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Is Buried Low Level Radioactive Waste Contamination Over Millennia Really Acceptable?

As Idahoans prepare for more conversations about nuclear waste storage, they should be paying attention to what's going on in Utah, writes Tami Thatcher in an editorial "Digging a little deeper" printed October 2, 2014 in the Idaho Falls Post Register.

As Idaho's Leadership in Nuclear Energy (LINE) Commission 2.0 contemplates how to roll out the conversation to promote public acceptance,[1] I would suggest Idahoans pay attention to what's happening in Utah.

Beyond Utah's tragic experience as downwinders exposed to Nevada weapons testing fallout and their halting a proposed "temporary" spent fuel storage facility at Goshute, radioactive waste issues are still making headlines on the Wasatch front.

In Moab, work is ongoing to move 16 million tons of uranium mill tailings in the flood plain of the Colorado river to a safer location. The detection of significant uranium contamination suspended faith in inadequate plans to cap the pile with soil and shore it up with stone riprap. Obtaining meaningful protective action required an active coalition of lawmakers to pass authorizing legislation and an outpouring of public comment on the Department of Energy's Environmental Impact Statement alternatives.[2]

In 2005, the Utah legislature banned Class B and C low level radioactive waste, reinforcing that Utah permitted only Class A LLW in the EnergySolutions facility in Clive Utah.[3]

But in 2008, the Nuclear Regulatory Commission threw Utah a curve ball by deciding that vast amounts of depleted uranium could now be disposed of as Class A waste. Depleted uranium, whose decay products continue to increase in radioactivity for over a million years, would

[1] LINE 2.0 July 28, 2014 meeting minutes at http://line.idaho.gov/pdf/LINE%20Minutes.7.28.14.pdf

[2] Read more at http://www.grandcanyontrust.org/utah/uranium_history.php and http://matheson.house.gov/nuclear-waste-and-nuclear-weapons/

[3] Read more at http://www.deseretnews.com/article/600109256/Senate-OKs-Class-B-C-waste-ban.html?pg=all

exceed Class B and C levels over time. The NRC chose to ignore its own studies, science and the existing waste classification scheme to simplify disposal of depleted uranium.[4]

EnergySolutions immediately began accepting DOE's depleted uranium, prompting the Utah Governor to intervene. Utah's DEQ has been reviewing EnergySolution's "performance assessment" for 700,000 tons of DU that models the transport of contaminants over thousands of years, not surprisingly, concluding that the shallow landfill is adequate.[5]

Here in Idaho, despite the retrieval of targeted buried waste at the Idaho National Laboratory's Radioactive Waste Management Complex, most of the radioactive waste buried at INL will remain buried, with the leaching of contaminants declared acceptable based on the rate of contaminant migration and virtually unending institutional controls to limit water infiltration.[6]

DOE plans to bury more waste at INL. The proposed replacement for RWMC for 7,500 m^3 of remote-handled[7] waste is estimated to contaminate the aquifer for hundreds and thousands of years, but stay under regulatory maximum contaminant levels.[8]

INL remains short-listed for burying 12,000 m^3 of "low level" Greater-than-Class C waste DOE will take ownership of as commercial nuclear reactors are decommissioned. This GTCC waste required a full EIS and consideration of a deep geologic repository, long deemed necessary for the long-lived waste.[9]

The public is expected to assume that (1) government regulations based on science are protecting them and future generations, (2) the estimates of contaminant migration over hundreds and thousands of years are worthy of confidence, and (3) the industry radiation health standards are protective. But, do more than scratch the surface and you will find that each of these assumptions is wrong.

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[4] Read more at http://www.nytimes.com/gwire/2009/03/20/20greenwire-nrc-decision-on-depleted-uranium-draws-rebuke--10229.html and NRC Chairman's comments on why DU should not be made Class A LLW at https://www.nirs.org/radwaste/llw/jaczko_ducomments.pdf

[5] Read more about the problems of accepting vast quantities of depleted uranium at the Clive Utah facility at http://www.deq.utah.gov/NewsNotices/annualreport/Planning/s14.htm, http://healutah.org/depleteduranium and http://healutah.org/files/u8/HealDuSlidesForRcb2009.pdf

[6] Department of Energy, "Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14," DOE/ID-11359, September 2008. http://yosemite.epa.gov/r10/CLEANUP.NSF/sites/INEEL/$FILE/INL-ROD-9252008-Radioactive-Waste-mgmt-complex.pdf

[7] Remote-handled waste has a surface dose rate of 200 mrem/hour or more.

