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Put Kate Brown's Book "Plutopia" on your Must Read List

With the recent plutonium release from Hanford and other issues coming to light that will be discussed in this newsletter, you really need to put Kate Brown's book *Plutopia* on your must read list. [1]

Plutopia is the story that begins in the 1940s of the U.S plutonium production plant, Hanford, with the city built to support its workers in Richland, Washington and the soon to follow Russian Maiak plant and the city built to support it, Ozersk, Russia.

You may have known of the secrecy, the immense expenditure of money and human labor, and the brilliant scientists. You may have known something of the radioactive releases unleashed on the public by Hanford's "Green Run." [2] But you will undoubtedly learn more about the consequences to the public, the workers and their families — in both the US and Russia by reading *Plutopia*.

If you already knew of the accident in Russia involving the explosion at a Maiak high level waste tank, [3] you may not have known that before this explosion, the Russians had begun releasing high level radioactive waste directly into the Techa River after storage tanks were filled. These highly radioactive liquid wastes from chemical separations of spent nuclear fuel to obtain the plutonium contaminated the river and nearby villages, requiring — yet not necessarily resulting — in their evacuation because of the lethal levels of radioactive contamination. Many of the evacuated then burned and buried villages were the result of the Techa River contamination rather than the Maiak waste tank explosion.

And anyone who has ever been a radiation worker in the US has been told repeatedly that, despite the known genetic damage to fruit flies from radiation exposure, no genetic consequences have every been documented in humans. Well, *Plutopia* documents the elevated percentage of

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[1] Kate Brown, *Plutopia – Nuclear Families, Atomic cities, and the Great Soviet and American Plutonium Disasters,* Oxford University Press, 2013. ISBN 978-0-19-985576-6. Note that many publications use spelling variation Mayak instead of Maiak.

[2] Michael D'Antonio, *Atomic Harvest – Hanford and the Lethal Toll of America's Nuclear Arsenal,* Crown Publishers, Inc., New York, 1993. ISBN 0-517-58981-8.

[3] Zhores A. Medvedev, *Nuclear Disaster in the Urals,* Vintage Books, Random House Inc. New York, Copyright 1979. ISBN 0-394-74445-4. This book writes of radiological contamination between Chelyabinsh and Sverdlovsk in the Urals and the Russian plutonium reactor near Kyshtym. Along with variations in spelling Russian names, the secrecy of the communities and facilities resulted in a variety of regional names or names of the nearest city to describe weapons plutonium facility locations.

deaths among infants in the Richland population in the 1950s. Elevated fetal deaths and birth defects in Richland were documented by the state health reports, yet Hanford's General Electric doctors and the Atomic Energy Commission that later became the Department of Energy failed to point these statistics out. The local newspapers failed to write of it. The Department of Energy has continued to fail to tell radiation workers and the public of the known risk of increased infant mortality and increased risk of birth defects that result from radiation exposure.

The finding of excess infant deaths near the Department of Energy Savannah River site around the 1970s and near the 1979 Three Mile Island nuclear accident are described in Jay Gould's book *Deadly Deceit*. [4] But I was unaware of the clarity of the records of infant mortality in the case of Richland near Hanford. The disregard to human life and human suffering seems to go hand-in-hand with the nuclear industry. But you don't have to take my word for it — read and know the history for yourself.

The Department of Energy support for and subsequent squelching of Hanford radiation worker epidemiology studies are described in Gayle Greene's *The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation*. [5] Alice Stewart is famous for the unexpected finding that very small external x-ray medical radiation doses to pregnant woman in the 1950s increased the risk of childhood cancer and leukemia.

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

For more information about the health effects and after math from the U.S. bomb tests over the Pacific islands and the repeated deceptions about the consequences, read Giff Johnson, *Don't Ever Whisper —Darlene Keju, Pacific Health Pioneer, Champion for Nuclear Survivors*. [6]

Former Idaho Governor Cecil Andrus Passes Away
Just Shy of 86th Birthday, Will Be Sorely Missed

Former Idaho Governor Cecil Andrus is known for fighting the federal government to protect Idaho from nuclear waste at the Idaho National Laboratory. Andrus served four terms as the Governor of Idaho, first 1971 to 1977, and then again from 1987 to 1995. As Governor, in 1988 he famously stopped a radioactive waste shipment from Colorado and the photograph of a state

[4] Jay M. Gould and Benjamin A. Goldman, *Deadly Deceit – Low Level Radiation High Level Cover-Up,* Four Walls Eight Windows New York, 1990. ISBN 0-941423-35-2.
[5] Gayle Greene, *The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation,* University of Michigan, 1999. ISBN 0-472-08783-5.
[6] Giff Johnson, *Don't Ever Whisper – Pacific Health Pioneer, Darlene Keju, Champion for Nuclear Survivors*, 2013. ISBN-10: 1489509062.

trooper with a patrol car stopping the shipment is iconic to the fight to get the Department of Energy to address its nuclear waste problems. This dramatic turning away of nuclear waste at the Idaho border along with legal wrangling caused the Department of Energy to be more willing to talk. [7] [8]

In the 1970s, the Atomic Energy Commission's Dixy Lee Ray made promises in writing that the nuclear waste from Rocky Flats being buried at the INL would be out of the ground and out of the state by the end of the 1970s. The Rocky Flats waste included chemical solvent laden transuranic radionuclides and uranium wastes. The Department of Energy conducted some studies of waste exhumation at the INL burial ground now known as the Radioactive Waste Management Complex but had relatively little success until the 1990s. But the Department of Energy would later say it had no intention of retrieving the buried waste. In the end, despite the legal wins, only a tiny fraction of the buried Rocky Flats transuranic waste is being exhumed.

