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Several Barrels of Waste Overpressurize Within Hours After Being Repackaged at the Idaho Cleanup Project ARP V

On April 11, a barrel of waste ruptured just hours after the waste was examined and put into a new barrel. The lids also blew off three other recently repackaged drums. The fire department responded to an alarm at the facility. The firemen were wearing breathing apparatus when they entered the ARP V enclosure. Minor skin contamination was reported. Fluor reported that no injuries or environmental contamination were caused by the event. [1]

The drum rupture and several lids popping off other drums occurred while no one was working in the enclosure. But if the accident had occurred during normal working hours, workers near the drums would not have been wearing breathing apparatus. The inhalation of radioactive material, which is strongly retained in the body, could have yielded significant adverse health effects including the increased risk of cancer even if workers appear to be relatively unharmed.

The accident occurred at the Idaho Cleanup Project Accelerated Retrieval Project (ARP) V. ARP V is a temporary structure built over a portion of the burial grounds at the Radioactive Waste Management Complex. The exhumation of a portion of the buried waste at ARP V, called "targeted" waste which is chemically-laden waste from the Rocky Flats weapons plant, had been completed and now ARP V was being used for repackaging sludge barrels stored at the Advanced Mixed Waste Treatment Project.

The waste in the drums that over pressurized is probably from the Rocky Flats weapons plant. The waste is thought to have been buried in the 1960s and exhumed in the 1970s. The barrels of waste had been stored in cargo containers until recently brought to ARP V's earthen floor temporary building for repackaging. While the barrels of waste are likely from Rocky Flats, there has not yet been confirmation to determine the source of the waste or the contents of the barrels.

No sparks were seen when the waste was emptied from the old barrel in a glove-box-like structure. Chucks of burning uranium are expected due to the pyrophoric nature of uranium (and plutonium). No sparks or flames were noted and no large items were found. The waste was

[1] Keith Ridler, *The Idaho Statesman*, "Officials say radioactive sludge barrel ruptures now total 4," April 25, 2018. http://www.idahostatesman.com/latest-news/article209827149.html

treated routinely and put into new new barrels. Thousands of sludge barrels have been packaged at ARP V.

Barrels of waste from Rocky Flats came with some recordkeeping for each shipment of barrels. But the barrels were dumped into unlined pits and there were no identifying labels on the barrels. Gallons of chemical "sludges" were often in the barrels of waste from Rocky Flats.

So, why did decades-old-waste heat up and over-pressurize four waste drums within hours of being repackaged? Hydrogen gas and other gases can build up in the presence of ionizing radiation. **The specific chemicals present in the barrel can each have a different propensity to generate hydrogen in the presence of ionizing radiation. Not only that, mixing the chemicals can yield an enhanced propensity to generate hydrogen gas and other gases.**

The need for venting drums has long been studied and have long been recognized to be a safety issue for storage and transportation of waste drums. According to a study published in 2000,[2] "Radiolytic generation of hydrogen occurs when ionizing radiation (e.g., [alpha, beta, or gamma]) interacts with hydrogenous materials. The metric for hydrogen generation from a particular material undergoing radiolysis is the G-value, which has units of molecules of gaseous hydrogen product per 100 eV of radioactive decay energy absorbed." The 2000 study lists G-values for various chemicals but notes that when certain chemicals are combined, the G-values can be increased.

The amount of plutonium and/or uranium in the waste cannot be accurately estimated because unless the entire contents in analyzed pinch by pinch, the actual concentrations and total curie amount is not actually known.

In study of uranium and the dependence of the size of the uranium pieces or powder, it has been observed that dispersed fine uranium powder would require higher ignition temperatures than larger pieces of uranium. **This indicates that finer particles of uranium would be less likely to spark when in the open trough for examination. But, conversely, the fine uranium powder would ignite at lower temperatures when packaged in a barrel.** [3]

Apparently, there was no monitoring of the hydrogen gas buildup after repackaging the waste. So, while the hydrogen gas buildup was occurring within hours, rather than weeks or months of storage, Fluor had assumed that the waste would behave as previously repackaged barrels of waste had. And Fluor assumed this despite not actually knowing what chemicals or combinations of chemicals were present in the drum.

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[2] B. L. Anderson et al., Hydrogen Generation in TRU Waste Transportation Packages, NUREG/CR-6673, UCRL-ID-13852, Lawrence Livermore National Laboratory, February 2000, https://www.nrc.gov/docs/ML0037/ML003723404.pdf p. 77 "Aromatic hydrocarbons, such as benzene, toluene, and cyclohexene protect TBP from radiolysis, while saturated hydrocarbons such as hexane, cyclohexane, and dodecane sensitize TBP to radiolytic degradation (Barney and Bouse 1977). Carbon tetrachloride has also been found to sensitize TBP radiolysis."

[3] M. Epstein et al., Fluor Hanford, "Uranium Pyrophoricity Phenomena and Prediction," SNF-6192-FP, April 2000. https://www.osti.gov/servlets/purl/803044

The local Department of Energy, Idaho and Idaho Cleanup Project contractor Fluor are planning to conduct an investigation to determine the cause of the accident. But, the decision to not have an investigation led by DOE Headquarters or other independent entity is, I believe, a mistake.

There may be the temptation to avoid responsibility for any mistakes made that might reduce Fluor's award fee. There would also be the temptation for the local DOE-ID who approved current work processes as safe to seek a return to production in the most rapid and least cost approach which may leave safety issues unresolved. The managers at the Waste Isolation Pilot Plant (WIPP) in New Mexico should require the Department of Energy Headquarters to lead the accident investigation before this waste packaging is resumed, transported, and accepted by WIPP. Idaho's Department of Environmental Quality rubber stamped its approval of vastly increased RCRA mixed waste (chemical and radioactive transuranic waste) at the Idaho National Laboratory's Materials and Fuels Complex last year DOE's vague statements about fire protection for the transuranic waste. [4]

Subdued Mood About IWTU at April Idaho Cleanup Project Citizens Advisory Board Meeting

Progress has been slow at the Integrated Waste Treatment Unit. At the April 19 Citizens Advisory Board meeting [5] at Fort Hall, Idaho, the February estimates of when the first radioactive testing of the Integrated Waste Treatment Unit (IWTU) to treat the sodium-bearing liquid waste at the Idaho National Laboratory were no longer expected to occur this year and were pushed out a year to next April.