[8] 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

[9] Department of Energy, "Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-like Waste," DOE/EIS-0375-D), February 2011. http://www.gtcceis.anl.gov/guide/gtccllw/index.cfm

INL to Build Replacement Remote-Handled Low Level Waste Facility

Construction of the Idaho National Laboratory's Remote Handled Radioactive LLW Disposal Facility is scheduled to start in July of 2015, with completion projected in 2017. The new disposal facility will be located southwest of the Advanced Test Reactor complex.

Battelle Energy Alliance awarded the $34 million subcontract to Areva Federal Services, an American subsidiary of the French nuclear giant Areva Inc. New construction will include administration and maintenance buildings, waste holding systems and environmental monitoring installations, along with more than 200 underground concrete vaults for waste disposal.

"The waste destined for this facility is generated by Idaho National Laboratory's nuclear technology research, development and demonstration mission; the Naval Reactors Facility [which accepts spent fuel from nuclear submarines and aircraft carriers and generates activated metal waste by cutting ends off the fuel]; and research, development and testing for other federal tenants and sponsors," said an INL spokesperson.

The storage facility will be used to dispose of waste that previously would have been sent to the "remote-handled low-level waste" disposal area of the Radioactive Waste Management Complex, which is slated for closure.

The design is similar to the design that was in the Final Environmental Assessment [10] with the main difference being that the shield plugs will be at grade rather than below grade. Communication from the Department of Energy to the Idaho Department of Environmental Quality said "The design is very focused on preventing water infiltration into the waste. The design is protective of the waste and intended to prevent water infiltration into the waste."

"There will be a honeycomb of concrete vaults and the waste will be placed in stainless steel canisters that in turn will be placed in the vaults. There will be 5 configurations on stainless steel containers. The largest (60" by 170") is for the activated components removed from the aircraft carrier fuel at NRF (I am not sure they are shipping that fuel yet but it is planned), waste that has traditionally been shipped to Radioactive Waste Management Complex (RWMC) in the 55 ton scrap cask (bottom dump) will be containerized in 48" by 105" canisters, Advanced Test Reactor (ATR) Resins (75" by 80"), field transfer canisters (29" by 70") for waste currently at RWSF at MFC [the Material and Fuel Complex], and newly generated ATR and MFC waste in HFEF 5 canisters (13" by 75"). The last canisters will be in an array of 7 stacked two high."

"The initial construction will be designed to accept waste projected for 20 years and the facility is scheduled to operate for 50 years. The site is 45 acres and the first phase will use ½ of the acreage. There are two down gradient aquifer wells planned by USGS and DEQ had the opportunity to review and comment on the placement of those wells. There will be shallow wells

[10] 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

surrounding the disposal cell to monitor for any potential leakage. INL Oversight will participate in co-sampling all of these wells." [11] [12]

Based on DOE's estimates of contaminant peaking, shown in Table 1, dominant contributors to radionuclide contaminants in the Snake River Plain aquifer appear to be Technetium-99, Iodine-129, and Carbon-14, peaking thousands of years from now. The number of years that the radionuclide will be contaminating the aquifer in detectable amounts was not provided in DOE's Environmental Assessment, because you are expected to assume that any quantity less than the maximum contaminant level is safe. While DOE calls the waste "low level," and does not fall under NRC regulations, the waste is long-lived Greater-Than-Class C waste.

The total volume of remote-handled radioactive waste will be 7,500 cubic meters. With Technetium-99 peaking at 20 percent of the maximum contaminant level, any mistake in the rate of migration, rate of ingestion, or radiation health risk model would show that the level of Tc-99 alone could exceed maximum contaminant levels. And it is important to understand that the maximum contaminant levels are not protective, particularly for continuous exposure. The radiation health risk model used by the industry is already known to underestimate internal radiation dose effects by more than a factor of 10 for a healthy adult. The MCLs are especially inadequate to protect children and developing fetuses.