The extent of airborne contamination from the operations at the burial grounds, including retrievals and the health effects on workers have yet to be fully recognized. But neither has the full extent of the harm from the buried waste from the trickle out of long-lived fission products like iodine-129, uranium, transuranics like americium and plutonium, and the chemical waste. The Environmental Protection Agency (EPA) timeframes focused on 1000 years with mention of the hazards at 10,000 years. The Department of Energy's model of the waste migration into the aquifer was based on biased calculations that delayed the waste migration until after 10,000 years by assuming geological stability, no flooding, and coefficients favoring the propensity of the radionuclide to cling to the soil. The Department of Energy's fictional result of steady slow and delayed migration of the contaminants into the aquifer is, well, rather consistent with its denial of the aquifer contamination that has already migrated south of the INL largely from its earlier radiological waste water practices.

The result of the State of Idaho's litigation against the Department of Energy was the 1995 Idaho Settlement Agreement that called for all transuranic waste from the Rocky Flats weapons plant, both the above ground stored waste and the buried waste to be sent out of state. [9] A lawsuit followed regarding the Department of Energy's interpretation of the 1995 Settlement Agreement that only the above ground stored transuranic waste was to be shipped to the Waste Isolation Pilot Plant (WIPP) in New Mexico, leaving all the buried transuranic waste buried. The judge ruled that indeed, "all means all" and even the buried transuranic waste was to be removed from the state.

But in 2008 the State of Idaho agreed that only a small fraction of the buried transuranic waste would be removed, with emphasis on the most chemically laden waste because the aquifer

[7] Cecil D. Andrus and Joel Connelly, *Cecil Andrus – Politics Western Style,* Sasquatch Books Seattle, 1998. ISBN 1-57061-122-X

[8] Rocky Barker, *Idaho Statesman* (reprinted in *The Idaho Falls Post Register*), "Cecil Andrus leaves large legacy in Idaho," August 27, 2017.

[9] Susan M. Stacy, *Proving the Principle,* DOE/ID-10799, 2000. See Chapter 24.

beneath the RWMC already exceeded federal drinking water standards for carbon tetrachloride from the waste. The DOE avoided admitting the true reasons included the high cost of exhuming the waste and the lack of room at WIPP, claiming instead that the risk to workers outweighed the benefit to the public. Yet the analysis assumed that radiation monitored workers were, by definition, adequately protected — something that appears not to be true given continuing Energy Employee Illness Compensation claims and hundreds of denied compensation claims by former INL workers. The analysis instead which was based on the radiation dose to an unmonitored state employee that inspected shipments both underestimated the harm to workers and underestimated the future harm to the public over millennia from waste migration into the aquifer.

Few people understand how little of the buried waste will leave Idaho. And because retrievals are reported in fraction of targeted waste exhumed, news releases often sound as though all the buried Rocky Flats waste is being retrieved. See a summary of INL cleanup status in our March and July 2017 newsletters.

Cecil Andrus had the intelligence to question the federal government's plans for high level calcine waste in the form of dry powdery soluble form, its shallowly buried transuranic waste, its liquid high level waste storage, and its spent nuclear fuel storage plans. He took Herculean actions to protect Idaho with the creation of the Federal court ordered Idaho Settlement Agreement.

The void in leadership was immediately apparent as the Idaho Department of Environmental Quality granted in 1995 the Department of Energy's request to no longer provide radiological drinking water data for the Idaho National Laboratory. [10]

In recent years as a citizen, he fought the efforts of the Department of Energy to create an interim spent fuel storage facility from coming to Idaho.

The hard won Settlement milestones continue to be missed such as failure to treat 900,000 gallons of highly radioactive sodium-bearing liquid waste by 2012 that still remains untreated. And settlement milestones can be expected to be missed in the future. With no place to ship the country's including Idaho's high level waste and spent nuclear fuel to, the Department of Energy will increasingly apply pressure to avoid the steps to prepare the nuclear waste for shipping. [11]

[10] Letter from Idaho National Engineering Laboratory Drinking Water Coordinator Brad A. Anderson to Idaho Department of Environmental Quality Blaine Drewes, "Record of Conversation on February 27, 1995, at Idaho falls Water and Wastewater Office Building – BDA-31-95. The fledgling state drinking water program that began in the late 1980s had until this time requested both chemical and radiological drinking water data from the Idaho National Laboratory. After this letter, the quality requirements and the requirements to use certified and independent lab analysis reported directly to the state for radionuclide monitoring in drinking water ends.

