

# **Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory**

**Comment submittal by Tami Thatcher, November 30, 2018.**

The draft DOE/EA-2087 is at

<https://www.id.energy.gov/insideNEID/PDF/Draft%20HALEU%20EA.pdf>

These comments address the proposal by the U.S. Department of Energy to fabricate nuclear reactor fuel from DOE-owned high assay low-enriched uranium (HALEU) currently stored at the Idaho National Laboratory. The DOE would process 10 metric tons of the enriched uranium at a rate of 5 MT per year. The processing could be at two facilities at the Materials and Fuels Complex or two facilities, one at MFC and one at the Idaho Nuclear Technology and Engineering Center (INTEC).

**The Environmental Assessment, besides relying on fiction in many cases, is so inadequate that a full environmental impact statement must be performed.**

Importantly, the EA relies on previous environmental impact statements that presume the existence of a non-existent spent nuclear fuel (SNF) and high-level waste repository. The Department of Energy is pretending that an SNF/HLW repository will be available soon and therefore should want to make more nuclear fuel to operate in nuclear reactors in order to make even more spent fuel. And the DOE is using the lack of a repository as an excuse for failing to prepare the SNF and HLW as the Idaho National Laboratory for shipment to a repository such as the proposed Yucca Mountain repository.

The EA fails to grapple with reality on so many fronts that it is an insult to the intelligence of anyone who follows what is actually going on. Protecting workers, the public and the environment is not achieved by strict adherence to the retelling of untruths. Relying on out-of-date EISs that don't represent the lack of progress toward a repository for spent nuclear fuel and high-level waste and DOE's failure to update radiological health models and standards cannot possibly achieve the stated goals of conducting NEPA analysis.

And by the way, there are 1000 kg in a metric ton. And there are 2.2 lb in a kg. And that would have been appropriate to include in the EA, but it wasn't.

## **Problems with Obtaining a Nuclear Waste Repository for Spent Nuclear Fuel and High-Level Waste**

There is considerable lack of understanding by the public about the longevity and toxicity of long-lived radiative waste. It is not like natural uranium and thorium bound up in rock. The longevity and toxicity of radionuclides that dominant repository contamination migration studies

include, for example, chlorine-36 (301,000 year), iodine-129 (17,000,000 year), technetium-99 (213,000 year), uranium-234 (245,500 year), neptunium-237 (2,144,000 year), americium-241 (432 year but decays to Np-237), plutonium-238 (87.7 year but decays to U-234), plutonium-239 (24,000 year but decays to U-235). We are not talking about a mere 150,000 years of radiotoxic material. The 10,000-year timeframe once proposed for Yucca Mountain was never adequate. And, even the one-million-year analysis timeframe for the waste migration may not be sufficient. The stable end product for uranium, thorium and plutonium is lead which is not good to have in your water either.

The actinides such as uranium decay in a long string of decays known as a decay chain.<sup>1</sup> Uranium-238, for example, decays to thorium-234 which decays to protactinium-234 which decays to uranium-234 which decays to thorium-230 which decays to radium-226 which decays to radon-222 which decays to polonium-218 which decays to lead-214 which decays to bismuth-214 which decays to polonium-214 which decays to lead-210 which decays to bismuth-210 which decays to polonium-210 which decays to lead-206 which does not decay anymore because it is “stable.”

The Yucca Mountain repository is destined to fail because the geology of the porous mountain located above groundwater does not isolate the spent nuclear fuel which is not protected from corrosion. The low radiation doses from ingestion of contaminants from the proposed Yucca Mountain repository rely on titanium drip shields which have not been designed nor has the method for their installation been developed. It may be impossible to robotically install the relied upon titanium drip shields in the dusty, collapsing tunnels after a few centuries of cooling the SNF. Any realistic assessment of the likelihood of failure to install the titanium drip shields or failure of their adequate performance has not been included by the NRC’s optimistic study of contaminant migration from Yucca Mountain. The NRC was supposed to review the Department of Energy’s Yucca Mountain submittal but ended up preparing the cornerstone estimate of the repository’s estimated radionuclide releases.<sup>2</sup>

The geology of Yucca Mountain does not prevent corrosion of the SNF or its containers and does not prevent the migration of radionuclides into nearby watersheds. The technology to monitor or retrieve the spent fuel does not exist.<sup>3</sup>

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<sup>1</sup> Actinides include uranium and transuranic radionuclides. Many decay progeny may be created before reaching a stable, non-radioactive state. They are alpha emitters that pose significant health risks if inhaled or in the blood stream. Beta and gamma radiation can also be emitted by transuranic radionuclides. See our factsheet at <http://www.environmental-defense-institute.org/publications/decayfact.pdf>. See also an ANL factsheet at <https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf>

<sup>2</sup> U.S. NRC, “Supplement to the U.S. Department of Energy’s Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada,” NUREG-2184, May 2016. <https://www.nrc.gov/docs/ML1612/ML16125A032.pdf>

<sup>3</sup> U.S. Nuclear Waste Technical Review Board, “Geologic Repositories: Performance Monitoring and Retrievability of Emplaced High-Level Radioactive Waste and Spent Nuclear Fuel,” May 2018.

Arguments that migration of the contaminants from the repository will be acceptably low hinge on the assumed protection of 1,500 5-ton titanium drip shields to be robotically installed after the waste is in place.<sup>4 5</sup>

(Footnotes continued)<sup>6 7 8 9 10 11</sup>

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<sup>4</sup> State of Nevada, Office of the Governor, Agency for Nuclear Projects, “Report and Recommendations of the Nevada Commission on Nuclear Projects.” December 10, 2010.  
<https://www.leg.state.nv.us/Division/Research/Library/Documents/ReportsToLeg/2010/61-10.pdf>

Excerpt: “For example, the current license application includes covering all the waste canisters with 11,500 titanium drip shields to protect them from rock fall and highly corrosive groundwater. But the drip shields themselves (estimate to cost \$12 billion or more) are only proposed to be installed 80 to 100 years after the waste is put into the mountain, using yet-to-be developed robotics due to the extreme thermal and radiological environment that would exist within the emplacement tunnels. Despite this, potentially disqualifying conditions were revealed at the site (i.e., fast groundwater pathways, unacceptably high level potential for escaping radioactive gasses, recent volcanism, high levels of seismicity, etc.). To get around this, DOE petitioned Congress to exempt the site from health and safety regulations and then scrapped its own site evaluation guidelines altogether.”

Another excerpt: “It posits the existence of titanium alloy ‘drip shields’, one 5-ton drip shield over each of the 11,500 waste packages, to ward off the corrosion-promoting water. However, these extremely expensive drip shields are not part of the current waste installation plan but are intended to be installed by a yet-to-be-designed, remote-controlled robotic mechanism about one hundred years after the wastes have been emplaced.”

<sup>5</sup> The Department of Energy was planning to use a consent-based approach for siting spent nuclear fuel and high-level waste storage and disposal facilities including: (1) a pilot interim storage facility, (2) consolidated interim storage facilities, and (3) permanent geologic disposal facilities, one for commercial spent nuclear fuel and the other for defense spent nuclear fuel and high-level waste.

A consent-based approach was recommended in the 2012 Blue Ribbon Commission report on the nation’s problem of spent nuclear fuel disposal, but no one knows what a consent-based approach entails. What we do know that even with local support, state opposition effectively stymied efforts to obtain authorization to construct the geologic waste disposal at Yucca Mountain at Nevada and prevented a proposed interim storage site at Skull Valley, Utah. The DOE held meetings in 2016 around the country seeking public input on the consent-based process, including one in Boise, Idaho. The Department of Energy successfully disposed of the consent-based approach and the public comments collected following the appointment of Rick Perry as the Secretary of Energy in 2017.

The majority of the spent nuclear fuel is from commercial electricity generation from US nuclear power plants. As of 2013, there was 70,000 metric tons heavy metal, enough for the stymied Yucca Mountain repository. The inventory is expected to roughly double as the existing fleet of US nuclear reactors operates for its expected life. Utilities are winning billions in compensation from the DOE over the continuing costs of storing the spent nuclear fuel because of the DOE’s failure to provide a disposal facility.

The rest of the spent nuclear fuel is from DOE research and defense reactors, including nuclear submarines and carriers. The DOE’s high-level waste is in various forms ranging from liquid waste at Hanford awaiting vitrification, highly soluble powder-like calcine at Idaho and vitrified waste at other sites.

<sup>6</sup> Before ending the consent-based siting effort, information found about the Department of Energy’s consent-based siting at [www.energy.gov/consentbasedsiting](http://www.energy.gov/consentbasedsiting) and its Integrated Waste Management and Consent-based Siting booklet at <http://energy.gov/ne/downloads/integrated-waste-management-and-consent-based-siting-booklet>

<sup>7</sup> State of Nevada’s website reflecting its opposition to Yucca Mountain, see <http://www.state.nv.us/nucwaste/>

<sup>8</sup> Utah Department of Environmental Quality reflects state leaders’ views and offers this information on its opposition to storage of spent nuclear fuel at the facility proposed on the Skull Valley Goshute Indian Reservation at <http://www.deq.utah.gov/Pollutants/H/highlevelnw/opposition/concerns/concerns.htm>

<sup>9</sup> See Yucca Mountain Environmental Impact Statement, DOE/EIS-0250F-S1.