The problems encountered during recent months were not described in much detail, but there has been an issue of obsolescence of installed equipment that no longer had vendor support and had to be updated or replaced.

The problem-plagued IWTU was supposed to complete treating the radioactive liquid waste in 2012. **The continued design, test, repair and redesign efforts for the IWTU is delaying other vital work, the treatment of calcine to make it road ready.** The treatment of calcine is supposed to take place in the IWTU building. Calcine retrieval studies and the transfer of calcine from the oldest, most seismically vulnerable calcine bin set can proceed despite tardy IWTU operations.

[4] Tami Thatcher, Environmental Defense Institute Special Report, "Public Comment for Class 2 RCRA Permit Modification for Materials and Fuels Complex," 2017. www.environmental-defense-institute.org/publications/EDIRCRAcomments2017.pdf

[5] Idaho Cleanup Project Citizens Advisory Board (formerly the Idaho National Laboratory Citizens Advisory Board) meeting schedules and presentations at https://energy.gov/em/icpcab/idaho-cleanup-project-citizens-advisory-board-icp-cab

The Idaho Department of Environmental Quality is levying fines for DOE's failure to comply with hazardous waste tank closure requirements for the untreated liquid sodium-bearing waste. The fines so far are $3.6 million and can be used to fund environmental projects in the state. [6]

On April 24, the Exchange Monitor reported that the Defense Nuclear Facility Safety Board issued a March 27 letter to the Department of Energy citing weaknesses in the safety planning needed to protect workers at the IWTU. The DNFSB letter [7] stated that the safety basis for the IWTU does not adequately address worker protection in some events such as a carbon dust explosion or oxygen displacement in the process areas. The letter also said that the fire hazard analysis for the IWTU failed to analyze several possible accident events such as a carbon dust fire and therefore the fire hazards analysis was inconsistent with the Department of Energy's documented requirements. The DNFSB also advised DOE to use a formal lessons learned program to consider whether proper documentation of screened items and reliance on site-wide safety management programs within a safety basis has been implemented.

Immediately, the general fire protection program of the new above ground transuranic waste asphalt pad at INL's Materials and Fuels Complex comes to mind, because the fire protections were far less specific at MFC than for the above ground facility at the DOE's Waste Isolation Pilot Plant (WIPP) in New Mexico.

Department of Energy Responds Regarding Possible Continued Missions of the AMWTP Saying Its "Analysis Has Not Been Completed"

In response to the Idaho Cleanup Project Citizens Advisory Board email dated March 28 to the Department of Energy requesting more information about the potential future mission for the Advanced Mixed Waste Treatment Project (AMWTP), the Department of Energy Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, Mark A. Gilbertson, sent a letter to Idaho Cleanup Project Citizens Advisory Board Chair Keith Branter, stating that "DOE is in the process of completing the business case analysis that examines these aspects in greater depth. While we are focused on completing the business analysis as soon as possible, the analysis has not been completed."

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

[7] Bruce Hamilton, Acting Chairman, Defense Nuclear Facilities Safety Board, letter to James Richard Perry, Secretary of Energy, March 27, 2018. (topic concerns the safety basis of the Integrated Waste Treatment Unit at the Idaho National Laboratory.) https://www.dnfsb.gov/sites/default/files/document/14546/IWTU%20Safety%20Basis%20Review%202018-100-015.pdf

The DOE's letter stated that the challenges that need to be addressed include the 1996 Idaho Settlement Agreement, packaging and transportation, and funding.

The existing mission of the Advanced Mixed Waste Treatment Project (AMWTP) will be ending December of this year.

Some ICP CAB members hoped — naively, I think — that if the CAB sent a consensus endorsement of unconditional support for finding continued missions for the AMWTP, no matter the impact on the Idaho Settlement Agreement or the reduced level of transportation safety, that DOE would quickly step up its completion of studies and avoid job interruption at the AMWTP. A consensus was not obtained, and a vote was taken during a March phone-in meeting where the majority of the CAB members agreed to request more information from the DOE.

The Idaho Settlement Agreement [8] milestone to ship a running average of 2,000 cubic meters per year out of the state and even if the compacting of waste at the AMWTP is complete, the cleanup project will not meet the milestone at the end of the year for completing shipments of transuranic waste (the stored above ground transuranic waste and the targeted buried waste and MFC transuranic waste) to WIPP by December 31, 2018.

Deficiencies in Department of Energy Spent Nuclear Fuel Program at the Idaho National Laboratory Highlighted by the US NWTRB

On April 19, the U.S. Nuclear Waste Technical Review Board presented to the Idaho Cleanup Project Citizens Advisory Board a number of deficiencies regarding U.S. Department of Energy activities related to packaging or transportation of high-level radioactive waste of spent nuclear fuel and the site characterization, design, and development of a disposal facility for high-level waste and spent nuclear fuel.

The NWTRB issued a new report summarizing a multi-year review in December 2017. [9] The NWTRB report summarizes the issues of waste disposal and spent nuclear fuel with an emphasis on the storage at the Idaho National Laboratory, Hanford and Savannah River Site.

The presentation by Bret Leslie to the Idaho Cleanup Project Citizens Advisory Board focused on issues at the Idaho National Laboratory. [10]

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[8] See more about Idaho's Settlement Agreement at https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement.aspx

[9] 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)

[10] Idaho Cleanup Project Citizens Advisory Board (formerly the Idaho National Laboratory Citizens Advisory Board) meeting schedules and presentations at https://energy.gov/em/icpcab/idaho-cleanup-project-citizens-advisory-board-icp-cab See presentations for the April 19, 2018 meeting at Fort Hall, Idaho.