[11] See more about the Department of Energy's failure to obtain nuclear waste disposal facilities in our July and August 2017 newsletters at http://www.environmental-defense-institute.org/edipubs.html

Beyond the spent nuclear fuel that the Idaho Settlement Agreement [12] requires be repackaged using a facility that has not been built in order to be shipped out of Idaho by 2035, the High Level Waste (HLW) at the INL includes the calcine and the remaining to be treated liquid sodium-bearing waste. Both the calcine and the SBW will require another expensive round of processing into canisters that can be shipped out of the state and meet disposal requirements for the yet-to-be-named defense repository.

But perhaps as important as the Department of Energy's failure to provide disposal facilities for the spent nuclear fuel and high level waste is that there appears to be no governor candidate on the horizon willing to question the Department of Energy's and southeast Idaho's nuclear booster propaganda. Candidates from both parties in recent years have done little more than be willingly courted by INL supporters in the southeast part of the state with votes in mind. They appear to have little understanding of the risks and human health and environmental harm of this enterprise.

Hanford Bioassay Confirms Worker Inhalation of Plutonium and Americium

Plutonium airborne detections led to conducting bioassay of potentially exposed workers, which so far had found twenty percent of workers tested had plutonium uptakes according to documents obtained by news reporters for KING 5. [13]

The uptakes are expected to have resulted from the demolition work of the Hanford Plutonium Finishing plant last June. The contractor in charge of the demolition work that activated the airborne contamination alarms, CH2M Hill, initially downplayed the seriousness of the event and said that they thought no intakes had occurred.

The positive results for plutonium inhalation was downplayed by CH2M Hill, saying it was less than 1 millirem.

First of all, the contractor conducting the analysis of radiation dose has a conflict of interest — they want to avoid having the incident seen as actually harmful to workers. Second of all, the actual health harm of the intake is underestimated by the use of the nuclear industry's unscientifically backed equating of internal dose to external dose.

Bioassay tests need to be taken several times and trended. Even then, the resulting radiation dose estimate is uncertain by several orders of magnitude. This means that a 1 mrem dose may

[12] 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.

[13] Susannah Frame, *King 5*, "Tests show Hanford workers inhaled radioactive plutonium," August 3, 2017. http://www.king5.com/news/local/hanford/tests-show-hanford-workers-inhaled-radioactive-plutonium/461574180

be 10 times higher, or 10 mrem, or 100 times higher at 100 mrem. It also means that when the Department of Energy contractor's estimated dose is 100 mrem, it might be 1000 mrem or 10,000 mrem. The health implications of a 100 mrem dose versus a 10,000 mrem (or 10 rem) dose are akin to the difference between life and an early death. Finally, the assumptions made in estimating the dose can greatly affect the dose estimate and must be provided to the workers. These assumptions include solubility class and particle size.

The model used for dose estimation is known to be highly inaccurate and not represent any person's intake accurately. Errors of several orders of magnitude are likely despite the assertion of confidence in the stated radiation intake dose estimate.

An estimated dose of 1 mrem is not going to result in a workers restriction from radiation work. Perhaps the Hanford intakes are really this small.

But at the Idaho National Laboratory, at least one worker involved in the 2011 ZPPR plutonium inhalation release at the Idaho National Laboratory [14] was not cleared for return to radiation work for over 8 months. Official bioassay had been terminated prematurely. Then because they could not answer why the worker was prevented for returning to radiation work, a bioassay test was conducted. The bioassay was positive for elevated excretion of transuranic radionuclides. But the worker was inexplicably cleared for radiation work even though excretion contamination levels remained above detection level. Not only had bioassay been terminated for the workers prematurely, when the bioassay to reinstate the workers to radiological work was found positive, the finding was ignored and not reported to workers as required.

From hopes of a nuclear renaissance to costly nuclear boondoggle: Construction of two South Carolina AP1000 nuclear reactors abandoned but Georgia presses on with construction of two AP1000 reactors at Vogtle

The July 31 decision to stop the construction of two South Carolina Westinghouse AP1000 units is officially on hold while it is being reviewed. This really does not signal hope for the project. The two South Carolina units likely will have no choice but to put an end to the rising construction costs.

But still refusing to cut bait is Georgia power with the two AP1000 units under construction in Georgia. The question is how Georgia will secure adequate funding to continue construction

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

given the bankruptcy of the AP1000 designer and builder, Westinghouse, last March. [15] [16] The Georgia Public Service Commission will still have to approve the plan to continue construction of the Vogtle units in light of the large cost overruns, the bankruptcy of Westinghouse, and the risk of further cost and schedule overruns.

The AP1000 construction cost increases have come at a time when energy prices are low because of cheap gas prices. The construction delays are also a problem not only because of the financing costs but also because of incentive program ineligibility. The plants were to be running by 2017 but are only partially completed. Current cost estimates for the two AP1000 reactors at Vogtle ballooned from $14 billion to $25 billion, but that's if all goes well from now on.