<sup>10</sup> Department of Energy Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste, January 2013. p. <http://energy.gov/em/downloads/strategy-management-and-disposal-used-nuclear-fuel-and-high-level-radioactive-waste>

<sup>11</sup> Blue Ribbon Commission on America’s Nuclear Future, Report to the Secretary of Energy, January 2012.  
[http://energy.gov/sites/prod/files/2013/04/f0/brc\\_finalreport\\_jan2012.pdf](http://energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf).

Despite any appearance of progress toward a repository, there are numerous ways that removal of spent nuclear fuel from the Idaho National Laboratory and other stranded fuel sites may continue to be delayed: failure to grant a license for permanent storage, delayed licensing, construction delays, lack of funding, delays in licensing or procuring transportation overpacks, or an accident that causes an interruption in shipping. Needed roads and railways don't necessarily connect the utility to the highway or railway or may be inadequate for the heavy loads.

### **The Tardiness of DOE to Treat Sodium-Bonded Spent Nuclear Fuel at the INL Is Obscured in the EA and Failure to Meet Idaho Settlement Agreement**

The EA referenced the Sodium-bonded fuel EIS <sup>12</sup> but the EA fails to mention that the DOE has conducted treatment of the EBR-II SNF at a snail's pace and has slowed to an average pace of only about 0.1 metric tons heavy metal (MTHM) per year.<sup>13</sup>

Importantly, the December 2017 report by the U.S. Nuclear Waste Technical Review Board (NWTRB) points out that the Department of Energy continues to fail to take actions to find disposal for the EBR-II wastes. **The NWTRB finds that the fate of the treated sodium-bearing waste streams is uncertain.** The EA presents to the public a rosy picture that is not consistent with the facts.

“Because DOE-NE is not a ‘waste custodian’ and, hence, is not subject to the waste acceptance system requirements that apply to all SNF and HWL that will be disposed in a repository, the fate of these waste streams is uncertain,” writes the NWTRB in its December 2017 report, “Management and Disposal of U.S. Department of Energy Spent Nuclear Fuel.”

Beyond the spent nuclear fuel that the Idaho Settlement Agreement <sup>14</sup> requires be repackaged using a facility that has not been built in order to be shipped out of Idaho by 2035, the High Level Waste (HLW) at the INL includes the calcine and the remaining to be treated liquid sodium-bearing waste. Both the calcine and the SBW will require another expensive round of processing into canisters that can be shipped out of the state and meet disposal requirements for the yet-to-be-named defense repository.

The DOE continues on a path to miss all future Idaho Settlement Agreement milestones for treating, packaging and shipping spent nuclear fuel and high-level waste out of Idaho and the EA

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<sup>12</sup> U.S. Department of Energy Sodium Bonded Environmental Impact Statement, DOE/EIS-306, July 2000. <https://www.energy.gov/nepa/downloads/eis-0306-final-environmental-impact-statement>

<sup>13</sup> U.S. Nuclear Waste Technical Review Board, “Management and Disposal of U.S. Department of Energy Spent Nuclear Fuel – Report to the United States Congress and the Secretary of Energy,” December 2017. [http://www.nwtrb.gov/our-work/reports/management-and-disposal-of-u.s.-department-of-energy-spent-nuclear-fuel-\(december-2017\)](http://www.nwtrb.gov/our-work/reports/management-and-disposal-of-u.s.-department-of-energy-spent-nuclear-fuel-(december-2017))

<sup>14</sup> See more about Idaho's Settlement Agreement at <https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement.aspx> Section D(1)(e) stipulates that naval fuel be among the early shipments to the first permanent repository or interim storage facility.

must not hide the numerous serious failures of the Department of Energy to meet these important milestones.<sup>15</sup>

### **The Evidence Shows That DOE Doesn't Comply with Its Regulations or State Regulations**

The EA reads like a propaganda brochure, stating “DOE uses engineered and administrative controls to make work safe and to reduce the potential for environmental consequences of its operations.”

To start off, let's look at the statement in the EA about the Department of Energy following its own regulations: “Activities that affect, or may affect, the safety of DOE nuclear facilities must also comply with the requirements of 10 CFR 830, Nuclear Safety Management.”

Anyone familiar with the two accidents at the Waste Isolation Pilot Plant (WIPP) in New Mexico in 2014 knows how DOE was failing in nearly all programs for safety at WIPP to provide adequate funding, oversight, or technically valid decision-making regarding nuclear safety at WIPP.

WIPP's original safety basis had been extensively reviewed, more than any other DOE facility. Reviews by the Environmental Protection Agency and by the Defense Nuclear Facility Safety Board had been conducted. But subsequent changes to the WIPP safety basis, approved by DOE had reduced safety significantly. They made the assumption that a roof fall would never occur in an open panel and had no accident analysis for this. WIPP experienced a roof fall within a couple months of not bolting the ceiling in the underground mine. The accident investigation report also discovered that far more plutonium/americium was released from a single drum in the February 12, 2014 event than the safety analysis predicted was possible.<sup>16</sup>

Anyone familiar with the numerous workers exposed to inhalation of plutonium and americium from ZPPR fuel plates for several minutes from the 2011 accident at the Materials and Fuels Complex knows that the DOE was not conducting and implementing adequate nuclear safety analysis or other safety programs to protect workers. In the 2011 ZPPR facility management

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<sup>15</sup> See more about Idaho's Settlement Agreement at <https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement.aspx>

<sup>16</sup> Department of Energy Office of Environmental Management, Accident Investigation Report, “Phase 2 Radiological Releases Event at the Waste Isolation Pilot Plant February 14, 2014,” April 2015. [http://wipp.energy.gov/Special/AIB\\_WIPP%20Rad\\_Event%20Report\\_Phase%20II.pdf](http://wipp.energy.gov/Special/AIB_WIPP%20Rad_Event%20Report_Phase%20II.pdf) See Sections 7.1 and 7.2. The release was found to have been from a single drum with stated inventory in plutonium-239 equivalent curies of 2.84 PE-Ci. But based on contamination on filters at Station A of 0.1 curies PE-ci far from the exploded drum in Panel 7, using conventional safety analysis assumptions the expected amount of material released to Panel 7 would not have exceeded 2.84E-4 PE-Ci — far less than what was measured downstream at Station A. The inventory in the drum appears to have been much higher than stated for WIPP drum and the release fractions may also be incorrect. This discrepancy in the transuranic inventory of the drum is in addition to the fact that forbidden inorganic “kitty litter” absorbent was placed in the drum which allowed an explosive combination of nitrates and organics. In my view, the extent to which the stated transuranic inventory was understated and actually not known does not appear to be adequately addressed by corrective actions recommended in the report. Alpha is difficult to monitor and easily shielded: DOE does not want you to know the degree that they say is in the drums may not conservatively bound what is actually in the drums.

refused to address\ any of the safety oversight chairman’s stated worker safety concerns when performing ZPPR plate inspections and directed workers to examine the plates in unsafe conditions caused multiple workers to inhale radionuclides that were still at detectable levels, based on urine and fecal bioassay, months after the event. <sup>17</sup>

According to The Center for Public Integrity investigation in 2017 titled “Nuclear Negligence” <sup>18</sup> that covered bad behavior around the Department of Energy Complex, INL’s MFC managers overseeing the ZPPR facility were warned 19 times by the Safety Oversight Chairman about worker safety issues concerning plutonium plate inspections but no action was taken. And Public Integrity reported that three legal settlements have resulted from the plutonium plate accident.

And anyone familiar with the cause of the four drums that blew their lids off at the INL’s Radioactive Waste Management Complex in April 2018 understands that the Department of Energy took egregious shortcuts in each of these accidents, including failure to conduct nuclear safety analysis for a waste stream that they actually knew contained a very reactive form of uranium along with beryllium carbide. The DOE was actively involved with not meeting hazardous waste RCRA requirements required by the State of Idaho and also no conducting required nuclear safety analysis per 10 CFR 830. A causal analysis <sup>19</sup> has been issued for the four transuranic waste drums that blew off their lids last April at the U.S. Department of Energy’s Radioactive Waste Management Complex. The causal analysis states that “Management failed to fully understand, characterize, establish and implement adequate process controls for treating waste which lacked documented origin or process information.” Specifically, the requirements for meeting 10 CFR 830 were not met.

A 2014 event at the Idaho National Laboratory’s FMF facility internally contaminated workers but this was not discovered until weeks had elapsed and workers had been exposed again to elevated airborne contamination during special processing in a leaking glovebox. <sup>20</sup> Battelle Energy Alliance failed to discuss why contamination swipes, hand-held alpha monitoring and step-in portal alpha monitors failed to identify the elevated contamination when the inadequately

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<sup>17</sup> Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, “Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory” accident 11/8/11 at the Materials and Fuels Complex (MFC). <http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor>.

<sup>18</sup> Patrik Malone, Peter Cary, *The Center for Public Integrity*, “Nuclear Negligence – Part Five: The inhalation of plutonium by 16 workers is preceded and followed by other contamination incidents but the private contractor in charge suffers only a light penalty,” June 28, 2017 <https://apps.publicintegrity.org/nuclear-negligence/repeated-warnings/>

<sup>19</sup> Idaho Cleanup Project Core, “Formal Cause Analysis for the ARP V (WFM-1617) Drum Event at the RWMC,” October 2018. [https://fluor-idaho.com/Portals/0/Documents/04\\_%20Community/8283498\\_RPT-1659.pdf](https://fluor-idaho.com/Portals/0/Documents/04_%20Community/8283498_RPT-1659.pdf)

<sup>20</sup> Department of Energy Occurrence Report NE-ID-BEA - - FMF – 2014- 0001. “MFC-704 FMF Suspect Contamination Found on CAM Filters,” Sept 24, 2014. “On October 9, 2014, it was reported that low levels of transuranic contamination were detected on four separate filters, two each taken from a Continuous Air Monitor (CAM) and a Portable Low Volume Air Sampler operating in the Fuel Manufacturing Facility between August 25 through September 2. Multiple workers were found, weeks later, to have internal contamination as determined by bioassay. Battelle Energy Alliance wrote in the occurrence report that no cause analysis of the undetected elevated levels of airborne contamination was needed.

configured constant air monitor failed to identify the contamination. That curious lack of curiosity about why the elevated levels of airborne contamination was not identified until weeks later when contamination was found on constant air monitor filters and the DOE contractor inexplicably decided that no causal analysis was needed.