The presentation pointed out that a nuclear fuel packaging facility is needed in order to comply with the Idaho Settlement Agreement to have the fuel shipped out of Idaho by 2035. It also pointed out that estimates that it would take 15 years to package the fuel for shipping would need to start in 2 years. But the Department of Energy has not even decided whether to build a new facility or use an existing facility to repackage the fuel.

Some highlights of the deficiencies identified include:

- The degradation of fuels stored is not being managed for degradation of the fuel and this may complicate future packaging, storage, transportation and disposal of the fuel.
- The Department of Energy has stopped developing the DOE standardized canister to store, transport, and dispose of nuclear fuel.
- More analysis on fuel drying and on hydrogen generation from corrosion products is needed
- The fate high-level waste streams of the sodium-bonded driver fuel at the Materials and Fuels Complex at the Idaho National Laboratory is uncertain and may not meet waste acceptance requirements for a disposal repository.
- The DOE's spent nuclear fuel will be stored decades longer than expected, and DOE SNF is typically more degraded than commercial SNF. SNF degradation may complicated storage, transportation and disposal.

The Idaho Settlement Agreement required Idaho to be the lead DOE Spent Fuel research laboratory. And the Idaho Department of Environmental Quality went along with DOE, pretending that the lack of funding and research to address DOE's spent fuel at the Idaho National Laboratory was made up for by the INL's claim to be the nation's premiere nuclear laboratory. But, predictably, the DOE has not been giving adequate attention to its degrading spent nuclear fuel or how the meet the Idaho Settlement Agreement milestones for repackaging the SNF for shipping, to a repository that DOE doesn't have.

Some basic background on Department of Energy Spent Nuclear Fuel is that it includes approximately 250 different fuel types of various uranium and thorium mixtures, of various cladding types from no cladding to stainless steel, to zirconium alloy to aluminum, and various uranium-235 enrichments from 0.2 to 93 percent enrichment. The sizes of nuclear fuel vary from 6 inches in length to 136 inches in length and varying diameters. Some of the fuel is damaged. The DOE's nuclear fuel is from the Navy fleet, DOE research reactors, DOE plutonium production reactors, fuel from experimental reactors such as the Shippingport Light Water Breeder Reactor program, damaged Three Mile Island fuel, and other commercial fuel that DOE has already taken ownership of. Ultimately, the DOE will be required to take ownership of all the nation's commercial nuclear fuel.

Nuclear fuel at the INL is stored in a variety of ways: wet pool storage and a variety of dry storage configurations at INTEC and the Naval Reactors Facility. Fuel in dry storage is not necessarily packaged as needed for shipping or disposal. There is fuel at INTEC also stored in underground caissons and in experiment storage casks. There is fuel at the Materials and Fuels Complex stored in carbon steel underground storage at the Radioactive Scrap and Waste Facility and in the HFEF hot cell.

Spent Nuclear Fuel and Waste from Fuel Reprocessing Repository Status for 2018

Gone is the Department of Energy's Consent-based storage and disposal effort for spent nuclear fuel and high-level waste from nuclear fuel reprocessing led by John Kotek. And deleted are the public comments from a dozen meetings held around the country in 2016.

Gone is the Department of Energy's two repository approach, one for commercial spent nuclear fuel and one for the Department of Energy's naval, research and other spent nuclear fuel (SNF). DOE does not have a license to construct the SNF repository at Yucca Mountain, nor does it have an underground salt mine somewhere that is willing to take its SNF.

The extent of DOE's efforts in 2017 and 2018 has been to request funding for continued licensing efforts at Yucca Mountain. But Congress has denied funding, knowing that the litigation over Yucca Mountain will take untold decades to resolve and may not result in allowing construction of the repository.

The Department of Energy is full of excuses. And these excuses mean that it is solidly on track to miss every important Idaho Settlement Agreement milestone from here on out, in addition to those currently being missed.

The U.S. Department of Energy describes *spent fuel* "as a resource until such time as it is declared a waste and is dispositioned to an operating repository." [11] Disposing of the INL's SNF — that the Department of Energy adamantly declares "is not a waste," disposing of INL's calcine, disposing of SNF and high-level waste associated with pyroprocessing at the Materials and Fuels Complex, and disposing of treated liquid sodium-bearing waste – these are vital to meeting the Idaho Settlement Agreement. The inability to meet the Idaho Settlement Agreement schedules is growing and the pile of excuses grows deeper and deeper.

If reprocessed, the uranium could be extracted from SNF. When uranium fuel is used in a reactor, radioactive fission products like cesium-137 and strontium-90 build up from the fissioned uranium, and transuranic isotopes like plutonium-238 and plutonium-239 build up when a neutron is absorbed instead of fission taking place. There uranium remaining in used nuclear fuel, which is considered "spent" when the fuel can no longer sustain needed power levels in a reactor, but to extract this uranium requires reprocessing. Reprocessing has been not only extremely expensive, it releases radioactive gases and creates a high volume of radioactive

[11] Idaho Cleanup Project Citizens Advisory Board (formerly the Idaho National Laboratory CAB), June 14, 2017. https://www.energy.gov/em/icpcab/articles/spent-nuclear-fuel

wastes. [12] Chemical extraction methods create toxic chemical and radioactive wastes. And the recovered uranium is tainted with radioactive materials that make fuel fabrication more difficult because of higher radioactivity that exposes workers who manufacture the fuel. The high enriched fuel reprocessed at the Idaho fuel reprocessing plant was used only to make non-commercial nuclear fuel that was used for plutonium production at the Savannah River Site. It is likely that stocks of this reprocessed material have never been utilized because of the radioactive impurities.