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

The Westinghouse Nuclear Division bankruptcy filing last March because of the cost overruns in the billions on the fixed-cost contract for construction of the four US plants, two at South Carolina's Summer station and two at Georgia's Plant Vogtle. [17] Westinghouse was bought by Japan's Toshiba in 2006 with hopes of a nuclear renaissance in the US. Toshiba has announced that it has no further plans to compete to build nuclear plants. Toshiba will be paying out $ 2.2 billion to S. Carolina, and $ 3.7 billion to Georgia to extricate itself from the fiasco. [18]

The Westinghouse nuclear website still claims to have designed a safer and simplified plant that because of modern, modular-construction techniques that would shorten construction times and improve quality. It claims that the AP1000 was designed to be economically competitive with contemporary fossil-fueled plants. [19] **Claiming nuclear energy to be reliable, safe, and affordable nuclear power doesn't pass the snicker test anymore, so the nuclear promoters are claiming that commercial nuclear reactors are needed for national security.** [20]

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[15] Russell Grantham, *The Atlanta Journal-Constitution*, "Regulators: Georgia's Vogtle not like S.C. nuke plant," August 1, 2017. http://www.myajc.com/business/regulators-georgia-vogtle-not-like-nuke-plant/G6wwM4Zd7jzOeEn8fOFSMM/

[16] Russell Grantham, *The Atlanta Journal-Constitution*, "'Go' recommendation for Plant Vogtle nuke plant heats up debate," September 1, 2017

[17] Russell Grantham and Johnny Edwards, *The Atlanta Journal-Constitution*, "Plant Vogtle: Georgia's nuclear 'renaissance' now a financial quagmire," May 19, 2017. http://www.myajc.com/business/plant-vogtle-georgia-nuclear-renaissance-now-financial-quagmire/5l16IFMFICknSCeI7RXG6J/ The two 1100 Megawatt reactors were to have powered 1.5 million homes, cost $14 billion, and been running in 2016.

[18] US Department of Energy, *Nuclear Power Summary – News & Notes*, August 2017. https://www.energy.gov/sites/prod/files/2017/08/f35/Nuclear-Power-Summary-August-2017_0.pdf

[19] Westinghouse Nuclear http://www.westinghousenuclear.com/New-Plants/AP1000-PWR/Economic-Benefits

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

With the decision by the Georgia utility to go forward with its two AP1000 units at Vogtle, the next decision will be by the Public Service Commission which could require the utility to absorb the increased costs. [21]

The AP1000 nuclear units under construction in China were sold in a way that allows China to build the plants and use the design to build any others in China or other countries. Duke Energy announced in August that it's dropping plans to build AP1000 plants — the Levy Nuclear Plant on Florida's Gulf Coast and the W.S. Lee nuclear plant in South Carolina. [22]

Now that Westinghouse is bankrupt, it joins the ranks of other nuclear builders that have exited the nuclear reactor business. France's Areva has been bailed out by France but remains swamped by the currently unfinished EPR plant in Finland that has large cost overruns and delays. Japan's GE Hitachi never found a buyer for its sodium cooled reactor based in the INL Experiment Breeder Reactor II (EBR-II) design. Other companies including Germany's Siemans have left the nuclear reactor construction industry. [23]

This reminds me of why the larger oil and gas companies bailed out of the nuclear energy business decades ago. Back in the 1950s and 1960s, Phillips Petroleum was a Department of Energy contractor at the Idaho National Laboratory. Large companies with investments to protect understood the financial risks and liabilities of nuclear energy were just too high.

Moniz explains his desperate argument that nuclear energy supports national security

No longer able to claim that nuclear energy is reliable, safe, and affordable, nuclear boosters are shifting the argument to claim that the nuclear plants are needed for national security. [24]

Former Energy Secretary Ernst Moniz explains it as follows:

> *"That the domestic commercial nuclear energy industry—and the supply chain that provides its equipment, services and skilled personnel—has an "inherent and very strong overlap" with the U.S. defense sector and its national security mission.*

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[21] Jim Galloway, *The Atlanta Journal-Constitution*, "Staffer: PSC [Public Service Commission] could stand pat, let Ga. Power absorb new Plant Vogtle costs," April 27, 2017. http://politics.blog.ajc.com/2017/04/27/staffer-psc-could-stand-pat-on-plant-vogtle-let-georgia-power-absorb-new-costs/

[22] Russell Grantham, *The Atlanta Journal-Constitution*, "'Go' recommendation for Plant Vogtle nuke plant heats up debate," September 1, 2017. The current cost estimate for the two AP1000 units at Vogtle are now estimated at $25 billion and are not predicted to be completed before 2020.

[23] *World Nuclear News*, "Siemens quits the nuclear game," September 19, 2011. http://www.world-nuclear-news.org/C_Siemens_quits_the_nuclear_game_1909111.html "The head of German industrial giant Siemens has said the company will withdraw its remaining nuclear power offerings and leave the industry."

[24] Ernst Moniz, *Energy Futures Initiative*, "Moniz: Robust Nuclear Industry Needed for National Security," August 17, 2017. https://www.nei.org/News-Media/News/News-Archives/2017/Moniz-Robust-Nuclear-Industry-Needed-for-National

One example is the Naval Nuclear Propulsion Program, which comprises civilian and military personnel responsible for the nearly 100 nuclear reactors that power U.S. aircraft carriers and submarines. The supply chain companies and universities that provide the materials and trained personnel for the nuclear Navy strongly overlap in states that are home to commercial nuclear plants.

