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Following Regs Could Have Prevented Barrel Explosion Last April at the Idaho National Laboratory's Radioactive Waste Management Complex ¹

U.S. Department of Energy cleanup contractor Fluor Idaho has issued a report on the causes of the transuranic waste drums that blew their lids off last April at the Idaho National Laboratory's Radioactive Waste Management Complex. ² And that report blows the lid off the DOE's excuses about the accident.

If DOE regulations and hazardous waste laws including the state-issued RCRA permit had been complied with, the accident would not have happened. And numerous opportunities were missed for Fluor Idaho to learn that they were playing with fire — finely divided uranium more susceptible to serious oxidation than the more commonly encountered form of uranium from the Rocky Flats weapons plant called “roaster oxide.”

A fire had occurred last December when a waste container with this form of uranium was opened at the Advanced Mixed Waste Treatment Facility. And despite this, a drum known to contain large amounts of the same form of uranium was sent to the Accelerated Retrieval Project V fabric enclosure despite its RCRA permit forbidding such material.

The drums one by one expelled their powdery radioactive contents throughout the ARP V enclosure just hours after workers had gone home.

The first smoldering drum set off fire alarms. The fire department responded, but because of radiation monitor malfunction they were unaware that radioactive airborne contamination inside the fabric tension membrane enclosure was far above normal. Radiological control personnel came to assist the fire fighters 43 minutes after requested. The responders had inadequate knowledge of the materials in the drums which also hampered their efforts.

The second drum exploded just after emergency responders exited the facility. The integrity of the enclosure could have been compromised by the heat and also by one of the ejected lids which penetrated a layer of the enclosure.

It is no small miracle that tragedy did not occur that night.

Of about 20,000 drums of waste that had been exhumed from burial in the 1970s, a few thousand drums of waste had been characterized for years simply as contents “unknown.” Then a

¹ Guest column by Tami Thatcher, printed in *The Idaho Falls Post Register*, “Following regs could have prevented barrel explosion,” November 14, 2018.

² 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

few years ago, the waste known to have resulted from various processes for weapons production was designated as SD-176 waste.

Dozens of possible chemicals were ascribed to this catch-all category for powdery material considered “homogeneous solids” of the kind from Rocky Flats nuclear weapons plant where Portland cement-like material had been added to drums with various chemical and finely divided radionuclide and metal wastes.³

No analyses were conducted for chemical compatibility and reactive and pyrophoric materials for the SD-176 waste as required by hazardous waste RCRA laws. On top of that, no nuclear safety analysis was conducted to mitigate the hazards of this new SD-176 waste stream.

The day of the accident, uranium from one drum was mixed with the unknown material in other drums to distribute the uranium among the drums. Now supplied with oxygen from the repackaging, the uranium began oxidizing and heating up the drums. The heat enabled another chemical reaction that rapidly produced methane from the beryllium carbide⁴ in the drums.

The DOE also violated its radioactive waste management regulations by not having a plan for disposing of the waste prior to processing it. Current Waste Isolation Pilot Plant (WIPP) waste acceptance criteria were not being applied.⁵

The cause of the accident appears to be the pervasive management culture that ignored DOE regulations and state and federal laws in order to streamline processing of the radioactive and chemically hazardous waste.

The DOE, Fluor Idaho and the Idaho Department of Environmental Quality all pretended that the waste was being treated in accordance with laws and regulations. But it wasn't.^{6 7}

Heaven help us if the DOE obtains more authority to reclassify its radioactive waste to shortcut cleanup and disposal of the Idaho National Laboratory.⁸

³ Idaho Completion Project, Bechtel BWXT Idaho, LLC for the Department of Energy, “Historical Background Report for Rocky Flats Plant Waste Shipped to the INEEL and Buried in the SDA from 1954 to 1971,” ICP/EXT-04-00248, Revision 1, March 2005. <https://ar.icp.doe.gov/images/pdf/200504/2005040400022KAH.pdf>

⁴ 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)) On p. 22 of this report, the NWTRB states that “Carbide-containing DOE SNF can create combustible gases such as methane and acetylene when contacted by water ...if the coatings on the carbide particles are damaged.” While what was in the transuranic (or uranium) waste drums was not spent nuclear fuel, the knowledge of potential reactions with carbide are well-known and yet no identification of this hazard was conducted for the waste being treated which they knew potentially contained beryllium carbide from Rocky Flats weapons production processes — that’s likely why the uranium had not be “roasted.”