### **Radiation Workers at INL Have Not and Are Not Being Adequately Protected**

Radiation worker training today still implies that a 5 rem annual dose would not be harmful even though radiation worker epidemiology has indicated elevated health risks at doses ten times less than 5 rem annually.<sup>21 22</sup> Radiation workers are still not warned of reproductive health risks such as sterility or increased risk of birth defects.<sup>23 24</sup>

The Department of Energy contractors who can be fined for workers getting excessive radiation exposures are in charge of conducting radiation dose assessment as well as handling samples and records used to estimate the radiation dose. Most workers do not understand the wide latitude allowed in making assumptions that can bias radiation dose estimates, nor the large uncertainty in the dose estimates.<sup>25</sup>

Investigations conducted of historical INL operations for energy worker illness compensation during the last two years have found shattering revelations about inadequate worker protections at the INL especially regarding inhalation of alpha emitters such as plutonium and the inability to estimate what doses these workers had received. The investigations partially include the early

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<sup>21</sup> 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 epidemiology study that included a cohort of over 300,000 nuclear industry workers has found clear evidence of solid cancer risk increases despite the average exposure to workers being about 2 rem and the median exposure was just 410 millirem. Also see December 2015 EDI newsletter.

<sup>22</sup> Email communication with INL’s public relations and Director Mark Peters confirmed that radiation worker training did not include training about recent epidemiology indicating higher health risk following Peter’s editorial in the Post Register on January 3, 2016 that promised more transparency, “New INL director looks ahead.”

<sup>23</sup> See the September EDI newsletter p. 2 and Kate Brown, *Plutopia – Nuclear Families, Atomic cities, and the Great Soviet and American Plutonium Disasters*, Oxford University Press, 2013. ISBN 978-0-19-985576-6. Note that many publications use spelling variation Mayak instead of Maiak.

<sup>24</sup> “Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII – Phase 2, The National Academies Press, 2006, [http://www.nap.edu/catalog.php?record\\_id=11340](http://www.nap.edu/catalog.php?record_id=11340) The BEIR VII report reaffirmed the conclusion of the prior report that every exposure to radiation produces a corresponding increase in cancer risk. The BEIR VII report found increased sensitivity to radiation in children and women. Cancer risk incidence figures for solid tumors for women are about double those for men. And the same radiation in the first year of life for boys produces three to four times the cancer risk as exposure between the ages of 20 and 50. Female infants have almost double the risk as male infants. BEIR VII findings are not included in Department of Energy radiation worker training, nor are the findings included in public radiation protection standards.

<sup>25</sup> “See the March 2017 EDI newsletter “How DOE underestimates the harm of plutonium inhalation,” at <http://www.environmental-defense-institute.org/publications/News.17.March.pdf> and other newsletters.

decades of INL operation until the 1980s but have not investigated all years of operation.<sup>26 27 28</sup>  
<sup>29 30 31 32 33</sup> Yet, as these studies for the National Institute for Occupational Safety and Health have begun to allow more workers to obtain compensation, many more studies need to be completed for various INL facilities and various years of operation. Roughly two thirds of INL illness compensation claims have been denied and these workers or their eligible survivors may die before the studies are complete.

The EA for HALEU fuel production pretends that workers have not been harmed and are not currently being harmed. The Department of Energy continues to fail to update the way radiation dose is calculated, choosing to ignore the more insoluble forms of radionuclides that are retained longer in the lungs and provide a higher dose than DOE is estimating by ignoring Super S class insolubility. The doses to the public are similarly underestimated.

The retention of particles in the lungs is greater when the particles are more insoluble. DOE has known for years that highly insoluble plutonium, called Super S class, stays in the lungs longer than the regular insoluble plutonium. But DOE does not account for Super S class even though worker compensation dose assessments do. Acknowledging Super S class could raise the dose and thus the severity of the inhalation.<sup>34</sup> So, the DOE contractors have permission to underestimate lung count results by ignoring Super S class, by delaying lung counts, by using very coarse methods to estimate chest wall thickness and muscle to fat ratio, by improper positioning of the detector over the lungs and by the selection of the statistical methods which are biased toward not finding a positive result. The DOE hides lung count results from workers and does not provide technical comparisons to validate their concluded radiation doses to workers.

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<sup>26</sup> See the EDI September 2017 newsletter and the Advisory Board on Radiation and Worker health meetings webpage for August 2017 at <https://www.cdc.gov/niosh/ocas/pubmtgs.html>. See the NIOSH/DCAS: Idaho Laboratory SEC Evaluation Report SEC-00238 from that page at <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2017/dc-inlsec238-082317.pdf>

<sup>27</sup> See the July 20, 2017 presentation to the NIOSH radiation advisory board (See August 14, 2017 board meeting) describing various problems at the Idaho National Laboratory's INTEC prior to 1981 at <https://www.cdc.gov/niosh/ocas/pdfs/sec/inl/inlcr-238-r0.pdf>

<sup>28</sup> INL May 2, 2016 NIOSH Radiation Advisory board recommended Special Exposure Cohort: <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/secsecs/bdrecinl-219.pdf>

<sup>29</sup> ANL-West May 2, 2016 NIOSH Radiation Advisory board recommended Special Exposure Cohort: <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/secsecs/bdrecanlw-224.pdf>

<sup>30</sup> See p. 19 of "INL SEC Proposed Class – Update SEC00219" at <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2015/dc-inlsec219-111015.pdf>

<sup>31</sup> See EDI's June 2017 newsletter article "Why so wrong for so long?" at <http://www.environmental-defense-institute.org/publications/News.17.June.pdf>

<sup>32</sup> SC&A, Inc., "Draft Review of NIOSH's Evaluation Report for Petition SEC-00219, Idaho National Laboratory: Burial Ground, 1952-1970," SCA-TR-2017-SEC007, May 2017.

<sup>33</sup> Department of Labor presentation August 2017 <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2017/dol-update-082317.pdf> p. 10-12.

<sup>34</sup> See our EDI newsletter for March 2017 for article "How DOE Underestimates the Harm of Plutonium Inhalation" at <http://www.environmental-defense-institute.org/publications/News.17.March.pdf>. See a table that compares Moderate Solubility, Class S Insolubility, and Super S Class Insolubility on p. 16.

At the INL, particle size may be assumed to be 5 um-AMAD.<sup>35</sup> But it is widely known that the actual particle size may be 1 um-AMAD oxide fuels at DOE facilities.<sup>36</sup> A higher dose results for the smaller particle size if the material is insoluble and the basis for INL's use of the particle size that lowers the estimated radiation dose needs to be supported by particle size analysis.

Table 1 gives a rough idea (but out-of-date) of the variation of the committed dose coefficients for an intake of a plutonium mixture at a weapons lab. The dose coefficient is used to estimate the total dose. The dose coefficient is highest for an intake directly into the blood. For dose to the bone, the dose from a moderately soluble mixture is about 5 times higher than the dose from a Class S solubility which more slowly enters the blood stream. The dose to the bone from a moderately soluble mixture is 16 times the dose of Super S solubility class. So, an assumption of moderate solubility would be conservative for all cases except those involving a very rapid intake such as a wound.

An assumed moderate solubility with 5 um particles is appropriately conservative unless the behavior is that of an instant uptake. But what INL has done is to assume the least conservative intake based on 5 um Class S while the material is very likely 1 um and may be Super Class S.

**Table 1.** Committed Dose Coefficients for Acute Intake of 20-Year Aged Weapons-grade mixture (rem/nanoCuries).

Source: PNNL-MA-860, Issued January 2003.<sup>37</sup>

Organ or Tissue	Instant Uptake	Class M Inhalation		Class S Inhalation		Super S Class inhalation	
		1-um	5-um	1-um	5-um	1-um	5-um
Effective	3.8E+00	4.7E-01	4.8E-01	3.3E-01	1.4E-01	5.9E-01	2.2E-01
Bone	7.1E+01	8.5E+00	9.3E+00	3.3E+00	1.7E+00	9.6E-01	5.7E-01
Red Marrow	5.5E+00	6.6E-01	6.1E-01	2.6E-01	1.3E-01	7.4E-02	4.4E-02
Liver	1.3E+01	1.5E+00	1.6E+00	6.0E-01	3.0E-01	1.9E-01	1.1E-01
Lung	insig.	6.3E-02	2.3E-02	1.2E+00	4.2E-01	4.4E+00	1.6E+00
Gonads	1.0E+00	1.3E-01	1.4E-01	4.8E-02	2.9E-02	1.3E-02	8.5E-03

a. Dose coefficient in rem/nanoCuries. 1 nano Curie is 1.0E-9 curie. 1 Seivert is 100 rem. 1 becquerel is 1 disintegration per second. 3.7E10 bq = 1 curie.

b. Particle size of 1-um or 5-um where um is micro-meter activity median aerodynamic diameter.

c. Class M has previously been named Class W; Class S has previously been named Class Y.

d. The CDC recognizes Super Class S for energy worker illness compensation calculations. See cdc.gov.