The interdependence of the commercial and defense nuclear industries is evident in the need for U.S.-origin highly enriched uranium to fuel naval reactors. From uranium feed to enrichment technology, the entire fuel supply chain for naval reactors must be "made in America."

In addition, small amounts of short-lived tritium must be produced regularly in order to maintain the readiness of the U.S. nuclear weapons stockpile. This tritium is provided by irradiating fuel rods in commercial power reactors. Again, the tritium must be sourced from U.S.-origin reactors using domestically produced low-enriched uranium reactor fuel.

An extensive U.S. supply chain—700 companies in 44 states—is currently sustained by what is still the world's largest fleet of nuclear reactors. However, domestic manufacturing capacity—including of reactor components such as pressure vessels, steam generators, pressurizers, main condensers and turbine generators—has been eroding steadily since at least 1979, when the Three Mile Island incident led to the cancellation of multiple reactor construction projects.

Some segments of the nuclear supply chain—such as domestic-origin uranium enrichment capacity—no longer exist in the United States. And, the report notes, the only enrichment plant currently operating in the United States uses European technology.

The recent spate of reactor closures and the suspension of the V.C. Summer Westinghouse AP1000 construction project are exacerbating pressures on the U.S. supply chain—including trained technologists and engineers graduating from universities and trade schools.

"(T)he imperatives of global climate change, collective energy security, balance of trade and U.S. national security require a viable domestic commercial nuclear power industry, including robust supply chain of technology, services and human resources," the report states.

"The picture is clear: A stabilized existing reactor fleet and new builds, perhaps incentivized by the favorable emissions characteristics of nuclear power, will be needed to rebuild a supply chain that will underpin both clean energy and national security success."

It's a desperate attempt to justify exorbitant costs for maintaining and building the nuclear industry. Uranium enrichment in the US was federal activity before its failed privatization. The nuclear navy can get what it needs even if it has to pay more to assure a supply chain. The university programs supporting nuclear programs will shrink and no doubt those universities won't be happy about it. It would require very few nuclear reactors to provide adequate tritium.

Nuclear energy is not reliable, not affordable, is too costly to help combat climate change, and can be slowly phased out without harm to the US nuclear navy or weapons industry. It will mean reduced a reduced number of universities continue nuclear programs as there are fewer positions for nuclear engineering and physics graduates.

Robert Alvarez writes about Spent Nuclear Fuel Pool accidents and Fuel Disposal

Robert Alvarez has recently written about the problem of spent nuclear fuel pool accidents and the problem of fuel disposal. See his full article on our website or at The Bulletin for the Atomic Scientists. [25]

In a nutshell, some of the key issues from the article are highlighted here. Currently 70 percent of US spent fuel is stored in densely packed fuel pools not originally designed to hold so much spent fuel. Only 30 percent of the SNF is stored in dry cask storage which is substantially safer. The zirconium clad spent nuclear fuel stored in pools from fresh operation in a reactor is vulnerable to severe accidents involving draining the water in the pool. A severe accident resulting in a zirconium cladding fire would release the fission products from the stored fuel resulting in lethal airborne contamination followed by many decades of large-scale land contamination.

The U.S. Nuclear Regulatory Commission has tried to suppress a National Academy of Sciences review that concluded that it is not prudent to dismiss nuclear plants, including spent nuclear fuel storage facilities, as undesirable targets for terrorists.

And while dry cask storage is far safer than fuel pool storage, the NRC has licensed 51 different dry cask storage canisters that may need to be reopened or repackaged before transport to either a centralized interim storage facility or to a permanent repository. Yet nearly 20 percent of the SNF is located at closed or soon-to-be-closed reactors so there is no facility such as a fuel pool for conducting repackaging.

[25] Robert Alvarez, *The Bulletin of the Atomic Scientists*, "Pushing the Storage Horse with a Nuclear Waste Cart: The Spent Fuel Pool Problem," August 9, 2017. http://thebulletin.org/pushing-storage-horse-nuclear-waste-cart-spent-fuel-pool-problem11002 or http://www.environmental-defense-institute.org/publications/AlvarezSNFpool.pdf

Under current law, title to the spent nuclear fuel is transferred to the federal government only after it enters the gate of an opened geologic repository. All expenses before then are to be borne by the reactor owners. None of the dry cask systems are licensed for long-term disposal and so will require repackaging for disposal.

How much will it cost for SNF repackaging for transportation and for disposal, for transporting the SNF, and for continued storage at the closed reactor sites and for obtaining interim storage and permanent disposal? The answers are not being spelled out to the public or to Congress even though addressing it will cost taxpayers and rate payers billions of dollars.