⁵ Department of Energy, Carlsbad Field Office, WIPP Waste Acceptance Criteria, DOE/WIPP-02-3122, Revision 8 Effective July 5, 2016. http://www.wipp.energy.gov/library/cra/CRA-2014/references/Others/US_DOE_2002_WIPP_Rev_6_TRU_Waste_Acceptance_Criteria_02_3122.pdf

⁶ For more about the April transuranic waste drum ruptures at the Radioactive Waste Management Complex at the Idaho National Laboratory Idaho Cleanup Project, see past EDI newsletters on the April drum ruptures (May through November 2018) and my second Public Comment submittal on October 30 to the Idaho DEQ concerning renewal of the Advanced Mixed Waste Treatment Project RCRA permit renewal at www.environmental-defense-institute.org

⁷ DOE Order 435.1, “Radioactive Waste Management,” DOE Order 830 “Nuclear Safety Management” (contains hazard identification and Unreviewed Safety Question requirements) and federal and state Resource Conservation and Recovery Act (RCRA) laws.

Fluor Idaho Sent High Risk Waste Drums to Energy Solutions in Clive Utah

The poorly characterized waste stream called SD-176 waste not only caused the overpressurization of four drums at the Accelerated Retrieval Project V at Idaho's Radioactive Waste Management Complex — hundreds of at-risk drums were sent to Energy Solutions low-level radioactive waste disposal facility near Clive, Utah.

The report issued by Fluor Idaho⁹ reveals that compensatory actions to monitor drum temperature were put in place not only at the RWMC but also included drums sent to Clive, Utah. The report isn't clear about whether previous assay for uranium-238 had been conducted or had not been reliable. Additional assay for uranium-238 was apparently conducted.

The concern for 120 "high risk" drums at Clive, Utah is discussed on page E-5 of the drum rupture causal analysis. There was also concern for 158 "low risk" drums at Clive, Utah and compensatory measures were taken including monitoring for temperature rise in the drums.

Did Energy Solutions know the drums potentially contained beryllium carbide? And why was there so much lack of certainty about the amount of uranium-238 in the drums?

There remain a lot of questions about the reliability of the waste characterization processes being used by Fluor Idaho and the Idaho National Laboratory.

US Ecology Site in Idaho Explosion Kills Worker

Add to the proof of Idaho Department of Environmental Quality RCRA permitting incompetence the recent explosion at a RCRA disposal site in Idaho. The US Ecology site at Grand View, Idaho is not a low-level radioactive waste dump — but loop holes in the law allow radioactive waste from around the country and the world to be sent there.

The details of why the explosion occurred remain to be revealed. But the safe processing of RCRA hazardous waste is supposed to be assured by the stringent RCRA permitting approval process by the Idaho DEQ.

⁸ Federal Register, Request for Public Comment on the U.S. Department of Energy Interpretation of High-Level Radioactive Waste, A Notice by the Energy Department on October 10, 2018. Public comment ends December 10. <https://www.federalregister.gov/documents/2018/10/10/2018-22002/request-for-public-comment-on-the-us-department-of-energy-interpretation-of-high-level-radioactive> Summary: "U.S. Department of Energy (DOE or the Department) provides this Notice and request for public comment on its interpretation of the definition of the statutory term "high-level radioactive waste" (HLW) as set forth in the Atomic Energy Act of 1954 and the Nuclear Waste Policy Act of 1982. This statutory term indicates that not all wastes from the reprocessing of spent nuclear fuel ("reprocessing wastes") are HLW, and DOE interprets the statutory term such that some reprocessing wastes may be classified as not HLW (non-HLW) and may be disposed of in accordance with their radiological characteristics."

⁹ 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

Recent reporting of the explosion included the fact that radiation monitoring was conducted.¹⁰ It has been stated that heavy metal wastes were often treated before burial, including cadmium.

Purely speculation here — I'm guessing nitrates were involved in this explosion that had TNT-like explosive energy. Trinitrotoluene (TNT) is an organic nitrogen compound ingredient of a long-known explosive chemical compound. Waste laden with nitric acid, organic material and in fine particle sizes could provide an explanation. Hopefully, we will soon learn why the explosion happened.

Washington State Passes Worker's Comp Law That Riles Department of Energy

In the news recently is a law change to worker's compensation laws in the State of Washington pertaining to Department of Energy workers at Hanford.¹¹ The state law change for the Hanford site allows resubmittal of denied claims for various illnesses.¹² A survivor of a worker who has died but had been denied compensation can resubmit a claim.