<sup>35</sup> 5 micro-meter activity median aerodynamic diameter, indicated here as 5-um-AMAD.

<sup>36</sup> John W. Gofman, MD, Radiation and Human Health, Sierra Club Books, 1981. p. 490 Gofman writes that when plutonium oxide is prepared for the purpose of making fuel rods, the particle sizes are in the 1-mircron range, perfectly suited for respiratory toxicity.

<sup>37</sup> H. Carbaugh et al., Pacific Northwest National Laboratory, "Methods and Models of the Hanford Internal Dosimetry Program, PNNL-MA-860, PNNL-15614, 2003.

[http://www.pnl.gov/main/publications/external/technical\\_reports/PNNL-15614.pdf](http://www.pnl.gov/main/publications/external/technical_reports/PNNL-15614.pdf) Table 8.14.

High levels of insoluble uranium often accompany plutonium intakes. While official estimates of cancer risk for the uranium dismiss the cancer risk of the uranium intake, the heavy metal stress and ionizing radiation from the multiple uranium decays causes serious stress on the body. A final suggestion to radiation workers, especially those who may be exposed to plutonium or uranium inhalation: have your children before you become a radiation worker. The elevated risk of serious birth defects from ionizing radiation including internal alpha emitters is ignored by the Department of Energy but should not be ignored by workers, of either gender, who plan to become parents. The birth defects of children of people with depleted uranium intakes has been documented in Gulf War veterans and in regions contaminated with artillery-use depleted uranium.<sup>38 39</sup>

The retention of particles in the lungs is greater when the particles are more insoluble. DOE has known for years that highly insoluble plutonium, called Super S class, stays in the lungs longer than the regular insoluble plutonium. But DOE does not account for Super S class even though worker compensation dose assessments do. Acknowledging Super S class could raise the dose and thus the severity of the inhalation.<sup>40</sup> So, the DOE contractors have permission to underestimate lung count results by ignoring Super S class, by delaying lung counts, by using very coarse methods to estimate chest wall thickness and muscle to fat ratio, by improper positioning of the detector over the lungs and by the selection of the statistical methods which are biased toward not finding a positive result. And beyond all of that, it appears that over the years that the DOE contractors have also manipulated the results to achieve the desired outcome. The lung count results may have been lowered in order to say you did not have a significant inhalation of actinides.

Bioassay analysis of urine and fecal samples can detect lower levels of intakes. It has long been recognized for the low but chronic inhalation of actinides, bioassay could detect intake when lung counts could not. The detection of radioactivity above expected background levels in urine and fecal samples reveals that a detection occurred. The activity in the bioassay (in disintegrations per second or curie) is then used in a variety of creative ways that allow the estimation of actinide intake to be as low as the DOE contractor wants the intake to be. The contractor can claim to follow official ICRP models and come up with any internal dose, ranging from 10 mrem to 30,000 mrem, whole body.<sup>41 42</sup> So, the internal dose assessment based on

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<sup>38</sup> Depleted Uranium Education Project, "Metal of Dishonor Depleted Uranium –How the Pentagon Radiates Soldiers and Civilians with DU Weapons," 1997.

<sup>39</sup> R. Bertell, *International Journal of Health Services*, "Depleted Uranium: All the Questions About DU and Gulf War Syndrome Are Not Yet Answered," 2006.  
<https://ntp.niehs.nih.gov/ntp/roc/nominations/2012/publiccomm/bertellattachmentohw.pdf>

<sup>40</sup> See our EDI newsletter for March 2017 for article "How DOE Underestimates the Harm of Plutonium Inhalation" at <http://www.environmental-defense-institute.org/publications/News.17.March.pdf> See a table that compares Moderate Solubility, Class S Insolubility, and Super S Class Insolubility on p. 16.

<sup>41</sup> Blanchin, N. et al., *Radioprotection*, "Assessing internal exposure in the absence of an appropriate model: two cases involving an incidental inhalation of transuranic elements," December 2008. DOI: <https://doi.org/10.1051/radiopro:2008014> and see at [http://www.iaea.org/inis/collection/NCLCollectionStore/\\_Public/43/004/43004048.pdf](http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/004/43004048.pdf)

<sup>42</sup> See our EDI newsletter for March 2017 for article "How DOE Underestimates the Harm of Plutonium Inhalation" at <http://www.environmental-defense-institute.org/publications/News.17.March.pdf>

bioassay results should not be comforting to the worker. The worker must obtain the bioassay results of the amount of activity and the nuclides occurring that are above expected background levels.

Workers are routinely denied access to their lung count reports, their internal dose assessment based on upper bound lung count intakes, their bioassay reports of nuclide and activity found, and their final internal dose assessment. DOE contractors have even denied workers these documents when Freedom of Information Act requests were submitted, saying that the dose results were contractor work product and were confidential information that could not be provided to the worker. Access to this information if it is attained is often many months after the intake and the reports may not be finalized until many months after the intake.

Many former INL workers may suspect that they have been exposed to radiation or chemicals and following illness may have applied to the Energy Employee Occupational Illness Compensation Program Act (EEOICPA) only to be denied.<sup>43</sup> The National Institute of Occupational Safety and Health (NIOSH) that administers the energy employee illness program, the EEOICPA, emphasizes that it uses claimant favorable modeling to determine whether working at INL likely caused the illness. But they have denied two-thirds of the claims by INL workers. Fortunately, there are now several radiation exposure cohorts that provide compensation for INL and ANL-W employees for certain years of employment without requiring radiation dose reconstruction to determine eligibility.<sup>44</sup>

NIOSH decides whether to approve or deny claims but has never taken a look at the drinking water contamination levels at various INL sites. If they had, they would have needed to fill-in-the-blanks on the contamination levels for the years that various contaminants were present but not monitored. No such report exists. Environmental Defense Institute has prepared two reports, however, that highlight some of the recorded levels of contamination in drinking water at INL and downgradient of the INL.<sup>45 46</sup>

NIOSH did, however, conduct epidemiology comparing the health of INL workers to that of surrounding communities and they found that both radiation workers and non-radiation workers at the INL site had elevated illnesses.<sup>47</sup> NIOSH never sought to answer why.

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<sup>43</sup> 42 USC 7384, [The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 \(EEOICPA\), as Amended](#) and see the website for the Center for Disease Control, National Institute of Occupational Safety and Health, Division of Compensation Analysis and Support at <http://www.cdc.gov/niosh/ocas/> and U.S. Department of Labor, Office of Workers' Compensation Programs, EEOICPA Program Statistics, <http://www.dol.gov/owcp/energy/regs/compliance/weeklystats.htm>

<sup>44</sup> See the Idaho National Laboratory status at <http://www.cdc.gov/niosh/ocas/ineel.html> and see the portion of INL formerly ANL-W at <http://www.cdc.gov/niosh/ocas/anlw.html>

<sup>45</sup> Environmental Defense Institute report by Tami Thatcher, *The Hidden Truth About INL Drinking Water*, June 2015, <http://environmental-defense-institute.org/publications/INLdrinkwaterR1.pdf>

<sup>46</sup> Thatcher, T.A., Environmental Defense Special Report, *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters*, 2017. [www.environmental-defense-institute.org/publications/kimamareport.pdf](http://www.environmental-defense-institute.org/publications/kimamareport.pdf)

<sup>47</sup> "An Epidemiology Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U.S. Department of Energy Facility, January 2005.

The information in this report, unfortunately, is not likely to help these non-radiation workers or radiation workers obtain energy employee illness compensation because, officially, many of these workers have little or no record of significant radiation exposure and may not have been assigned a radiation badge. And this is despite the growing body of human epidemiological evidence that shows that the officially accepted models of radiation cancer risk underestimate the harm of ionizing radiation.<sup>48 49</sup>

I gave public comment at the October meeting of the INL Citizens Advisory Board to update CAB members on the November 8, 2011 plutonium plate inspection accident at the INL's Materials and Fuels Complex.<sup>50</sup> Meeting minutes from 2011 document how the CAB had been assured that the radiation doses from the accident were so low that no worker would be restricted from returning to radiation work.<sup>51</sup>

But more than one worker was restricted from radiation work for months. And bioassay at eight months still showed elevated plutonium and americium excretion.<sup>52</sup> Bioassay results and other details of their radiation dose estimates were withheld from workers.

Several MFC workers were affected by a subsequent americium inhalation event in 2014 involving a different process.<sup>53</sup>

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<http://www.cdc.gov/niosh/docs/2005-131/pdfs/2005-131.pdf> and <http://www.cdc.gov/niosh/oerp/ineel.htm> and Savannah River Site Mortality Study, 2007. <http://www.cdc.gov/niosh/oerp/savannah-mortality/>

<sup>48</sup> Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), *BMJ*, v. 351 (October 15, 2015), at <http://www.bmj.com/content/351/bmj.h5359> Richardson et al 2015 ] (And please note that studies of high leukemia risk in radiation workers and of ongoing studies to assess health effects of high and low-linear energy transfer internal radiation must also be studied in addition to this one on external radiation.)

<sup>49</sup> "Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII – Phase 2, The National Academies Press, 2006, [http://www.nap.edu/catalog.php?record\\_id=11340](http://www.nap.edu/catalog.php?record_id=11340) The BEIR VII report reaffirmed the conclusion of the prior report that every exposure to radiation produces a corresponding increase in cancer risk. The BEIR VII report found increased sensitivity to radiation in children and women. Cancer risk incidence figures for solid tumors for women are about double those for men. And the same radiation in the first year of life for boys produces three to four times the cancer risk as exposure between the ages of 20 and 50. Female infants have almost double the risk as male infants.