NIOSH Found That INL's Chem Plant Failed to Provide Adequate Uranium and Plutonium Monitoring of Workers in 1975-1980 and Investigation of Other INL Radiation Worker Protection Issues Continues

Meetings were held in August of the Advisory Board on Radiation and Worker Health for the Center for Disease Controls (CDC) National Institute of Occupational Safety and Health (NIOSH) regarding the Idaho National Laboratory, including Argonne National Laboratory – West now renamed the Materials and Fuels Complex.

The contractor investigating plutonium and uranium contamination and worker monitoring at the INL's "Chem Plant" (or Chemical Processing Plant known as CPP) now renamed the Idaho Nuclear Technology and Engineering Center (INTEC) found that while the problems with worker radiation protection problems were identified in the 1970s, problems persisted until at least 1980. While the need for more bioassay was recognized in 1976, bioassay of workers remained sparse until 1981. Evidence of laboratory room contamination not being effectively controlled was found because of recurring contamination and positive bioassay results from the limited bioassay that was conducted. [26] Problems may have continued after 1980, investigators admit. Intakes included alpha emitters including uranium-233 and uranium-235 intakes.

"NIOSH has concluded, based on assessment of the available employee monitoring data, that there are insufficient internal dosimetry data or air monitoring data available to bound intakes of transuranic radionuclides for the period from January 1, 1975 through December 31, 1980."

[26] See the July 20, 2017 presentation to the board (See August 14, 2017 board meeting) describing various problems at the Idaho National Laboratory's INTEC prior to 1981 at https://www.cdc.gov/niosh/ocas/pdfs/sec/inl/inler-238-r0.pdf

Because of these findings, the current SEC at the INL for 1970 to 1974 is being expanded as a new special exposure cohort (SEC) for the chem. plant for 1975 to 1980 proposed by NIOSH at the August 23 meeting and approved by the radiation board. [27]

This latest board approved SEC class is worded as follows: "Proposed SEC Class: All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Idaho National Laboratory (INL) in Scoville, Idaho, and who were monitored for external radiation at the Idaho Chemical Processing Plant (CPP) (e.g., at least one film badge or TLD dosimeter from CPP) between January 1, 1975 and December 31, 1980 for a number of work days aggregating at least 250 work days, occurring solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort."

Previously, a 1970 to 1974 SEC-00219 was created for the entire INL site because of the problems at the chem. plant combined with the "one badge, multiple facilities" practice which made identifying which workers at the chem. plant difficult. [28]

Another SEC for the INL includes the 2016 recommendation for SEC-00224 for ANL-W workers April 10, 1951 to December 31, 1957. [29]

The NIOSH proposed SEC class for the chem. plant from 1963 to February 28, 1970 has languished as it has apparently not been approved by the board. [30] Because an SEC class can be expanded, there appears to be no justification for the delay of claimants that meet the proposed definition as the problem of investigation of the use of temporary badges and visitor badges may expand the definition and allow addition claimants to qualify.

Other facilities and timeframes continue to be investigated by NIOSH to determine if more special exposure cohorts (SECs) are needed. When radiation dose reconstruction cannot adequately be conducted and there was sufficient risk of exposure, SECs grant compensation to the workers qualifying for the SEC.

NIOSH continues to investigate the chem. plant prior to 1970, the burial grounds now known as the Radioactive Waste Management Complex, particularly after retrievals began in the 1970s, [31] [32]and other INL sites. NIOSH continues to presume that a workers intake at sites such as the

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

[28] INL May 2, 2016 Advisory board recommended Special Exposure Cohort: https://www.cdc.gov/niosh/ocas/pdfs/abrwh/secrecs/bdrecinl-219.pdf

[29] ANL-West May 2, 2016 Advisory board recommended Special Exposure Cohort: https://www.cdc.gov/niosh/ocas/pdfs/abrwh/secrecs/bdrecanlw-224.pdf

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

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

Test Reactor Area (now the ATR Complex) can be proportioned to the composition of the reactor fuel prevalently in use at the site. NIOSH continues to ignore the irradiation target separations issues involving transuranic radioisotopes both historically and continuing. NIOSH considers the reactor studies and sites such as the Test Reactor Area a lower priority and has provided limited resources for data capture. In other words, workers denied compensation who worked at the Test Reactor Area are likely to die before an SEC granting compensation is investigated and approved. NIOSH avoids providing the number of claimants from various facilities for its partial patchwork of special exposure cohorts but probably hundreds of workers are being left to wait, possibly for many more years before determining that their past radiation dose reconstructions were inadequate.

Submitting a petition to NIOSH that a new SEC should be created requires that the submittal be from a claimant. However, existing SEC petitions can be expanded under the 42 CFR 83.14 process. [33]

The August meeting presentations are available online. According to the Department of Labor presentation August 2017, about $14 billion has been paid in illness compensation to former workers. [34]

Over all the sites across many states, if a radiation dose reconstruction is performed to determine eligibility for compensation, 72 percent of the cases are denied compensation. See the August 2017 presentation for 29,283 cases with probability of causation less than 50 percent were denied of a total 40,638 cases. [35] Of the INL and nine other sites described in the DOL presentation, of the number of claimants for each site, the number of Part B and Part E (chemical exposure) cases denied was the highest for the INL, at 66 percent denial of radiation and chemical claims. The average for the other nine sites was 52 percent denial with the range of 62 percent to 34 percent of Part B and Part E claims denied. [36]

The findings of recent investigations of radiation protection practices at the Idaho National Laboratory showing significant problems particularly in monitoring and control of alpha emitters such as plutonium and uranium should be front page news. The high rate of claim denial could change as new Special Exposure Cohorts are created or expanded, but this is happening very slowly. As claimants and their qualifying survivors die, the claims don't have to be paid.