A 2003 study by Massachusetts Institute of Technology estimated that uranium resources were limited to 80 years of reactor operation if the existing US fleet kept operating and one thousand new reactors were deployed worldwide of 1000 megawatt-electric (MWe) capacity each, that operated for 40 years each.[13] **To operate enough nuclear reactors to make a dent in global warming would use up the world's uranium stores in less than 100 years! Very little of already spent nuclear fuel can be burned in fast reactors, although they will use fewer uranium resources. So, the NuScale's once-through light water reactor is already obsolete but will result in even more locations with stranded spent nuclear fuel.**

According to the Nuclear Energy Institute, as of December 31, 2017, the US had generated 80,960 metric tons of uranium in spent nuclear fuel from commercial nuclear power reactors. [14] This figure does not include Department of Energy research, foreign reactor, weapons production reactors or high-level waste. There is some fuzziness about which commercial nuclear reactor that DOE has already taken ownership of that may be included in the figure. In any case, the Yucca Mountain repository was stipulated to be limited to 70,000 metric tons heavy metal.

It is not clear that the DOE has any disposal path for the INL's high-level waste, including its calcine waste and the treated sodium-bearing waste (assuming it gets treated by the IWTU). The NWTRB also points out that DOE-NE has not addressed the lack of waste acceptance requirements for the pyroprocessed waste at INL's Materials and Fuels Complex that includes SNF and high-level waste with no designated repository. Idaho is at risk for DOE to attempt to

[12] Disposal Subcommittee Report to the Full Commission, Blue Ribbon Commission on America's Nuclear Future, June 1, 2011. https://www.nrc.gov/docs/ML1209/ML120970323.pdf and final report https://www.energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf

[13] John Deutch and Ernest J. Moniz, et al., Massachusetts Institute of Technology Report, "The Future of Nuclear Power: An Interdisciplinary MIT Study, 2003, April 2011. Chapter 1 page 3. http://web.mit.edu/nuclearpower/pdf/nuclearpower-summary.pdf See also http://web.mit.edu/nuclearpower/ Chapter 4, p. 34, that states that uranium below$130/kgU resources are approximately 3 or 4 million tonnes uranium. See also the 2009 update which shows that the cost of nuclear plant construction was underestimated in the 2003 study, and this has been found to have been an underestimate of the costs in light of the AP1000 reactor construction in the US that resulted in abandoning construction in South Carolina and continuing cost overruns in Georgia.

[14] Nuclear Energy Institute, https://www.nei.org/resources/statistics/used-fuel-storage-and-nuclear-waste-fund-payments Note that the figure of 80,960 metric tons heavy metal (may include Three Mile Island fuel) but are only for commercial spent nuclear fuel and not Naval or Department of Energy commercial spent fuel from research or from Department of Energy research reactors or foreign research reactor fuel accepted by DOE.

redefine these highly soluble and radio-toxic high-level waste as "low-level" waste that it can leave in Idaho.

Nuclear boosters are keen to make more spent nuclear fuel at the INL that the Department of Energy has no way to dispose of. The Idaho Settlement Agreement requires that by January 1, 2035 all of the DOE's SNF at Idaho, with the exception of a limited amount of Navy SNF is to be removed from Idaho. [15] The Settlement Agreement requires the high-level waste from reprocessing nuclear fuel to be ready to be moved out of the state by 2035.

Small modular reactors, such as the light-water NuScale reactors, will be at the back of the line for disposal should a facility ever open. Those who profit from the new reactors, such as the already obsolete NuScale reactors, do not budget the money for long term storage or for safer dry storage.

Ask these nuclear boosters where the NuScale SNF will be disposed of. Ask them when it will leave Idaho. Ask them how it will be stored while it stays in Idaho. Ask them how many times it will need to be repackaged while it is stored in Idaho. Ask them what facility will be needed to repackage the aging SNF from the NuScale (or similar) nuclear reactor operations. Ask them who is going to pay for the repackaging facility and the repackaging. Ask them why they do not plan to pay for the SNF they will leave stranded in Idaho.

What the FUSRAP are These Radioactive Waste Dumps Doing in Idaho?

A program called the "Formerly Utilized Sites Remedial Action Program" (FUSRAP) and others have been dumping radioactive waste in Idaho for the financial benefit of a few owners. The Idaho legislature and Idaho Department of Environmental Quality have greased the laws and environmental protections to allow this to happen. The radiation active waste dumping is called the "storage" of "non-hazardous" waste. [16] [17] The US Ecology Site B Grandview site has made millions of dollars for the sites owners and has rewarded Idaho's politicians.

According to a 2010 article by The Idaho Statesman, "The waste from these sites contains radioactive contamination above current federal guidelines but is not regulated by the Nuclear Regulatory Commission or the Atomic Energy Act. The Idaho Department of Environmental

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[15] 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. The Addendum to the 1995 Settlement Agreement signed in 2008 has provisions to allow some Naval SNF to stay in Idaho after January 1, 2035, including allowance for 9 metric tons heavy metal of Naval SNF and Naval fuel shipped to Idaho after January 1, 2035.

[16] FUSRAP "Formerly Utilized Sites Remedial Action Program" by the U.S. Army Corps of Engineers at http://www.mvs.usace.army.mil/Missions/FUSRAP/What-is-FUSRAP/

[17] *Mountain Goat Report*, from *The Idaho Statesman*, "It's More Than Contaminated Sand," July 28, 2010. http://mountaingoatreport.typepad.com/the_mountaingoat_report/environment/

Quality, which through passage of this legislation now regulates such material, classifies it as non-hazardous."

"In 2001, with passage of this legislation allowing radioactive FUSRAP waste to be stored in Idaho (including contracts in existence on July 1), American Ecology was awarded $4.4 million in federal contracts."

"The dollar amount of the contracts grew in 2002 by over 200 percent to $13.8 million, with American Ecology having been awarded an average of $16.6 million in federal contracts per year from 2002 through 2007. The majority of these are radioactive FUSRAP waste storage contracts for the company's Grandview facility."