The state will assume that respiratory disease; or heart problems, experienced within seventy-two hours of exposure to fumes, toxic substances, or chemicals at the site; or cancer; or beryllium sensitization, and acute and chronic beryllium disease; and neurological disease was caused by working at Hanford if the Department of Energy cannot provide clear and convincing evidence otherwise. Please note that state worker's compensation laws are separate from and not related to the federal Energy Employee Occupational Illness Act. State worker's compensation laws vary from state to state and can include lost wages as well as medical expenses.

The State of Idaho worker's compensation laws can be found on the Idaho Industrial Commission website.¹³

The cancers listed include lung cancer, but not including mesothelioma or pleura cancer; bone cancer including primary polycythemia vera (also called polycythemia rubra vera); kidney cancer; lymphomas, other than Hodgkin's disease; Waldenstrom's macroglobulinemia and mycosis fungoides; and primary cancer of the thyroid, breast, esophagus, stomach, pharynx, larynx, small intestine, pancreas, bile ducts, gall bladder, salivary gland, urinary bladder, brain, colon, ovary, or liver. See the law for more specific information pertaining to covered illnesses.

In the past, the records concerning a worker's chemical or radiation exposure which are controlled by the Department of Energy contractor needed to show that a worker had an exposure. But poor chemical vapor and radiation exposure monitoring and reporting was being used to deny worker compensation to sick workers. How can a worker prove what the exposure

¹⁰ Keith Ridler, Associated Press, *Star Tribune*, "Monitors check for radiation release after waste site blast," November 20, 2018. <http://www.startribune.com/monitors-check-for-radiation-release-after-waste-site-blast/500943471/>

¹¹ *Richland Washington* (Associated Press), appeared in *The Idaho Falls Post Register*, "Feds threaten to sue Washington to block Hanford worker comp," November 29, 2018.

¹² Washington State, Laws of 2018, Substitute House Bill 1723, HANFORD SITE EMPLOYEES—OCCUPATIONAL DISEASE PRESUMPTION, June 7, 2018. <http://lawfilesexxt.leg.wa.gov/biennium/2017-18/Pdf/Bills/Session%20Laws/House/1723-S.SL.pdf>

¹³ Idaho Industrial Commission, Worker's Compensation Code, <https://iic.idaho.gov/rules-and-legislation/>

was? The law changes appear aimed at not allowing the DOE contractors to avoid worker compensation costs by denying that the worker had a significant exposure – which rewards the DOE for poor monitoring or poor record keeping.

See this detailed 2014 Hanford Tank Vapor report ¹⁴ for an idea of the issues involved with inadequate protection of workers from chemical exposures at Department of Energy facilities, historically and, sadly, continuing to this day. Recent epidemiology of thousands of radiation workers found elevated cancer risk occurring at annual doses below 400 mrem/yr. ¹⁵

DOE's HALEU is a Hell of an Idea for Many Reasons, Including High Radionuclide Airborne Emissions

The Department of Energy has released a draft Environmental Assessment for making fuel for advanced reactors at the Idaho National Laboratories Materials and Fuels Complex or the Idaho Nuclear Technology and Engineering Center. ^{16 17}

The public comments were due on November 30 regarding the Department of Energy's draft Environmental Assessment of using its high-assay low-enriched uranium (HALEU) from the EBR-II sodium-cooled fast reactor to make nuclear fuel. The draft Environmental Assessment (EA) skirts the many huge issues about the Idaho National Laboratory's failure to move toward meeting important Idaho Settlement Agreement milestones for spent nuclear fuel and high-level waste.

The draft EA is so loose with unsupported propaganda that one would never know that they've been pyroprocessing the sodium-bonded spent nuclear fuel from the EBR-II reactor at a snail's pace and they haven't treated the sodium-bonded SNF from Fermi at all. (Pyroprocessing or electrometallurgical treatment is conducted at the Fuel Conditioning Facility at the Materials and Fuels Complex.) Not only that, the Department of Energy has long claimed the treated

¹⁴ Hanford Tank Vapor Assessment Report, SRNL-RP-2014-00791, Oct 30, 2014.

http://srnl.doe.gov/news/releases/nr14_srnl-advisory-hanford-vapors-report.pdf

¹⁵ 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.)

¹⁶ Nathan Brown, *The Idaho Falls Post Register*, "DOE studying making fuel at INL for advanced reactors," November 1, 2018.