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[32] SC&A, Inc., "DRAFT REVIEW OF NIOSH'S EVALUATION REPORT FOR PETITION SEC-00219, IDAHO NATIONAL LABORATORY: BURIAL GROUND, 1952-1970," SCA-TR-2017-SEC007, May 2017.

[33] Code of Federal Regulations 42 CFR 83 https://www.cdc.gov/niosh/ocas/pdfs/42cfr83/42cfr83b.pdf

[34] Department of Labor presentation August 2017 https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2017/dol-update-082317.pdf

[35] NIOSH Program Update August 2017 https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2017/dc-update-082317.pdf See p. 7.

[36] Department of Labor presentation August 2017 https://www.cdc.gov/niosh/ocas/pdfs/abrwh/pres/2017/dol-update-082317.pdf p. 10-12.

Irradiated Target Separations Continue at the ATR Complex

The CERCLA cleanup investigations at the Auxiliary Reactor Area known for the 1961 Stationary Low Power (SL-1) reactor accident have found not only contamination including wind blown soils from the SL-1 accident and waste burial near the site of the reactor, the investigations have found uranium and transuranic wastes from irradiation target separations processes.

The radionuclides from the irradiated target separations conducted at hot cells at the ARA are similar to the CERCLA cleanup investigations finding of contamination at the ATR Complex formerly the Test Reactor Area at the Idaho National Laboratory.

High levels of americium-241, curium, plutonium-238 and plutonium 239/240 and uranium-233/234 have been found that are disproportionate to the reactor fuels used at these areas. Irradiation target separation processes might have seemed that practices from a bygone era. But at the ATR Complex, it appears on the basis of the resin composition for anticipated wastes that the separations processes continue.

Despite discovering extensive americium-241 contamination in the perched water investigated as part of CERCLA cleanup in the 1990s at the ATR Complex, [37] the Department of Energy, state and federal Environmental Protection Agencies put their heads in the sand and ignored the transuranic contamination at the ATR Complex. It was not until 2015 that a soil investigation was conducted that torpedoed the Department of Energy's earlier statements that the ATR Complex would be allowed unrestricted use by 2095. [38]

In the tardy 2015 investigation of soils at the ATR Complex, several long-lived radionuclides were found in the soil where the retention basin was located prior to demolition. [39] The soil contamination was 17 times higher for americium-241 than would allow unrestricted use, see our August newsletter's Table 1. This means it would take 17 half lifes for natural decay to lower the soil concentration sufficiently to reach the unrestricted use exposure level of 187 picoCurie/gram soil. The half life of americium-241 is 430 years — but it decays to neptunium-

[37] Lewis, S.M, et al., EG&G Idaho, "Remedial Investigation (RI) Report for the TRA Perched Water System OU 2-12," EGG-WM-10002, June 1992. https://ar.icp.doe.gov/ This and draft CERCLA evaluation documents in the early 1990s found perched water levels of Americium-241 at the Test Reactor Area of 2110 picoCuries/liter, far exceeding 15 pCi/L that relates to alpha emitters.

[38] See. https://ar.icp.doe.gov/ See WAG 2 Operable Unit 2-13. Various documents beginning around 1997 discuss continuing institutional controls "for at least 100 years." There are public relations brochures saying natural radioactive decay would eliminate the health risk within 1000 years. And proposed actions would make no other actions required after 100 years. See NSI-260002 and other recent documents that have revised these previous statements.

[39] Federal Facility Agreement and Consent Order (FFA/CO) New Site Identification (NSI), "TRA-04; TRA-712 Warm Waste Retention Basin System (TRA-712 and tRA-612)," Site Code: TRA-04, Document Number: NSI-26002, Rev. 1., prepared July 2015. This NSI states that the retention basin cannot be released for unrestricted use by 2095. Nor can it be released for unrestricted use in 2310 as a 2011 DOE 5-yr review indicated. The document incorrectly states that institutional controls will require 24,100 years to elapse. But they have forgotten that americium-241 decays to neptunium-237 and so have underestimated to time for americium-241 to decay to levels not requiring institutional controls by a few million years.

239 which has a half life of 2.1 million years. There are several other decay progeny before becoming non-radioactive. In other words, it will take longer than forever to reach unrestricted use levels.

Plutonium-239 levels were also found above unrestricted use concentrations in soil analyzed in 2015 and would take forever to decay to unrestricted use levels.