<sup>50</sup> U.S. Department of Energy Office of Health, Safety and Security Accident Investigation Report, "Plutonium contamination in the Zero Power Physics Reactor Facility at the Idaho National Laboratory, November 8, 2011," January 2012.

<sup>51</sup> Idaho National Laboratory Citizens Advisory Board, meeting minute archive for November 2011 at <http://inlcab.energy.gov/pages/meetings/archive.php>

<sup>52</sup> Private communication with radiation worker 2012 through 2015, witness of NIOSH data capture interview regarding the ZPPR dose analysis in 2014 and access to INL's "Dose Assessments for November 8, 2011 ZPPR Event" with redactions, INL/INT-12-27269, September 2012.

<sup>53</sup> Department of Energy Occurrence Report NE-ID-BEA - - FMF – 2014- 0001. "MFC-704 FMF Suspect Contamination Found on CAM Filters," Sept 24, 2014. "On October 9, 2014, it was reported that low levels of transuranic contamination were detected on four separate filters, two each taken from a Continuous Air Monitor (CAM) and a Portable Low Volume Air Sampler operating in the Fuel Manufacturing Facility between August 25 through September 2. Multiple workers were found, weeks later, to have internal contamination as determined by bioassay. Battelle Energy Alliance wrote in the occurrence report that no cause analysis of the undetected elevated levels of airborne contamination was needed.

## Nuclear Energy is Not Affordable

The EA asserts that nuclear energy is affordable but with no basis. It is a simple sharing of an untrue myth, typical of much of the baseless assertions in the EA. Despite enormous federal taxpayer subsidies of nuclear energy, it remains one of the most expensive sources of electricity and recent bailout requests and two partially constructed AP1000 plants in S. Carolina have been abandoned, at great expense to rate payers.

**The pre-renaissance claim around 2006 that the nuclear industry knew how to control construction costs has not panned out.** It will have rate payers paying higher power bills for decades without any energy generation from the abandoned South Carolina plants unless legal actions succeed in protecting ratepayers from the ballooning costs. Ratepayers in Georgia are paying a surcharge for the plants despite no power being generated by the plants.

The Westinghouse Nuclear Division bankruptcy filing last March because of the cost overruns in the billions on the fixed-cost contract for construction of the four US plants, two at South Carolina's Summer station and two at Georgia's Plant Vogtle.<sup>54</sup> Westinghouse was bought by Japan's Toshiba in 2006 with hopes of a nuclear renaissance in the US. Toshiba has announced that it has no further plans to compete to build nuclear plants. Toshiba will be paying out \$ 2.2 billion to S. Carolina, and \$ 3.7 billion to Georgia to extricate itself from the fiasco.<sup>55</sup>

The Westinghouse nuclear website still claims to have designed a safer and simplified plant that because of modern, modular-construction techniques that would shorten construction times and improve quality. It claims that the AP1000 was designed to be economically competitive with contemporary fossil-fueled plants.<sup>56</sup> **Claiming nuclear energy to be reliable, safe, and affordable nuclear power doesn't pass the snicker test anymore, so the nuclear promoters are claiming that commercial nuclear reactors are needed for national security.**<sup>57</sup>

Now that Westinghouse is bankrupt, it joins the ranks of other nuclear builders that have exited the nuclear reactor business. France's Areva has been bailed out by France but remains swamped by the currently unfinished EPR plant in Finland that has large cost overruns and delays. Japan's GE Hitachi never found a buyer for its sodium cooled reactor based in the INL Experiment Breeder Reactor II (EBR-II) design. Other companies including Germany's Siemens have left the nuclear reactor construction industry.<sup>58</sup>

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<sup>54</sup> Russell Grantham and Johnny Edwards, *The Atlanta Journal-Constitution*, "Plant Vogtle: Georgia's nuclear 'renaissance' now a financial quagmire," May 19, 2017. <http://www.myajc.com/business/plant-vogtle-georgia-nuclear-renaissance-now-financial-quagmire/5116IFMFICknSCeI7RXG6J/> The two 1100 Megawatt reactors were to have powered 1.5 million homes, cost \$14 billion, and been running in 2016.

<sup>55</sup> US Department of Energy, *Nuclear Power Summary – News & Notes*, August 2017.

[https://www.energy.gov/sites/prod/files/2017/08/f35/Nuclear-Power-Summary-August-2017\\_0.pdf](https://www.energy.gov/sites/prod/files/2017/08/f35/Nuclear-Power-Summary-August-2017_0.pdf)

<sup>56</sup> Westinghouse Nuclear <http://www.westinghousenuclear.com/New-Plants/AP1000-PWR/Economic-Benefits>

<sup>57</sup> Ernst Moniz, *Energy Futures Initiative*, "Moniz: Robust Nuclear Industry Needed for National Security," August 17, 2017. <https://www.nei.org/News-Media/News/News-Archives/2017/Moniz-Robust-Nuclear-Industry-Needed-for-National> The argument is that nuclear energy is needed for

<sup>58</sup> *World Nuclear News*, "Siemens quits the nuclear game," September 19, 2011. [http://www.world-nuclear-news.org/C\\_Siemens\\_quits\\_the\\_nuclear\\_game\\_1909111.html](http://www.world-nuclear-news.org/C_Siemens_quits_the_nuclear_game_1909111.html) "The head of German industrial giant Siemens has said the company will withdraw its remaining nuclear power offerings and leave the industry."

## DOE Continues Shallow Burial of Long-lived and Mobile Radionuclides Over the Aquifer

The EA briefly mentions the Remote Handled Low-Level Waste disposal facility at the Idaho National Laboratory but fails to discuss that this includes Greater-Than-Class-C long-lived radionuclides that are expected to migrate into the Snake River Plain aquifer. The computations to provide the Performance Assessment for the rate at which the radionuclides will migrate into the aquifer are based on unsupported assumptions regarding optimistic selection of properties to slow the estimated rate of migration, assumption of uniform mixing in the aquifer while ignoring the known presence of “fast paths,” the presumed lack of flooding, and stable geology for the need million and more years. The EA fails to mention have the DOE hopes to increase the amount of radionuclides buried over the aquifer without so much as even the pretense of a soil cap to slow the migration of radionuclides into the aquifer. The EA obscures the fact that the DOE continues to bury radioactive waste over our Snake River Plain aquifer.<sup>59</sup> The DOE has failed to be truthful about past aquifer contamination migration to the south of the Idaho National Laboratory, as I describe in *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters*.<sup>60</sup>

The INL appears to be ignoring the transport of radionuclides from buried waste to the surface by upward diffusion through the unsaturated soils. In an EA for shallow burial of the nation’s entire GTCC inventory at the Andrews, Texas WCS facility,<sup>61</sup> that EA found that burial of GTCC waste at the WCS facility, at the Andrews County, Texas waste site would be dominated by upward diffusion of volatile radionuclides. This means the estimates of air emissions may be omitting this contribution for INL air emissions.

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<sup>59</sup> 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> and see EDI’s report “Unwarranted Confidence in DOE’s Low-Level Waste Facility Performance Assessment – The INL Replacement Facility Will Contaminate Our Aquifer for Thousands of Years” at <http://www.environmental-defense-institute.org/publications/rhllwFINALwithFigs4.pdf>

<sup>60</sup> Thatcher, T.A., Environmental Defense Special Report, *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters*, 2017. [www.environmental-defense-institute.org/publications/kimamareport.pdf](http://www.environmental-defense-institute.org/publications/kimamareport.pdf)

<sup>61</sup> U.S. Department of Energy, Environmental Assessment for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste at Waste Control Specialists, Andrews County, Texas, DOE/EA-2082, October 2018. <https://www.energy.gov/sites/prod/files/2018/11/f57/final-ea-2082-disposal-of-gtcc-llw-2018-10.pdf> The inventory of GTCC and GTCC-like waste is about 12,000 cubic meters (420,000 cubic feet) in volume and contains about 160 million curies of radioactivity. “Since the site is in a semi-arid environment, most of the transport of radionuclides to the environment is expected to be through upward diffusion of volatile radionuclides, including helium-3, carbon-14, argon-39, krypton-85, iodine-129, and radon-222, to the surface rather than via groundwater.” “The peak dose is dominated by upward diffusion of technetium-99.” “Because of the geologic conditions at the site, as well as the license mitigation measures, releases would not be expected until well after most of the radionuclides had decayed away. Only very long-live [sic] radionuclides would be expected to remain...Transport of radionuclides from the waste to the surface or underlying groundwater would still be limited by diffusion through the unsaturated soils.” The EA provides effective dose after loss of institutional control that increases over time, higher at 100,000 years after closure. Because the radionuclides ingested are not delineated, the effective dose which may appear low may in reality cause serious developmental problems or premature death to children.

## **Radiological Air Emissions More Harmful Than Presented in the EA**

The representation of harm from air emissions to the region must assess cumulative impacts from historical releases and ongoing releases as well as future releases. The EA does, however, by its presentation of estimated dose from radiological emissions in Table 2 demonstrate the inaccuracy and underrepresentation of ongoing radiological air emissions as reported at Frenchman's Cabin in National Emissions Standards for Hazardous Air Pollutants.