¹⁷ Department of Energy, Office of Nuclear Energy, "DOE invites public comment on Draft Environmental Assessment for the use of DOE-owned High Assay Low-Enriched Uranium Stored at INL," November 1, 2018. <https://www.energy.gov/ne/articles/doe-invites-public-comment-draft-environmental-assessment-use-doe-owned-high-assay-low> The draft environmental assessment prepared in accordance with the National Environmental Policy Act is posted for public review at: <https://www.id.energy.gov/insideNEID/PDF/Draft%20HALEU%20EA.pdf> .

sodium-bonded SNF would go to the Yucca mountain repository but it has never taken actions that would allow this waste to be approved for disposal.^{18 19}

The feedstock at the Materials and Fuels Complex contains various impurities including plutonium-239, americium-241, cesium-137, uranium-236 (a neutron poison), technetium-99, and neptunium-237.²⁰

The radiological airborne emissions from the high temperature processes proposed for making nuclear fuel from the HALEU feedstock are more significant than the EA lets on because (1) many of the radionuclides that cannot be captured in filters are either moderately long-lived including strontium-90 and cesium-37 (roughly 30 yr half life) or very long-lived radionuclides such as americium-241 (beyond thousands of years before decay progeny result in a stable form), (2) the health harm is not distributed as ideally as modeling assumes and the people inhaling these cancer- and illness-causing radionuclides won't know their dose, (3) the actual cancer risk is higher for inhaled or ingested radionuclides than official models predict, and (4) the actual health harm is not limited to cancer but includes genetic effects, heart disease and other illnesses.

See Environmental Defense Institute's full comments by Chuck Broschius and also comments by Tami Thatcher on HALEU fuel production for the draft DOE/EA-2087 at <http://environmental-defense-institute.org/index.html>

U.S. Nuclear Regulatory Commission Finds Problems at San Onofre's Holtec Dry Storage Spent Nuclear Fuel Facility

A Nuclear Regulatory Commission (NRC) Inspection report has found that the Holtec canisters for spent nuclear fuel at the San Onofre Nuclear Generating Station (SONGS) are scratched when the canisters are lowered into the vertical dry storage vault due to inadequate clearance between the canister and the storage vault.²¹ The NRC inspection was triggered by the belatedly reported misalignment of a loaded spent fuel storage canister as it was being lowered into the concrete storage vault. The canister caught on an edge near the top of the vault

¹⁸ 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)) See p. 21, 22, 79, 80, 86, 89, 94 through 97 for sodium-bonded fuel information at the Idaho National Laboratory. There are 34.2 metric tons heavy metal (MTHM) of sodium-bonded Fermi SNF in dry storage; 19.2 MTHM of EBR-II blanket fuel; about 2.3 MTHM of EBR-II driver fuel; about 2 MTHM EBR-II driver fuel at INTEC's CPP-666 pool that is being transferred to MFC. About 4.5 MTHM has been treated of the roughly 55.7 MTHM at the Idaho National Laboratory.

¹⁹ "Under requirements of an Environmental Impact Statement performed in 2000, DOE uses an electrorefiner at MFC to refine and down-blend spent fuel that contains highly-enriched uranium material generated decades ago in the Experimental Breeder Reactor-II (EBR-II)." *DOE-owned High Assay Low-Enriched Uranium Stored at INL (DOE/EA-2087)* HULU Notice]

²⁰ See Table 1 radionuclide inventory in 2,500 kg of the HALEU feedstock in the draft environmental assessment at <https://www.id.energy.gov/insideNEID/PDF/Draft%20HALEU%20EA.pdf>

²¹ See Donna Gilmore's news release "11/29/2018: NRC admits San Onofre Holtec nuclear waste canisters are all damaged," at <https://sanonofresafety.org/> and <https://sanonofresafety.org/2018/11/29/11-29-2018-nrc-admits-san-onofre-holtec-nuclear-waste-canisters-are-all-damaged/> and NRC Inspection Report and Notice of Violation, ML18223A357 at <https://sanonofresafety.files.wordpress.com/2018/11/ml18332a357.pdf>

but workers did not notice the slack in the lifting slings and the canister could have fallen into the vault roughly 17-18 feet. The load drop accident was not previously analyzed in the safety analysis for the facility.

The NRC inspection report also found that previously personnel were aware of the canisters were frequently contacting the vault components. Yet no inspections of the canisters were conducted. The report stated that: “Additionally, the failure to evaluate and disposition wear marks on a canister, if left uncorrected, could impact the adequacy of the aging management program.” The “aging management program” is currently used by the NRC as an excuse for not analyzing the likelihood and consequence of a canister cracking, despite the high likelihood of canister degradation over modest time frames of a few years.