The radioactively contaminated soils are trucked to Idaho and then dumped. Is the air blown radioactive material partially at least an explanation for the gyrating levels of public drinking water contamination in the Boise area? [18] [19] [20]

Disposal of FUSRAP uranium byproduct waste has been trucked to Idaho for disposal at the western Idaho U.S. Ecology site in Owyhee County, near Grand View.[21] Depleted uranium from Kuwait, 6700 tons of radioactively contaminated sand, have been shipped to Idaho's US Ecology Grandview facility that opened in 2001. [22] The US Ecology Site A RCRA dump at Bruneau closed in 2001, formerly owned by Envirosafe. [23] It accepted unlicensed radioactive waste from FUSRAP programs. [24]

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[18] Idaho Department of Environmental Quality, http://www.deq.idaho.gov/water-quality/drinking-water/pws-monitoring-reporting/ and http://www.deq.idaho.gov/water-quality/drinking-water/pws-switchboard/ and find sample results for all counties at http://dww.deq.idaho.gov/IDPDWW/ where you select your county or drinking water system, select the specific water system. For the specific water system, it may be helpful to select the link at the left called "Chem/Rad Sample/Result by Analyte." Then select the analyte of interest that the well has data for by clicking on its code. This brings up the applicable lab samples that included that contaminant. Note that non-community wells typically sample fewer contaminants.

[19] Environmental Defense Institute newsletter for December 2017 "Where to Find Out More About Your Drinking Water." http://www.environmental-defense-institute.org/publications/News.17.Dec.pdf

[20] Environmental Defense Institute newsletter for February 2018 that contains several articles about drinking water: "What's Up With the Radionuclides in Drinking Water Around Boise, Idaho?" "Radionuclides in Drinking Water in Ammon, Idaho," "Understanding the Radionuclide MCLs in Drinking Water in Idaho," and "Understanding the Man-Made Radionuclides in Drinking Water in Idaho (with helpful decay chain information for uranium-238, thorium-232, uranium-235 and uranium-233 and the man-made actinides that can feed these decay series)" http://www.environmental-defense-institute.org/publications/News.18.Feb.pdf

[21] Hazardous Waste Management in Idaho, 2016 includes FUSRAP waste, see http://www.deq.idaho.gov/media/60179710/hw-management-idaho-2016.pdf

[22] *Mountain Goat Report*, from *New West*, "Idaho to get Giant Kuwaiti Litter Box," May 8, 2008. http://mountaingoatreport.typepad.com/the_mountaingoat_report/environment/

[23] US Ecology Annual Report, Form 10-K, February 25, 2014. https://seekingalpha.com/filing/2033622

[24] US Senate Haring 106-959, "Disposal of Low-Level Radioactive Waste," July 25, 2000. https://www.gpo.gov/fdsys/pkg/CHRG-106shrg71521/html/CHRG-106shrg71521.htm

GAO Report on NNSA's Planning for Fuel Enrichment and How It Affects Idaho

United States Government Accountability Office February 2018 report reviews National Nuclear Security Administration (NNSA) plans to supply high enriched uranium (HEU) for national security and other missions. NNSA provides HEU to fuel the U.S. Navy's submarines and aircraft carriers. According to NNSA's estimates, HEU from excess dismantled nuclear weapons will supply HEU sources to meet naval reactors' demand through 2060.

But NNSA also needs "high assay" low enriched uranium (LEU) that is below 20 percent enrichment but higher than the standard 3 to 5 percent used in most commercial reactors. The high-assay LEU would be used in research and isotope production reactor fuel. This fuel supply is projected to be exhausted by around 2030.

NNSA also needs a LEU fuel supply for weapons tritium production that is "unobligated." According to DOE, only unobligated uranium can be used to achieve NNSA's national security missions. All uranium is considered unobligated when neither the uranium nor the technology or equipment used to enrich it carries an "obligation" to a foreign country. These obligations are established under international agreements that describe the conditions for civilian nuclear cooperation between the United States and foreign partners. Uranium or uranium-related technology subject to peaceful-use obligations under such agreements cannot be used for military purposes by the United States. The United States lost its sole supplier of unobligated enrichment services when the last operating enrichment plant using U.S. technology ceased enriching uranium in May 2013. The Paducah Gaseous Diffusion Plant, in Paducah, Kentucky was constructed and began enriching uranium in the 1950s and ceased operations in 2013 because of high production costs coupled with a global drop in demand for enrichment services.

Tritium is a key isotope used in nuclear weapons. NNSA needs an assured source of tritium to maintain the capabilities of the nuclear stockpile and has called tritium a "pressing" defense need. However, tritium has a relatively short half-life of 12.3 years and decays at a rate of about 5.5 percent per year. It must be periodically replenished to maintain the designed capability of the weapons. Some tritium may be recycled from dismantled weapons, but the inventory must also be replenished through the production of new tritium. At present, NNSA produces tritium through the use of one of TVA's electricity-producing nuclear reactors fueled with unobligated LEU. Small quantities of tritium are the normal by-products of electricity -producing nuclear power plants, such as those owned and operated by TVA. To produce more tritium than usual and later collect it, specially designed targets—called tritium-producing burnable absorber rods (TPBAR)—are loaded with the unobligated LEU and irradiated in TVA's Watts Bar 1 reactor. Irradiated TPBARs are unloaded during normal fuel reloading and shipped to NNSA's Tritium Extraction Facility at the Savannah River Site in South Carolina. There the tritium is extracted and prepared for use in nuclear warheads and bombs. (Tritium is created in nuclear reactors that use water as coolant, but the tritium released to the air and with waste water is not monitored at the Idaho National Laboratory. Inscrutable estimates of INL's tritium releases are published in the annual air emissions reports, however.)