The EA refers to one year of NESHAPs data without even providing a reference to the document. Most of NESHAPs reporting for the INL is not based on monitored emissions; it is based on estimated releases computed in documents that are not identified and are not available for public review. In fact, no one at DOE will discuss whether or not the years of "accidental" resin releases from the Advanced Test Reactor to the open air evaporation pond has been included in NESHAPs reporting. These resins are highly radioactive and a not a permitted release to the evaporation pond, but when the new contractor inadvertently discovered the release, they covered up contaminated soil with 1 ft of soil without any transparency or accountability to Idaho citizens what-so-ever.<sup>62</sup> CERCLA cleanup standards promised by the DOE are 11 ft depth, while DOE reneged to a 3 ft depth cleanup at the ATR Complex.

In fact, long-lived radionuclides are present not only at INL's INTEC facility where naval and research spent nuclear fuel was reprocessed, long-lived radionuclides including americium-241 are present at the ATR Complex.<sup>63 64</sup>

Because of the habitual omission of long-lived radionuclides, even the Department of Energy had not properly determined the number of years that institutional controls limiting access to contaminated areas would be required. The 2095 date was incorrect, then in 2010, 300 years was added to create the later 2310 date, which was also incorrect. Then NSI-26002 stated an additional 24,100 years needed to be used. But the number of years that needed to be added was actually far larger because more than one half life of americium-241 decay was needed and they forgot that americium-241 must decay through several radioactive decay progeny before reaching a stable non-radioactive isotope.<sup>65</sup>

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<sup>62</sup> See EDI newsletters on ATR Evaporation Pond release in August and September 2017 at [www.environmental-defense-institute.org](http://www.environmental-defense-institute.org)

<sup>63</sup> 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 August 2015. See the CERCLA Administrative Record at [ar.icp.doe.gov](http://ar.icp.doe.gov)

<sup>64</sup> Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA Courtyard Area," NSI-26011, signed April 2014. See the CERCLA Administrative Record at [ar.icp.doe.gov](http://ar.icp.doe.gov). Table 9 includes extensive americium-241 contamination in soil along with europium-152, cesium-137, and cobalt-60.

<sup>65</sup> 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 August 2015. See the CERCLA Administrative Record at [ar.icp.doe.gov](http://ar.icp.doe.gov) See page 7 of Rev. 1. showing americium-241 contamination at 3210 pCi/g yet the unrestricted use concentration is 187 pCi/g.

**Add to this now the flushing of highly radioactive resin beads to the open air evaporation pond at the ATR Complex, and covering up contaminated soil with 1 ft of soil without any transparency or accountability to Idaho citizens what-so-ever. <sup>66</sup>**

At the Idaho National Laboratory, formerly the Idaho National Engineering and Environmental Laboratory, the Idaho National Engineering Laboratory, and the National Reactor Testing Station, historical releases were monitored yet not actually characterized as to what and how many curies were released. When asked by the governor in 1989 to provide an estimate of the radionuclides released from routine operations and accidents, the Department of Energy issued the “INEL Historical Dose Evaluation.” <sup>67</sup> <sup>68</sup> It has been found to have underestimated serious releases by sometimes 10-fold. Furthermore, the past environmental monitoring used all along to claim no significant releases had occurred were not used in the INEL Historical Dose Evaluation. The environmental records that could have been used against the Department of Energy were destroyed.

### **The Effect on Local Drinking Water Ignored**

In the Idaho Falls area, nearby Comore Loma had the following water sampling data in 2006: gross alpha excluding radon and uranium at 8.2 pCi/L and gross beta at 19.6 pCi/L. <sup>69</sup> The annual environmental reporting for the Idaho National Laboratory and surrounding communities had large spikes in gross alpha and gross beta in air monitoring at [www.idahoeseer.com](http://www.idahoeseer.com) for 2006. The gamma spectrometry of filters showed contributions to airborne radioactivity from the usual emissions and/or soil resuspensions from the INL of cesium-137, strontium-90, plutonium-239, americium-241 and plutonium-238. These are among the most common radionuclides detected that are significant contributors to radiological dose from the INL.

Note that other transuranics such as curium-244 and californium-252 are known to be disposed of to the open-air evaporation pond at the ATR Complex (formerly known as the Test Reactor Area), in addition to radionuclides listed in the previous paragraph and various other radionuclides such as europium-152 and -154 are also disposed of to the evaporation pond from chemical separations processes as well as normal reactor operations effluent. The Advanced Test Reactor is also a large emitter of tritium, argon, xenon, and krypton.

No matter the repeated refrain that based on the airborne monitoring, officialdom just can't say where the radionuclides might have come from, since, shucks, the contamination is spread from Rupert to Rexburg, Carey and Arco to Mud Lake and Sugar City, and Blackfoot to Craters of the Moon.

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<sup>66</sup> See EDI newsletters on ATR Evaporation Pond release in August and September 2017 at [www.environmental-defense-institute.org](http://www.environmental-defense-institute.org)

<sup>67</sup> US Department of Energy Idaho Operations Office, “Idaho National Engineering Laboratory Historical Dose Evaluation,” DOE-ID-12119, August 1991. Volumes 1 and 2 can be found at <https://www.iaea.org/inis/inis-collection/index.html>

<sup>68</sup> Environmental Defense Institute’s comment submittal on the Consent-based Approach for Siting Storage for the nation’s Nuclear Waste, July 31, 2016. <http://www.environmental-defense-institute.org/publications/EDIXConsentFinal.pdf>

<sup>69</sup> See EDI newsletter for February 2018.

The airborne contamination settles on soil which is incorporated into crops like lettuce and wheat. And the airborne contamination from the INL is getting into our drinking water despite not arriving there from the flow of the aquifer.

Gross alpha levels excluding uranium and radon are called “adjusted gross alpha” and the federal limit is 15 pCi/L. High adjusted gross alpha levels are an indicator of possible man-made radionuclide contaminants such as plutonium. But drinking water programs tend to not to identify the source of the elevated gross alpha in drinking water.

Uranium, plutonium, americium, and other transuranics released to the air by the Idaho National Laboratory can elevate levels of airborne gross alpha contamination. The elevated levels tend to coincide with elevated levels of gross alpha not only in surface water but also in public drinking water supplies that do not use surface water. Trends can be difficult to discern from sometimes infrequently sampled drinking water.

Exceeding federal MCLs can invoke more costly sampling requirements and could trigger the need for water treatment.<sup>70</sup> Imposing water treatment is also considered costly and water districts have resorted to aggressive data manipulations to avoid exceeding MCLs. In Texas, uncertainty was subtracted from sample data results to lower the reported results.<sup>71</sup> Data averaging can be used to dilute peak results. In Idaho, many water districts having high radionuclide levels have numerous reporting violations which might be related to attempts to avoid reporting high radionuclide sample results.

Because drinking water monitoring is complex, it might sound more comprehensive than it is. Public water supply sampling requirements have evolved based on expectations that are not necessarily correct and on economics. The result is a patchwork of sampling that may provide some clues but will leave various radionuclides unidentified in community wells. Non-community wells where people work but don't live, don't require any monitoring of radionuclides.

Radium-224 sampling was not required in part because of the expectation that the thorium decay series that includes radium-228 and radium-224 as decay progeny was expected to be less prominent than the uranium-238 decay series. That assumption has not panned out. Radium-228 is often higher than radium-226, and radium-224 levels when further researched can equal or exceed the radium-228 levels which do require sampling.

The U.S. Geological Survey reported in 2001 that “Conventional monitoring procedures, which do not require analysis of gross-alpha-particle activities in time to account for the contribution of

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<sup>70</sup> Here is a concise overview of water treatment technologies for radionuclide removal by David P. Boaz, HydraTech, 2008.

[https://www.hydratechnm.org/documents/technical\\_articles/understanding\\_the\\_epa\\_radionuclides\\_rule.pdf](https://www.hydratechnm.org/documents/technical_articles/understanding_the_epa_radionuclides_rule.pdf)

<sup>71</sup> Bill Walker, Editor in Chief and Wicitra Mahotama, Environmental Analyst, “170 Million in U.S. Drink Radioactive Tap Water. Trump Nominee Faked Data to Hide Cancer Risk,” January 11, 2018. [https://www.ewg.org/research/170-million-us-drink-radioactive-tap-water-trump-nominee-faked-data-hide-cancer-risk#.WnO\\_vedG2Um](https://www.ewg.org/research/170-million-us-drink-radioactive-tap-water-trump-nominee-faked-data-hide-cancer-risk#.WnO_vedG2Um) See also the interactive map to find radionuclide contamination in public drinking water in your area.

short-lived isotopes such as Ra-224, could lead to false indications of compliance.”<sup>72</sup> The report noted that although Ra-224 was not typically measured, it generally occurs in ratios near 1:1 with Ra-228. Gross alpha particle screening of 3 pCi/L of Ra-226 can wrongly indicate that there is no significant Ra-228 (a beta particle emitter).

The USGS report also pointed out the absence of lead-210 and polonium-210 sampling may be missing this source of radiation but the report indicated that the levels would be expected to be below 3 pCi/L. Polonium-210 binds to hemoglobin and there have been concerns that it may be an underestimated public health risk.<sup>73</sup>

Tritium levels are not sampled presumably because the federal MCL would not be exceeded; yet reasonable public health goals may be exceeded. See EDI reports on the aquifer including “Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters.”<sup>74</sup>

Radionuclides in our drinking water in southeast Idaho include naturally occurring radionuclides, past nuclear weapons testing fallout and resuspension of historical releases from the INL in the soil. The extent that the radionuclides in our drinking water are from continuing airborne releases from the INL is not something that INL monitoring programs are going to discuss given the denials that INL is the source of elevated airborne radionuclide contamination.