Table 1. Selected peak predicted groundwater concentrations and time of occurrence.[13]

Radionuclide (Progeny)	Radioactive Half-life (years)	Peak Concentration (pCi/L)	Calendar Year Peak Occurs	MCL[a] (pCi/L)	Ratio of Peak Concentration to MCL
C-14	**5,730**	**150**	**5500**	**2,000**	**0.075**
Cl-36	301,000	0.12	3900	700	0.00017
H-3	12.3	0.000023	2200	20,000	-
I-129	**17,000,000**	**0.19**	**11000**	**1**	**0.19**
Ni-59	76,000	5.8	270000	300	0.019
Tc-99	**213,000**	**110**	**3100**	**900**	**0.12**
Pu-239	24,110	3.1E-13	260000	15	-
U-235b	700,000,000	0.0021	56000	65	-
U-238b	4,470,000,000	0.097	130000	10	0.0097
(Pb-210)	(22.3)	0.016	370000	2.12	0.0075

a. MCLs for beta-gamma emitting radionuclides are based on a whole body and critical organ dose equivalent limit of 4 mrem/year. The whole body and critical organ doses are calculated using the dose conversion factors in the National Bureau of Standards Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air and Water for Occupational Exposure," (NBS 1963). The dose conversion factors in National Bureau of Standards Handbook 69 are based on International Commission on Radiation Protection Publication 2, which has been superseded by International Commission on Radiation Protection Publication 30, and more recently, International Commission on Radiation Protection Publication 72 (ICRP 72 1995).
b. MCL for uranium isotopes converted from 30 μg/L mass concentration to equivalent activity concentration.

[11] Email to Chuck Brocious from Kerry Martin at Idaho Department of Environmental Quality, August 26, 2014.
[12] See also the Project Execution Plan, DOE/ID-11466, Rev 0, and the Conceptual Design Report, INL/EXT-07-12901, Rev 4.

[13] ibid, data from Table 4-1 from DOE/EA-1793.

Status of DOE's Greater-Than-Class C Waste Storage Problem

In February 2011, the Department of Energy released a draft Environmental Impact Statement[14] for the Greater-Than-Class C (GTCC) "low level" radioactive waste that it will take ownership of, by law, such as activated metal from the commercial nuclear industry when nuclear plants are decommissioned, sealed sources from industry, and DOE's own waste that it calls "GTCC-like." No preferred alternative was specified and there is no schedule yet for the final EIS for this 12,000 cubic meters of long-lived waste that contains over 163 million curies.

Greater-Than-Class C waste is known to be a hazard far longer than 500 years, far exceeding the duration of time that Class A, B and C low level wastes were to be protected. And it has long been deemed appropriate that Greater-Than-Class C radioactive waste should be isolated in a deep geologic storage facility.

The draft EIS includes consideration of the geologic storage facility at the Waste Isolation Plant (WIPP) in New Mexico as one of the EIS alternatives. "Above grade vaults, enhanced near surface trench, and intermediate depth borehole" are evaluated at the Hanford Site, Idaho National Laboratory, Los Alamos National Laboratory, Nevada National Security Site, Savannah River Site, WIPP vicinity, and commercial disposal sites in the U.S.

The draft EIS concludes that WIPP would confine the contaminates for at least 10,000 years. The draft EIS estimates that burying the waste at INL would result in much higher releases and contamination than Hanford, LANL, NNSS, WIPP vicinity, or a generic commercial region IV facility, yielding a maximum annual dose over 2 rem/yr for trench or vault burial.

The high dose yields to a hypothetical well near the facility result from assumptions that the contaminants stay concentrated above the basalt layer prior to basalt layer being penetrated. Based on the GTTC draft EIS's assumptions and modeling, the INL is a terrible place for buried waste, but that hasn't deterred DOE from building the new Replacement facility discussed above.

[14] Department of Energy, "Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-like Waste," DOE/EIS-0375-D), February 2011. http://www.gtcceis.anl.gov/guide/gtcclw/index.cfm

Battelle fined for safety violations

June 21, 2014
By NATE SUNDERLAND
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“Battelle Energy Alliance was fined $168,750 for five violations of the U.S. Department of Energy’s worker safety and health regulations stemming from a Feb. 11, 2013, incident involving an injured researcher.

“The unidentified Idaho National Laboratory researcher received multiple second- and third-degree burns to about 10 percent of his body in the incident at a lab facility, according to an Independent Activity Report on the Department of Energy’s Office of Health, Safety and Security’s website in 2013.

“Those injuries occurred when two INL researchers were conducting a test on a synthetic gas and hydrogen production process at the INL Engineering Demonstration Facility. During the test, hot steam and molten salt were forced out of the top of the container and into the experiment enclosure. That mixture was 1,652 degrees Fahrenheit.

“One of the researchers was burned. He was transported to a local hospital for treatment and released the same day. The two researchers no longer are employed at INL, officials said in July 2013.

“Department of Energy Office of Enforcement Director Steven C. Simonson issued Battelle a preliminary notice of violation Friday.

“’DOE considers the serious injuries sustained by the researcher and associated violations to be of high safety significance,” Simonson wrote. “DOE’s evaluation of the circumstances concluded that BEA did not apply the rigor and formality to work planning, control, execution and oversight at a level commensurate with the hazards and risks associated with the scope of work for the … test.”’