Uranium is a naturally occurring radioactive element that is enriched to fuel nuclear power plants and that can also be used to meet certain national security purposes. Natural uranium is comprised of approximately 99.3 percent of the uranium-238 isotope and 0.7 percent of the uranium-235 isotope—which undergoes fission to release energy. Uranium enrichment is the process of increasing the concentration of uranium-235 in a quantity of natural uranium to make LEU to fuel nuclear power plants, or to make HEU, which is used in nuclear weapons and as fuel by the U.S. Navy. Generally, to produce enriched uranium, uranium is extracted or mined from underground deposits, converted from a solid to a gas, enriched to increase its concentration of uranium-235, and then fabricated into fuel elements, such as rods for commercial nuclear reactors, appropriate for their ultimate use. After the fuel has been irradiated in a nuclear power reactor, it is considered "spent" nuclear fuel. Spent fuel can be chemically reprocessed, and the enriched uranium recycled for reuse.

Until 2013, uranium was enriched in the United States both for national security and commercial purposes. Beginning in the 1940s, DOE and its predecessor agencies provided uranium enrichment services—first for national security purposes and later for the emerging commercial nuclear power industry—using government-owned gaseous diffusion plants. In 1992, the U.S. government established the United States Enrichment Corporation (USEC) as a government corporation to take over operations of DOE's enrichment facilities and to provide uranium enrichment services for the U.S. government and utilities that operate nuclear power plants.

In 1998, the corporation was privatized under the USEC Privatization Act. From 1998 until 2013, DOE relied exclusively on USEC to obtain enrichment services for the production of LEU needed to produce tritium. In May 2013, USEC ceased enrichment at its last commercially active enrichment plant in Paducah, Kentucky, which it had leased from DOE since the time of USEC's establishment. USEC has been the only company to enrich uranium with U.S. technology.

The GAO report discusses aluminum-clad high enriched uranium at the Idaho National Laboratory. [25] **Previously, the Department of Energy had said that the HEU aluminum-clad Advanced Test Reactor fuel had been slated to be shipped to the Savannah River Site for reprocessing.** However, the 93 percent enriched aluminum-clad fuel at the Idaho National Laboratory may be destined for disposal. The HEU aluminum-clad fuel is stored wet adjacent to the reactor until it is transported to wet storage at INTEC. After sufficient cooling time, greater than 5 years, the fuel is being transferred to dry storage. [26]

[25] US Government Accountability Office, "Nuclear Weapons – NNSA Should Clarify Long-Term Uranium Enrichment Mission Needs and Improve Technology Cost Estimates," GAO-18-126, February 2018. https://www.gao.gov/assets/700/690143.pdf

[26] See the December 2017 U.S. Nuclear Waste Technical Review Board report and Department of Energy presentations to the Idaho Cleanup Project Citizens Advisory Board.

Options for recovering HEU from either type of spent fuel are limited. The United States can only process and recover HEU from aluminum-clad spent nuclear fuel using the Savannah River Site's H-Canyon facility, which is the only hardened nuclear chemical separations plant still in operation in the United States. There is a small amount of aluminum-clad fuel at the Idaho National Laboratory that would need to be shipped to the Savannah River Site. However, according to NNSA officials, it would be expensive to transport the material from the Idaho National Laboratory to the Savannah River Site, and the costs to operate H-Canyon to process the material would be high. Further, receipts of all nuclear material at H-Canyon have been halted by Savannah River Site's management and operations contractor due to the facility's degraded conditions and seismic risks.

A June 30, 2017 memo from the Defense Nuclear Facilities Safety Board states that H-Canyon and HB Line –which sits atop Savannah River Site's H-Canyon and helps feed the material through—**are not currently taking materials for processing citing potential safety issues should an earthquake occur.** It is unclear whether this is a short -or long-term suspension of work. According to NNSA officials, federal staff at Savannah River Site confirmed that H-Canyon is on a six-month outage to reconfigure a dissolver for processing the fuel for the High Flux Isotope Reactor at Oak Ridge National Laboratory and anticipates resuming fuel processing in January 2018. HB Line is offline for another 18-22 months until—following a safety analysis—they complete the modeling of potential degradation of a ventilation duct.

Even if H-Canyon were to resume operations, NNSA officials stated that processing aluminum -clad spent fuel would yield relatively small quantities of LEU usable for tritium production, as a considerable portion of the spent fuel is encumbered under a 1994 Presidential declaration. Therefore, NNSA officials reported that this is considered a long-term option due to the high costs and risks involved.

DOE's Office of Nuclear Energy is researching a process that could recover HEU from the zirconium-clad spent naval reactor fuel. In May 2017, Idaho National Laboratory completed a study examining the feasibility of processing a portion of its zirconium-clad spent fuel inventory through a new process called "ZIRCEX." The report concluded that ZIRCEX showed promise; however, it also noted that pilot-scale testing was needed to prove that it can be used effectively at production scale. According to DOE officials, a pilot-scale demonstration is planned using

ZIRCEX, with limited testing planned in fiscal year 2018. DOE officials told us the costs and schedules to implement a full-scale production plant using ZIRCEX to recover HEU from zirconium clad spent fuel are not known. Furthermore, additional processing and downblending would be needed to produce unobligated LEU. DOE considers recovering unobligated HEU for tritium production for use in nuclear weapons through the ZIRCEX process a long-term possibility that could be re-evaluated as the technology matures.

GAO on Continuing Quality and Cost Problems at Hanford Vit Plant

A recent United States Government Accountability Office report says that problems identified six years ago at the Department of Energy Hanford site in Washington state where plutonium was produced for nuclear weapons have not fully completed planned actions. [27] [28] And the corrections have not prevented continuing quality assurance problems associated with the multi-billion-dollar treatment plant to process 56 million gallons of liquid radioactive waste from weapons production stored in 177 tanks. The plant is to turn the waste into a glass form that is to be buried at another, unidentified site. The GAO recommends that the operating contractor, Bechtel, find out the full extent of the problems. There are concerns that the plant may never be able to safely treat the waste.