When reviewing drinking water radionuclide sampling, understanding how the actinides can contribute to the “natural” decay series of uranium-238 and of thorium-232, and the decay series of uranium-235 and of uranium-233 can be quite helpful. And it also becomes necessary to understand not only the fission products resulting from reactor operation, but also the radionuclides formed by successive neutron absorption that occurs in the neutron rich environment of an operating nuclear reactor.

Four decay series are presented in Tables 5 through 8 below:

- the uranium-238 decay series known as the uranium series;

- the thorium-232 decay series known as the thorium series;

- the uranium-235 decay series known as the actinium series, and

- the uranium-233 decay series which is man-made and remains officially nameless.

I have included these decay series tables here for three reasons: (1) unless you have a degree in radiochemistry, you need to have the names of the nuclides spelled out along with their short-hand symbol identifier (such as U, Pu, Np), (2) it is difficult to locate decay series that are complete with man-made decay chains feeding in, and (3) it is important to understand the

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<sup>72</sup> Michael J. Focazio et al., U.S. Geological Survey, “Occurrence of Selected Radionuclides in Ground Water Used for Drinking Water in the United States: A Reconnaissance Survey, 1998,” Water-Resources Investigations Report 00-4273, 2001. <https://pubs.usgs.gov/wri/wri004273/pdf/wri004273.pdf>

<sup>73</sup> James A. Jacobus, Minnesota Department of Health, Fact Sheet RP099, <http://www.health.state.mn.us/divs/eh/risk/guidance/dwec/radionpostsetac.pdf>

<sup>74</sup> Tami Thatcher, Environmental Defense Institute Special Report, “Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why this Matters,” 2017. [www.environmental-defense-institute.org/kimamareport.pdf](http://www.environmental-defense-institute.org/kimamareport.pdf)

specific decay series that a radionuclide belongs to as you study drinking water, lung count results and environmental radionuclide emissions data.

These decay series show the man-made actinides that may also decay through the same series in grey. The decay series depict alpha decay as progressing downward and reducing the atomic mass by 4. Beta decay by electron emission is depicted as progressing upward diagonally to the right. Beta decay flips a neutron into a proton and stays at the same atomic mass. Isotopes of the same chemical element have the same number of protons but can have variable numbers of neutrons and variable atomic mass. The half-lives of the various radionuclides range from millions or billions of years to milli-seconds.

Along with alpha and beta decays at various energy levels, gamma photon emissions of various energy levels can also occur which can be detected by gamma spectrometry.

So, while uranium, thorium and plutonium are thought of primarily as alpha particle emitters, gamma radiation is also emitted and decay progeny may emit beta particles rather than alpha particles along with gamma radiation at various energy levels measured in kiloelectron volts (keV).

Weak or low energy gamma emissions require less shielding than higher energy gamma emissions. Uranium decay progeny of Th-231, Th-234 and Pa-234, all beta emitters, have high specific activity in curies per gram that require some protection of workers.

Sources of uranium-238 include natural soil and rock sources, mill tailings, depleted uranium, reactor fuel melting from reactor accidents, and spent fuel reprocessing. Sources of uranium-234 decay progeny can include man-made plutonium-238 that is present in various materials and processes at the INL.

Sources of thorium-232 include natural thorium-232 in rock and soil. Sources of thorium-232 can also include man-made plutonium-240 and uranium-236 resulting from neutron capture in a reactor.

Sources of uranium-235 include natural uranium in rock and soil but are typically considered to be of small enough abundance to be ignored. But this decay series should not be ignored where enriched uranium is released to the environment. Sources of the U-235 decay series also include plutonium-239 which decays to uranium-235. Dispersion of reactor fuel from reactor accidents and spent fuel reprocessing can spread uranium-235 in the environment. Waste water disposal from HEU spent fuel reprocessing has put uranium-236 in the Snake River Plain Aquifer. Fuel reprocessing and calcining and reactor fuel melt tests or accidents spread various radionuclides present in nuclear fuels to air and soil.

Table 5. Uranium-238 decay series.

Californium	Cf-250 *						
Curium	Cm-246 *		Cm-242				
Americium	↓	Am-242 / ^	↓				
Plutonium	Pu-242	↓	Pu-238				
Neptunium	↓	Np-238 / ^	↓				
Uranium	U-238		U-234				
Protactinium	↓	Pa-234 / ^	↓				
Thorium	Th-234 / ^		Th-230				
Radium			Ra-226				
Radon			Rn-222				
Polonium			Po-218		Po-214		Po-210
Bismuth			↓	Bi-214 / ^	↓	Bi-210 / ^	↓
Lead			Pb-214 / ^		Pb-210 / ^		Pb-206 (stable)

Table notes: Alpha decay downward reduces the atomic mass by 4; beta decay upward diagonally to the right flips a neutron to a proton and stays at the same atomic mass. In the table, arrow symbols downward are used to show the progression of some alpha decays if there was space to show the arrow. Movement upward and to the right is shown by / ^ which is a lame keyboard attempt to look like an arrow. Man-made actinides are shown in grey.

\* Decay series to Cf-250 and Cm-246 not shown which include Cm-250, Pu-246, Am-236 and Bk-250.

Sources of uranium-238 include natural soil and rock sources, depleted uranium, reactor fuel melting from reactor accidents, and spent fuel reprocessing. Sources of uranium-234 decay progeny can include plutonium-238.

Table 6. Thorium-232 decay series.

Californium	Cm-252		Cf-248				
Curium	Cm-248		Cm-244				
Americium	↓		↓				
Plutonium	Pu-244		Pu-240				
Neptunium	↓	Np-240 / ^	↓				
Uranium	U-240 / ^		U-236				
Protactinium			↓				
Thorium			Th-232		Th-228		
Actinium			↓	Ac-228 / ^	↓		
Radium			Ra-228 / ^		Ra-224		
Radon					Rn-220		
Polonium					Po-216		Po-212
Bismuth					↓	Bi-212 / ^	↓
Lead					Pb-212 / ^	↓	Pb-208 (stable)
Thallium						Tl-208 / ^	

See table notes for Table 5. Sources of thorium-232 include natural thorium-232 in rock and soil. Plutonium-240 and uranium-236 which results from neutron capture in a reactor also decay to thorium-232. Depleted uranium can include uranium-236. The higher actinides that decay to plutonium-240 are not shown but include californium-252 and -248, curium-248 and -244, plutonium-244, and neptunium-240.

Table 7. Uranium-235 decay series.

Californium	Cf-251						
Berkelium	↓	Bk-247					
Curium	Cm-247	↓	Cm-243				
Americium	↓	Am-243	↓				
Plutonium	Pu-243 / ^	↓	Pu-239				
Neptunium		Np-239 / ^	↓				
Uranium			U-235				
Protactinium			↓	Pa-231			
Thorium			Th-231 / ^	↓	Th-227		
Actinium				Ac-227 / ^	↓		
Radium				↓	Ra-223		
Francium				Fr-223 / ^	↓		
Radon					Rn-219		
Polonium					Po-215		
Bismuth					↓	Bi-211 / ^	
Lead					Pb-211 / ^	↓	Pb-207 (stable)
Thallium						Tl-207 / ^	

See table notes for Table 5. Sources of uranium-235 include natural uranium in rock and soil. It should not be ignored where enriched uranium is released to the environment. Plutonium-239 also decays to uranium-235 and higher actinides (californium, curium, americium and neptunium) are shown. Dispersion of reactor fuel from reactor accidents and spent fuel reprocessing can spread uranium-235 in the environment.

Table 8. Uranium-233 decay series.

Californium	Cf-241						
Curium	Cm-245						
Americium	↓	Am-241					
Plutonium	Pu-241 / ^	↓					
Neptunium		Np-237					
Uranium		↓	U-233				
Protactinium		Pa-233 / ^	↓				
Thorium			Th-229				
Actinium			↓	Ac-225			
Radium			Ra-225 / ^	↓			
Francium				Fr-221			
Radon				↓			
Astatine				At-217			
Polonium				↓	Po-213		
Bismuth				Bi-213 / ^	↓	Bi-209	
Lead				↓	Pb-209 / ^	↓	
Thallium				Tl-209 / ^		Tl-205	

See table notes for Table 5. Uranium-233 is not naturally occurring. This weapons fissile material can only be produced in a reactor or by the higher actinide decays shown including plutonium-241 and americium-241 decay. Higher actinides (californium, curium, americium and neptunium) are shown. Uranium-233 can and has been used in nuclear weapons testing. Its dispersion can also result from various weapons production and separations processes. Disposal of americium-241 following plutonium purification may be a significant source. It can also result from spent fuel reprocessing particularly of high enriched uranium fuel because of the high buildup of neptunium-237 in HEU reactor operations.

Depleted uranium is uranium that is left over after extraction of uranium-235. Enriched uranium includes more than 0.72 percent up to 93.5 percent U-235 enrichment. Commercial nuclear power reactors typically use 3 to 5 percent enrichment. Enriched uranium also includes increased amounts of uranium-234 which cannot be separated from the uranium-235. Most depleted uranium includes between 0.2 and 0.4 percent uranium-235. Depleted uranium composition can vary and can include uranium-236 if it resulted from reactor fuel reprocessing. The health harm caused by inhalation or ingestion of depleted uranium includes illness and increased risk of birth defects.<sup>75 76</sup>

Uranium-233 is not naturally occurring. This weapons fissile material can only be produced in a reactor or by the higher actinide decays shown including plutonium-241 and americium-241 decay. Uranium-233 has been dispersed by its production, separation and limited use in nuclear weapons testing. Disposal of americium-241 following plutonium purification may be a significant source. It can also result from spent fuel reprocessing particularly of high enriched uranium fuel because of the high buildup of neptunium-237 in HEU reactor operations.