In order for stress corrosion cracking to occur, three conditions must be met: (1) a sufficiently aggressive chemical environment, (2) the metal is susceptible to SCC, and (3) sufficient tensile stress must be present. A published in 2016 found that all three conditions are present for at least some of the spent nuclear fuel dry storage sites.²²

For spent nuclear fuel storage near the ocean coast and practically everywhere else, all three criteria are met for localized corrosion to create a through-wall crack, and through-wall cracking may fail the canister with sixteen years of crack initiation.²³

While other countries (Germany, France, Japan and others) had decided to use thick walled cast iron canisters that can be repaired if cracks develop, the U.S. NRC licensed thin walled stainless steel dry storage canisters knowing that there was no approved method for repairing the canister or replacing the canister. Even if a fuel pool were required to be available (and there is no requirement for a pool to remain available), it may not be known whether fuel could be safely extracted from the canister.^{24 25 26 27}

At dry fuel storage sites around the U.S. as well as at the spent nuclear fuel consolidated interim storage facilities proposed by Holtec in New Mexico and by Interim Storage Partners in

²² D. G. Enos and C. R. Bryan, Sandia National Laboratories, “Final Report: Characterization of Canister Mockup Weld Residual Stresses,” SAND2016-12375R, November 22, 2016. <http://prod.sandia.gov/techlib/access-control.cgi/2016/1612375r.pdf>

²³ Kristina L. Banovac, NRC to Anthony Hsia, NRC, Memorandum: Summary of August 5, 2014, Public Meeting with the Nuclear Energy Institute on Chloride Induced Stress Corrosion Cracking Regulatory Issue Resolution Protocol, September 9, 2014. <https://sanonofresafety.files.wordpress.com/2013/06/ml14258a081-8-5-14meetingsummary.pdf> or <https://www.nrc.gov/docs/ML1425/ML14258A081.pdf> “Based on estimated crack growth rates as a function of temperature and assuming the conditions necessary for stress corrosion cracking continue to be present, the shortest time that a crack could propagate and go through-wall was determined to be 16 years after crack initiation.”

²⁴ See the petition Ray Lutz, Citizens’ Oversight, PRM-72-8, Position White Paper by Citizens’ Oversight, “A New Strategy: Storing Spent Nuclear Fuel Waste,” January 2, 2018.

²⁵ See this power point presentation by Erica Gray: <https://www.nrc.gov/public-involve/conference-symposia/dsfm/2015/dsfm-2015-erica-gray.pdf>

²⁶ See Donna Gilmore on thin walled canister versus thick walled canisters used in other countries at <https://sanonofresafety.org/>

²⁷ More nuclear “qwap” about canisters near the coastline <https://documents.coastal.ca.gov/reports/2017/10/w9a/w9a-10-2017-corresp.pdf>

Andrews County, Texas, so far there is no way for canisters to be effectively inspected for cracking.^{28 29}

For more about the dry storage canisters for spent nuclear fuel, see EDI's August 2018 newsletter on Holtec's proposed consolidated interim storage (CIS) facility in New Mexico,³⁰ EDI comments on Interim Storage Partners proposed CIS facility at the Waste Control Specialists site in Andrews County, Texas,³¹ and see Donna Gilmore's research at SanOnofreSafety.org.

Articles by Tami Thatcher for December 2018.

²⁸ See SanOnofreSafety.org

²⁹ Krishna P. Singh, Ph.D. and John Zhai, Ph.D., Holtec, "The Multipurpose Canister: A Bulwark of Safety in the Post-9/11 Age," 2003. (begins on 8th page of the link which is compiled by Dr. Fred Bidrawn, Ph.D., Revision 1 March 28, 2018.) <https://publicwatchdogs.org/wp-content/uploads/2018/06/holtec-response-to-queries-on-shim.pdf>

³⁰ Environmental Defense Institute August 2018 newsletter article by Tami Thatcher "Ill-Conceived Consolidated Interim Storage of Spent Nuclear Fuel in New Mexico Proposed by Holtec," at <http://environmental-defense-institute.org/publications/News.18.August.pdf>

³¹ Environmental Defense Institute comments by Tami Thatcher on the Interim Storage Partners proposed Consolidated Interim Storage at the Waste Control Specialists site in Andrews County, Texas at <http://environmental-defense-institute.org/publications/CommentNRC2018Texas.pdf>