Some of the oldest liquid radioactive waste tanks date back to the 1940s, have single-layer walls, or shells; were built to last about 20 years; and will be almost 100 years old by the estimated end of waste treatment. DOE has reported that 67 tanks are assumed or are known to have leaked radioactive waste into the soil. Treatment options were reviewed in another GAO report. [29] The costs of building a vitrification plant have ballooned and may not even treat all of the waste, if the plant ever runs. An analysis of options for treating some of Hanford's 56 million gallons of radioactive waste held in underground tanks is underway and the study is to be reviewed by the National Academy of Sciences. [30]

Trump Faces Obstacles to a Korean Deal, Some Self-Inflicted

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If you are hopeful that the pending talks between Donald Trump and Kim Jong Un will bring an imminent end to the nearly 68-year-long Korean War, don't bet on it. The 1953 armistice, which was struck by military leaders of North Korea, the United States, South Korea, and their United Nations allies to halt the fighting, was in fact never concluded by a peace agreement to bring a formal end to a war in which, over three years, some 4 million people perished. The

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[27] US Government Accountability Office, "Hanford Waste Treatment Plant – DOE Needs to Take Further Actions to Address Weaknesses in Its Quality Assurance Program," GAO-18-241, April 2018. https://www.gao.gov/assets/700/691422.pdf

[28] Annette Cary, *Tri-City Herald*, "Feds bash Hanford nuclear waste plant troubles, question DOE priorities," April 24, 2018. http://www.tri-cityherald.com/news/local/hanford/article209749064.html "The multi-billion-dollar Hanford vitrification plant has been under construction since 2002."

[29] US Government Accountability Office, "Nuclear Waste – Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford," GAO-17-306, May 2017. https://www.gao.gov/assets/690/684468.pdf

[30] Annette Cary, *Tri-City Herald*, "Is there a cheaper way to treat Hanford radioactive waste? Northwest officials are wary," March 4, 2018. http://www.tri-cityherald.com/news/local/hanford/article203465329.html

Korean War was a turning point for the United States, it precipitated the quadrupling of military spending between 1951 and 1952 and paved the way for creation of the most destructive global military force in history.

First and foremost, a formal peace accord, the prospect of which is now being raised by North and South Korea, will have to address the large U.S. military presence that has been in the region for more than two generations. North Korea has reportedly agreed going into the talks to accept the U.S. military presence, but it remains to be seen if the U.S. will agree to alter its military posture and force structure from one of war preparation to a goal of non-aggression. That Trump recently changed his position on the Trans Pacific Partnership trade agreement three times in a week, and impulsively walked back on Russian sanctions, undermining his staff and UN ambassador, does not inspire confidence that this thorny problem can be worked out.

I spent some time at North Korea's Yongbyon nuclear site while working in the Energy Department in 1994 and 1995 to secure spent reactor fuel containing plutonium that North Korea had planned to extract for its first nuclear weapons. Our work at the time was the direct outgrowth of a nuclear non-proliferation agreement signed by the U.S. and North Korea in 1994. Based on that experience, I view it as essential that ascertaining the true nature and degree of the North's nuclear weapons production should be on the short list of priorities in the current negotiations.

That this will be extremely difficult, without good-faith cooperation, is an understatement, especially for the accounting of weapons and vital components, which are very likely stored in the labyrinthine network of underground tunnels built after bombings in the 1950's. Other than former Soviet states that returned their nuclear weapons to Russia, the only country that gave up its nuclear weapons is South Africa, and this happened only after the ruling apartheid government peacefully relinquished its power in 1990.

Despite recent hopeful statements about denuclearization, it may be too late to expect the North Koreans to relinquish their nuclear arms any time soon. That bridge was dismantled in the decades-long pursuit of regime change by hard-Right forces in U.S. political leadership, a pursuit that not only provided a powerful incentive but also plenty of time for the North Koreans to amass a nuclear arsenal.

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Although North Korea recently announced it was halting nuclear and long-range missile testing, North Korea's leader, Kim Jong Un, clearly outlined what he expects going into talks with Trump in a speech given in January of this year. First, North Korea must be recognized and treated as a nuclear weapons state with potential long-range missiles. He is willing to discuss nuclear arms control on a step-by-step basis. Denuclearization, in the eyes of North Korea, also means a process in the U.S. that will reduce and change the mission of its military on the peninsula, which is predicated on resuming war with the North.

It's no mystery that North Korea wants the exact opposite of the "all or nothing" demand by John Bolton, President Trump's polarizing new National Security Advisor, to promptly give up its nuclear arms or face a war.

As recently as late December of last year, Bolton, a leading keeper of the regime change flame, told Fox News, "I think the only diplomatic option left is to eliminate the regime by reunifying the peninsula under South Korean control." According to Bolton, it has to be "regime elimination (conducted) with the Chinese. This is something we need to do with them."

Even though China may not oppose a peaceful reunification of the two Koreas, Bolton proceeded to undermine the prospect of Chinese cooperation when in February 2018 he declared in the *Wall Street Journal* that the U.S. was legally justified to launch a first strike against North Korea. Six months before Bolton's belligerent outburst, China warned it would honor the Sino-North Korean Mutual Aid and Cooperation Friendship Treaty and would intervene militarily in any hostile actions initiated against its regional partner. The last thing that China seeks is a war. However, let's not forget that China sent 3 million troops to defend North Korea in the 1950s.

China shares many of the same goals as North Korea—maintaining the existing regime, preserving regional stability, and setting a freeze, at most, on nuclear arms development. Meeting the U.S. demand for complete denuclearization could lead to a geopolitical shift on the Korean Peninsula that could disadvantage China, leaving the acknowledged superpower with diminished regional leverage. In addition, South Korea, under President Moon's leadership, is detaching itself from the U.S. hardline position by seeking a preliminary rapprochement with the North, resuming efforts that were suspended for some 20 years.