Higher actinides such as californium, curium, americium and neptunium may be produced using target material in nuclear reactors in order to produce weapons related materials or to produce a heat source for radiothermal generators such as plutonium-238 which is used as a power supply in spacecraft.<sup>77</sup> These materials have been disposed of routinely to an open-air evaporation pond at the INL's ATR Complex. These materials have not necessarily been included in required federal reporting under the National Emissions Standards (NESHAPs) because they are not monitored but only estimated. Therefore, whenever unplanned releases are occurring via escaping resin beads, for example, the emissions would be underestimated. Frankly, the NESHAPs reporting by the INL appears to lack validation and may substantially understate INL's airborne emissions of transuranics and other radionuclides.

The environmental monitoring of airborne radioactivity that is conducted tends to ignore peaks and appears to be missing weeks of data in graphs charting alpha and gamma airborne radiation levels. This can be observed for various years, but is particularly obvious in 2006.<sup>78</sup> Particulate matter in filters for 2006 provide instances of elevated levels of radionuclides such as plutonium-

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<sup>75</sup> Rosalie Bertell, International Journal of Health Services, "Depleted Uranium: All the Questions About DU and Gulf War Syndrome Are Not Yet Answered," 2006. p. 514  
<https://ntp.niehs.nih.gov/ntp/roc/nominations/2012/publiccomm/bertellattachmenthw.pdf>

<sup>76</sup> Depleted Uranium Education Project, *Depleted Uranium Metal of Dishonor How the Pentagon Radiates Soldiers & Civilians with DU Weapons*, 1997. ISBN:0-9656916-0-8

<sup>77</sup> Transuranics are radionuclides often having extremely long half-lives. Many decay progeny may be created before reaching a stable, non-radioactive state. See our factsheet at <http://www.environmental-defense-institute.org/publications/decayfact.pdf>. See also an ANL factsheet at <https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf>

<sup>78</sup> Annual and quarterly environmental monitoring reports of the Idaho National Laboratory and surrounding communities is available at [http://www.idahoer.com/Publications\\_surveillance.htm](http://www.idahoer.com/Publications_surveillance.htm) as the Department of Energy funded and overseen Idaho National Laboratory Site Environmental Surveillance, Education, and Research Program. Some charts are edited to reduce clarity but charts using raw data show significant gaps in monitoring airborne gross alpha and gross beta the graphs available by community.

239, plutonium-238 and americium-241 in the filters along with cesium-137 and strontium-90. A high statistical bar allows denial that a “detection” of the radionuclide occurred.

Numerous “detections” were admitted in assessing filter particulate in 2006, see first quarter 2006 air monitoring at [www.idahoer.com](http://www.idahoer.com).<sup>79</sup>

The coincidence of elevated levels of airborne radioactivity seem to correspond to elevated gross alpha and gross beta levels in drinking water monitoring.

Weapons material that is fissile include uranium-235 which is concentrated by enrichment while plutonium-239 is created from uranium-238 by neutron capture in a nuclear reactor. Fission products such as cesium-137 and strontium-90 (and many others) are created in a nuclear reactor by the splitting apart of uranium atoms. Actinides are created by neutron capture and these include the actinides neptunium, plutonium, americium, curium and californium.

As shown in the decay series tables, man-made actinides can decay to “natural” decay series. But natural does not mean healthy especially when the levels of decay progeny are elevated. And the experts that pretend that the decay progeny are from “natural” background are not admitting that the reason the levels of decay progeny are elevated is due to the release of radionuclides from the INL and other nuclear operations.

Many of these decay progeny are harmful to health but are not monitored because of the techniques used to perform sampling or due to a mistaken belief that since uranium is natural it does not need to be monitored. Uranium health effects depend on the solubility and the concentration and health studies of miners are not necessarily exposed to comparable chemical forms of uranium.

Uranium, including depleted uranium, persists in the environment essentially forever and causes illness, cancer and increased risk of birth defects. Gulf war veterans found this out as their babies were born with missing fingers and arms. See our 2017 EDI report about radiological and chemical exposures at the INL.<sup>80</sup>

### **EA Ignores Genetic Consequences of Radionuclide Emissions**

Anyone who has ever been a radiation worker in the US has been told repeatedly that, despite the known genetic damage to fruit flies from radiation exposure, no genetic consequences have every been documented in humans. Well, *Plutopia* documents the elevated percentage of deaths among infants in the Richland population in the 1950s. Elevated fetal deaths and birth defects in Richland were documented by the state health reports, yet Hanford’s General Electric doctors and the Atomic Energy Commission that later became the Department of Energy failed to point these statistics out. The local newspapers failed to write of it. The Department of Energy has

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<sup>79</sup> Annual and quarterly environmental monitoring reports of the Idaho National Laboratory and surrounding communities [http://www.idahoer.com/Publications\\_surveillance.htm](http://www.idahoer.com/Publications_surveillance.htm)

<sup>80</sup> Tami Thatcher, Environmental Defense Institute, *Radiological and Chemical Exposures at the INL That Workers May Not Have Known About*, April 2017. <http://www.environmental-defense-institute.org/publications/Radchemreport.pdf>

continued to fail to tell radiation workers and the public of the known risk of increased infant mortality and increased risk of birth defects that result from radiation exposure.

The finding of excess infant deaths near the Department of Energy Savannah River site around the 1970s and near the 1979 Three Mile Island nuclear accident are described in Jay Gould's book *Deadly Deceit*.<sup>81</sup> But I was unaware of the clarity of the records of infant mortality in the case of Richland near Hanford. The disregard to human life and human suffering seems to go hand-in-hand with the nuclear industry. But you don't have to take my word for it — read and know the history for yourself.

The Department of Energy support for and subsequent squelching of Hanford radiation worker epidemiology studies are described in Gayle Greene's *The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation*.<sup>82</sup> Alice Stewart is famous for the unexpected finding that very small external x-ray medical radiation doses to pregnant woman in the 1950s increased the risk of childhood cancer and leukemia.

*Time* magazine recently mentioned Julian Aguon's book *What We Bury At Night*, a chronicle of how irradiated Marshallese mothers had borne “jellyfish babies” with translucent skin and no bones. From 1946 to 1958, the U.S. tested 67 nuclear weapons in the Marshall Islands near Guam. Official reports omitted the truth of the birth defects.

For more information about the health effects and after math from the U.S. bomb tests over the Pacific islands and the repeated deceptions about the consequences, read Giff Johnson, *Don't Ever Whisper —Darlene Keju, Pacific Health Pioneer, Champion for Nuclear Survivors*.<sup>83</sup>

## Summary

For the action proposed in the EA, to make HALEU fuel, to be meaningful, that fuel would need to be utilized. The environmental impacts from the utilization of the fuel have not been included in the EA. Omitted are meaningful and complete air emissions for the Idaho National Laboratory, not only in terms of radiation dose in units of rem, but including the radionuclides and contribution of each radionuclide to dose. Currently, radiological emissions from the INL are reported at Frenchman's Cabin which obscures the releases from MFC as well as lacking radionuclide contribution to the dose estimate and being generally based on guesses that are not available to the public.

The air and water in our region are constantly bombarded with radiological releases from the INL, and various annual reports through the years indicate that these releases include americium-241, plutonium-238, plutonium-239 and other extremely long-lived radionuclides.

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<sup>81</sup> Jay M. Gould and Benjamin A. Goldman, *Deadly Deceit – Low Level Radiation High Level Cover-Up*, Four Walls Eight Windows New York, 1990. ISBN 0-941423-35-2.

<sup>82</sup> Gayle Greene, *The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation*, University of Michigan, 1999. ISBN 0-472-08783-5.

<sup>83</sup> Giff Johnson, *Don't Ever Whisper – Pacific Health Pioneer, Darlene Keju, Champion for Nuclear Survivors*, 2013. ISBN-10: 1489509062.

It should be noted that while the radioactive half life of Am-241 is 432 years, it decays to neptunium-237 (2.1 million years half life) which decays to protactinium-233 which decays to uranium-233 (160,000 year half life) and will progress through many other decays before becoming stable.

We already, periodically, exceed gross alpha levels safe for drinking water in this region. Just how long can the INL continue to release long-lived radionuclides to the environment?

The additive influence of these continued radiological releases from the INL have not been taken into account. The issue is obscured by the use of gross alpha monitoring of air and water without reporting what radionuclides are contributing to the elevated levels of gross alpha. Who wants to admit to plutonium and americium in our water? So, they prefer to leave it as a mystery as to why elevated levels of gross alpha radiation are often detected in our drinking water. The radionuclide path to our drinking water can be due to the intake of contaminated air as the water tanks cycle, as well as via contaminated groundwater.

The EA presents the emissions from the proposed activity as yielding a small radiation rem dose. But the EA fails to provide the radionuclide-specific contribution to radiation dose. The EA ignores the reality that incorporating radionuclides into the human body disproportionately harms the unborn child and children, and women more than it harms an adult male.

The EA for making HALEU is a hell of an idea and a truthful and complete environmental impact statement must be provided. Ignoring cumulative impacts because it is inconvenient is not justified.

Sincerely,

Tami Thatcher