRC). The used reactor would be stored at the Materials and Fuels Complex, either in the Radioactive Scrap and Waste (below grade) facility or the nearby outdoor above-grade storage, the Outdoor Radioactive Storage Area (ORSA). Radioactive wastes would be dispositioned using "existing processes" or stored onsite.
>
> The final EIS is stated to be expected in early 2022, and the Record of Decision by spring of 2022. (End of paraphrase.)

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 microreactor and the greatly reduced source term assumed in the draft EIS are provided in Table 2.

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

Isotope (Half-Life)	Inventory of spent fuel, curie	Greatly reduced "source term" stated in the draft EIS
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 (5.25 day) I-131 decays to stable Xe-131.	886	41.1
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.

Unexplained in the draft EIS is how the inventory was so greatly "attenuated" in the accidents considered. And documents that might contain this information are not available.

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, 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 for the project to appear "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. **Rather, very intentional obscuration of the full set of assumptions made to assume that the fuel retains the lion's share of the fission and activation products has not been provided.**

I was able to provide public comment twice in the first session and once in the second session, with an allowed maximum of 3 minutes each time. Here are some of the issues I raised concerning the proposed project, based on my notes and not verbatim.

The so-called mentioned "cradle to grave" management of the project's spent nuclear fuel 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's flowchart tries to hide the fact that the Project Pele's spent nuclear fuel is going to languish in Idaho. [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 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 draft EIS is full of deception. Let's talk about what the draft EIS means when it presents the estimated radiation dose from ingestion of waterfowl (page 3-40). It 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.

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

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 from 1 picocurie per liter (pCi/L) to 3 pCi/L for several years, as these releases were increased.

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 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.**

If you were wondering why 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, now you know why. [13] **The draft EIS (page 3-42) presents the higher thyroid cancer incidence rates for a few years but does not address why.**

[13] 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

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.

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.

The Department of Energy emphasizes that its regulations allow it to dose the public with 100 mrem/yr. They don't mention that 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, [14] which would imply a limit of 16 mrem/yr, the DOE retains the same 100 mrem/yr limit. (End of October 20 public comment.)

Finally, the draft EIS included references that were not publicly available. Several days after the meeting, I was sent three of the documents referenced that should have been publicly available, including INL external report INL/EXT-21-62873. [15] Documents that are approved for external release should have been available on the Idaho National Laboratory's technical document online library.

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 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. The draft

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.

[14] 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.

[15] 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.

EIS is misleading, lacks transparency, and fails to protect people or the environment. I oppose the Project Pele Mobile Microreactor project.

Public comment submittals to Project Pele are accepted until November 9.

Articles by Tami Thatcher for November 2021.