“Battelle initially was assessed a civil penalty of $337,500, however, that amount was halved as a result of Battelle’s corrective action plan to address issues brought forward in the investigation report.

‘“Our first and most important priority is always the safety of our people and preventing incidents such as this one from happening in the future. One of our co-workers — a colleague — was injured in this event and that is never acceptable,” INL Lab Director John Grossenbacher said in an emailed statement Friday.

Cheers & Jeers
Post Register
Printed on: April 19, 2013

"JEERS to Battelle Energy Alliance. On Feb. 11, two researchers were involved in an accident at the INL Engineering Demonstration Facility. One suffered burns serious enough to send him to the hospital.

"The Post Register only learned of the incident through anonymous tips. A lab official said the accident wasn't serious enough to merit a news release. If that's the case, their threshold is too low

"Transparency matters, not just to the cops on the street or the lawmakers in the Statehouse, but also concerning the safety and well-being of the men and women who conduct the often-dangerous and necessary work at the lab."

Bringing a nuclear test reactor back to life at INL

October 3, 2014

By LUKE RAMSETH lramseth@postregister.com

"Today, [John] Bumgardner, 58, is charged with breathing new life into this 1959 relic of nuclear history. About three years ago, the Department of Energy declared its desire to resume using the [Transient Reactor and Test Facility, (TREAT)] reactor's unique fuel testing capabilities.

"The Fukushima, Japan, nuclear accident in 2011 was the trigger for TREAT's rebirth. Congress directed DOE to focus its efforts on developing more accident-tolerant nuclear fuels in order to thwart a similar disaster in the U.S. It turned out TREAT already had most of the testing infrastructure in place.

". . .Today, about seven months after work began to restart TREAT, the operating staff is in place and refurbishments are well underway. About $75 million will be spent on the project.

"Before a company can license a new type of reactor fuel, it is required to go through transient testing, simulating harsh conditions such as those that would occur in a large-scale disaster such as Fukushima.

"TREAT, largely due to already-existing infrastructure at INL, won out over the Annular Core Research Reactor in New Mexico and several other options, officials said. An environmental assessment then was conducted, examining natural, cultural and socioeconomic effects of a possible restart.

". . .Several local environmental groups, however, voiced their opposition, calling for more public scrutiny and environmental review. Beatrice Brailsford, of the Snake River Alliance, questioned whether there would be enough demand for the transient testing, considering the lack of customers in 1994.

"Others, such as the Keep Yellowstone Nuclear Free group, have said additional public vetting should happen before TREAT fires up. "An accident at the TREAT Reactor can, INL admits, have an impact on people who live and work offsite," wrote Kit DesLauriers of Keep Yellowstone Nuclear Free, "… the most careful and realistic assessment must be done, and there must be full public participation in the decision to restart."

"As many as 34 tests could be conducted at TREAT per year, according to environmental documents. But that number might end up being closer to 10, officials have said. "Spending over $900 million on new fuels research at TREAT is typical of the mindset of an industry that prefers new research over cleanup," wrote nuclear safety consultant Tami Thatcher, in a January Post Register guest column.

". . .The reactor's cooling fans (it's air-cooled, not water-cooled) still are in great shape, with low operating hours. A filtration system for radioactive material will hardly need to be touched. The entire electrical system was replaced in the '80s. Even the reactor core itself is good to go.

DOE wants TREAT to be operational by 2018. . . .

DOE waste cleanup deadline missed

October 1, 2014

By LUKE RAMSETH lramseth@postregister.com

"False starts continue to plague the new Integrated Waste Treatment Unit, located at the Idaho National Laboratory desert site west of Idaho Falls.

"As of Tuesday, the Department of Energy missed a state-mandated deadline to have the $571 million treatment unit up and running. The unit, which started construction in 2007, is supposed to treat 900,000 gallons of liquid sodium-bearing waste and turn it into a powder similar to laundry detergent.

'"Obviously we set a milestone that we expected to be met, and it has not been met," said Bob Bullock, hazardous waste permits manager for the Idaho Department of Environmental Quality. "And we did not unilaterally set those (milestones) — those were agreed to."'

"The liquid waste, which contains a low level of radiation, is stored in three tanks at INL's Idaho Nuclear Technology and Engineering Center. It is leftover from the reprocessing of high-level radiation spent nuclear fuel.

"Following treatment, the solid, granular-looking product will be packaged inside stainless steel canisters, before being tucked away in concrete vaults at the site. But none of that treatment process has occurred.