Little mention in the run up to the Trump-Kim summit is given to Russia, which it is worth recalling also shares a border with North Korea and has long played an historic role in its development. Russia, especially under the Putin regime, has expanded economic ties with Pyongyang that include major transportation and energy systems. Russia is keen on building nuclear power plants in North Korea and establishing a major natural gas pipeline through the border with North Korea into Asia. Even though Russia recently supported stronger sanctions, it has been "laundering" North Korean coal exports, a major source of revenue for the North Korean economy. Russia does not support regime change and certainly seeks to enhance its strategic interests in the Far East.

How Trump will handle Bolton is one of the biggest questions affecting the outcome of the meeting. Combining threats with concessions has characterized negotiations with North Korea for decades. However, this mode does not sit well with Bolton, who has consistently advocated for war as the best path for the U.S. to achieve its goals. Mike Pompeo, Trump's nominee for Secretary of State (whose confirmation is stirring resistance in the Senate and should not be considered a foregone conclusion), has apparently taken the lead on the North Korea negotiations. Will he offset the belligerence of Bolton, and continue in the steps of the banished Rex Tillerson, who repeatedly assured North Korea that the U.S. is not seeking regime change? Given the positive hype Trump is giving to this meeting, it is possible he understands that pushing for regime change will turn it into an embarrassing disaster. Trump has already given himself an escape hatch, by announcing shortly after Pompeo's recent visit to North Korea that he'll walk away if the talks "are not fruitful."

The last time regime change was seriously taken off the table was in 1994. In the spring and summer of that year, the United States was on a collision course with North Korea over its efforts to produce the plutonium needed to fuel its first nuclear weapons. This confrontation was resolved with a bilateral non-proliferation pact known as the Agreed Framework, signed in October 1994. It remains the only government-to-government accord ever made between the United States and North Korea.

North Korea agreed to freeze its plutonium production program in exchange for heavy fuel oil, economic cooperation, and the construction of two modern light-water nuclear power plants. During Clinton's second term, the administration was moving towards establishing a more normalized relationship with the North. Presidential advisor Wendy Sherman described an agreement with North Korea to eliminate its medium and long-range missiles as "tantalizingly close" before final negotiations were overtaken by the 2000 presidential election.

But the Framework was bitterly opposed by many Republicans, and when the GOP took control of Congress in 1995, it threw roadblocks in the way of key elements of the agreement. After George W. Bush was elected president, his administration promptly began to terminate the agreement and established an explicit policy of regime change. In January 2002, Bush declared North Korea as a charter member of the "axis of evil" in his State of the Union address. By the fall of that year, North Korea was singled out publicly as a potential nuclear target.

These huge steps backward set the stage for a hostile confrontation at a meeting between Assistant Secretary of State James Kelly and North Korean Officials at Pyongyang in October 2002, during which the U.S. demanded that North Korea cease a "secret" uranium enrichment program or face severe consequences. By 1999, this enrichment project was well-known in the Congress after intelligence findings by the U.S. Energy Department about North Korea's pursuit of enrichment was reported in the national news media. North Korea had strictly complied with the Agreed Framework, freezing plutonium production for eight years. This problem could have been fixed using an existing provision in the agreement dealing with enrichment. North Korea, after its offer during a break in the 2002 meeting to put uranium enrichment on the table was spurned, per instructions from the White House, promptly withdrew from the Nuclear Non-Proliferation Treaty and began to produce nuclear weapons—igniting a full-blown crisis. Since then, the North has exploded six ever-more powerful nuclear weapons and is now near the threshold of possessing intercontinental ballistic missiles.

There are other vital geo-political concerns, the status of which will affect the outcome of the U.S.—North Korea talks. For example, if Trump and Bolton act on their oft-stated desire to pull the plug on the Iran nuclear agreement, it is unlikely North Korea will be willing to embark on a path of denuclearization, not to mention the adverse consequences such a step will have on the fragile non-proliferation regime in the Middle East. North Korea, for its part, has repeatedly stated it will not fall into the same trap as Gaddafi, who, after being threatened, gave up Libya's very limited pursuit of nuclear weapons only to be overthrown. True to form, Bolton sees the Libyan outcome as a success to be emulated.

A largely obscured element of this crisis involves Japan. With the third largest domestic nuclear program in the world behind the US and France, Japan holds about 5.3 metric tons of separated plutonium—enough to fuel some 1000 nuclear weapons—and has advanced ballistic missiles and naval forces. Although Japan's constitution bars the development of nuclear weapons, and relies on the U.S. "nuclear umbrella," former Secretary of State Henry Kissinger told the U.S. Senate Armed Services Committee in January of this year, "If they [the North Koreans] continue to have nuclear weapons, nuclear weapons must spread in the rest of Asia." He added, "Nor can it be that Japan will sit there."

Lifting the ban on making nuclear weapons is now widely opposed by the public in Japan. But, a very important lesson is how quickly the 2011 Fukushima nuclear accident unraveled a strong national consensus in Japan in support of the "peaceful atom." A bigger looming threat may not be a North Korean missile hitting the U.S., but rather the collapse of the nuclear non-proliferation regime in the Far East. This is an especially serious concern with respect to Japan, which continues to engender bitter regional memories of its brutal colonial rule over Korea and China in a not-so-distant 20th century.

An ideal outcome for the upcoming meeting between Trump and Kim Jong Un would be the establishment of a more serious dialogue that would somehow be insulated from Bolton's predilections. A state of dormant war continues to exist on the Korean Peninsula and threatens to reawaken with unprecedented consequences for the rest of the world. The first order of business is to find a path to end this war, once and for all.

A senior scholar at the Institute for Policy Studies, Robert Alvarez served as senior policy adviser to the Energy Department's secretary and deputy assistant secretary for national security and the environment from 1993 to 1999. During this tenure, he coordinated the Energy Department's nuclear material strategic planning and established the department's first asset management program.

Articles except as noted are by Tami Thatcher for May 2018.