"Missing Tuesday's first Idaho Site Treatment Plan deadline means a second deadline of Dec. 31, the date when the treatment process was to be fully completed, also will most likely not be met.

"DOE and its Integrated Waste Treatment Unit, operated by contractor CH2M-WG Idaho, have missed deadlines before.

"In 2012, the DOE missed its first pair of state-mandated milestones for the new waste treatment facility. The Site Treatment Plan was established by the Federal Facility Compliance Act, which requires federal facilities to develop a plan outlining how to handle generation, storage, treatment and disposal of mixed waste.

"That initial delay came when a filter at the new treatment unit became clogged. The Department of Environmental Quality agreed to extend the milestones to 2014.

"By the end of 2012, however, the DOE also had passed by another big deadline related to the Integrated Waste Treatment Unit. The 1995 Idaho Settlement Agreement mandated all liquid waste be removed from the state by Dec. 31, 2012. That missed milestone has never been renegotiated, Bullock said.

'"Meeting our milestones is extremely important to us," CH2M-WG spokesman Erik Simpson said in an email. "Our number one priority remains the safety of our workers, public, and the environment."'

". . .DOE spokeswoman Danielle Miller said the department and CH2M-WG Idaho are taking a "very cautious approach" to starting the first-of-its-kind treatment facility. This time around, there hasn't been a single incident, such as the clogged filter, that prevented the plant from starting, she said.

". . ..Lately, operators have been circulating steam through the facility to test its effectiveness, Miller said. Next, a "simulant," which is a material that mimics real, radioactive waste, will be run through the system.

"But it's difficult to know when actual radioactive waste treatment can commence — and how long treating the 900,000 gallons will take — until the simulant step is completed, Miller said. "If it operates as expected, it will not operate for very long," Bullock said.

"A meeting between DOE and state environmental officials is set for later this month. . ."

EDI Comments on Hazardous Waste Permit

EDI submitted comments to the Idaho Department of Environmental Quality on the Renewal Partial Permit for Hazardous Waste Storage and Treatment for the Idaho Nuclear Technology Center (INTEC) Liquid Waste Management System (ILWMS) and Integrated Waste Treatment Unit (IWTU). [15] The Department of Energy (DOE) Idaho National Laboratory (INL) currently has an approved HWMA/RCRA Storage and Treatment Partial permit for Liquid Waste Management System (LWMS). This permit is due to expire on October 18, 2014. CH2M-WG Idaho, LLC is the current operating contractor for ILMS.

The INL Integrated Waste Treatment Unit (IWTU) is designed to convert ~900,000 gallons of previously classified high-level liquid waste generated over decades of nuclear fuel reprocessing together with newly generated waste to a solid form suitable for final disposal in a geologic repository.

Defense Nuclear Facility Safety Board report to Congress[16]

"**Integrated Waste Treatment Unit**. During 2012, the Board's staff evaluated preparations to commence operations of the Integrated Waste Treatment Unit project at Idaho National Laboratory. This facility is designed to convert approximately 900,000 gallons of radioactive liquid waste stored in tanks at the Idaho Nuclear Technology and Engineering Center to a solid form in preparation for permanent disposal. On June 16, 2012, the process system over-pressurized during pre-operational testing using nonradioactive materials. The system's off-gas filters were breached, creating an unimpeded path from the process vessels to the environment. The staff reviewed the operating contractor's corrective action plan and found several weaknesses. Among the staff's concerns was the potential for improper operation of bypass valves in the pressure relief system to impact the function of safety-significant rupture disks that protect other portions of the process system from over-pressurizing. The staff's communication of this concern prompted the contractor to declare a Potential Inadequacy of the Safety Analysis to ensure the issue was formally tracked and resolved. The Board continues to monitor the project's progress as DOE prepares to resume startup activities."

EDI's extensive comments including individual files (Section I, Sections II to V, and Tank Table) on DOE's "re-permit" are available on our website:
www.environmental-defense-institute.org

[15] HWMA/RCRA Part B Permit Reapplication for the Idaho National Laboratory, Volume 14- Idaho Nuclear Technology and Engineering Center Liquid Waste Management System (ILWMS), EPA ID No. ID4890008925,
April 2014, Book 1 (342 pgs.) 2 (437 pgs.), 3 (177 pgs.) ,and 4 (433 pgs.).

[16] http://www.dnfsb.gov/sites/default/files/Board%20Activities/Reports/Reports%20to%20Congress/2013/ar_2013228_21831_0.pdf