Subsequent to early mid 1990s CERCLA investigations, the US Geological Survey monitoring and reporting specifically of shallow and deep perched water inexplicably omitted monitoring of americium and other alpha emitting radionuclides in the shallow perched water at the ATR Complex. [40] Eventually, the contaminants in the soil and shallow perched water will migrate downward into the aquifer. Chemical and radiological contamination has already reached the aquifer from the ATR Complex and upgradient facilities including the Naval Reactors Facility. Because DOE has wanted to promote the idea that all the significant radiological contamination would naturally decay away within 100 years, the DOE, INL contractors, the state, and the EPA have all actively avoided mentioning the long-lived radionuclide contamination. The cesium-137 and cobalt-60 radioactivity and others will decay away within 400 years. But the long-lived plutonium-239 and americium-241 contamination at TRA in the soil will never decay to unrestricted use concentrations.

A 2016 Occurrence Report (OR) stated **that soil contamination levels were as high as 250,000 disintegrations per minute per 100 square centimeters near the ATR Complex evaporation pond.** The contractor admitted that radionuclides were being sent to the open air pond that the pond was not designed for. And the OR stated that snow fence was erected to limit the spread of radioactivity among other actions. [41]

This is not the first time radioactively laden resins, intended to capture radionuclides and clean up the waste water, have escaped the resin beds. Resin beads were found near an underground piping leak in waste water lines headed for the evap pond. [42] Radiation monitors that should have detected the elevated radiation levels in the waste water going to the pond were either kept off or were otherwise ineffective in detecting the elevated radiation levels in the waste water. The damaged pipe and resins inside it were then left in the ground.

But in the 2016 OR, it was admitted that the resins escaped to the open air evaporation pond and resulted in contaminating the pond and soil near the pond. The reality is that resins may have

[40] Linda C. Davis, US Geological Survey "An Update of the Distribution of Selected Radiochemical and Chemical Constituents in Perched Ground Water, Idaho National Laboratory, Idaho, Emphasis 1999-2001. The is NO Americium monitoring at the Test Reactor Area now called the ATR Complex. There is not even gross alpha monitoring in the perched water found to have exceeded the MCL for americium in CERCLA studies conducted just a few years before this report was written although it was not released until 2006.

[41] Department of Energy Occurrence Report NE-ID—BEA-ATR-2016-0014. "Contaminated Soil Outside Warm Waste Evaporation Pond at the ATR Complex." a copy made available on our website www.environmental-defense-institute.org/publications/ATR-2016-0014.htm

[42] DOE/NE-ID-11139, "Track 1 Decision Documentation Package for TRA-605 Warm Waste Line," January 2005. http://ar.inel.gov/images/pdf/200503/2005030300231KAH.pdf

been sent to the pond since the evap pond was installed in 1993. The degree to which the release may have increased in recent years or months is not described.

When resins were previously found as described in DOE/NE-ID-11139 in the 2001, federal cleanup CERCLA Track 1 documentation was prepared. But apparently this has not occurred for the 2016 OR despite the radioactivity involved being above ground rather than occurring underground where a pipe was leaking.

The evap pond installed in 1993 was to accept only warm waste water that had been filtered through resin cleanup systems and the main radionuclide to be released was to be tritium. Based on DOE/NE-ID-11139, the normally accepted levels of radioactivity released to the evap pond are not trivial and the tritium released to the evaporation pond is in concentrations far exceeding drinking water standards, over 9 million picocuries/liter. [43] But the Battelle Energy Alliance does not estimate its releases of tritium from the ATR Complex to the skies. This requires others to make rough estimates when creating air emissions reports for the INL.

The 2006 INL report (INL/EXT-06-11601) characterized potential ATR resins from experiment loops and the main primary coolant system in order to investigate waste disposal options. [44] The ATR resins require remote handling and are too radioactive to be accepted by most commercial low-level radioactive waste disposal facilities. The resins likely include cesium-137, strontium-90, and may include long-lived radionuclides significant for migration to the aquifer including americium-241, neptunium-239, plutonium-239, iodine-129, technetium-99 and others.

For that reason, these radioactive resins with long-lived radioisotopes are shallowly buried over the Snake River Plain aquifer at the Radioactive Waste Management Complex and soon to be buried over the aquifer at the Remote-handled Low-level Waste facility outside the fence at the ATR Complex. And for now, some unknown quantity of the radionuclides from the resins have apparently been flushed to the open air evaporation pond and may be blowing in the wind.

So far, Idaho Department of Environmental Quality has taken no action with regard to exceeding the conditions of the state air permit or with regard to noting that a new CERCLA contamination site may have been created.

In addition to the radiological contamination posed by the release of used resins to the evap pond that can have a long term environmental effect, workers conducting work near the pond at any time since the release may have received both external and internal exposures. The alpha and beta radioactivity would not be measured by a workers radiation badge although the badge, if worn outside the fence, would detect increased gamma radiation. The inhaled radionuclides

[43] DOE/NE-ID-11139, "Track 1 Decision Documentation Package for TRA-605 Warm Waste Line," January 2005. http://ar.inel.gov/images/pdf/200503/2005030300231KAH.pdf

[44] Timothy Carlson et al., Idaho National Laboratory for the Department of Energy Office of Nuclear Energy, "Low-level Waste Disposal Alternative Analysis Report," INL/EXT-06-11601 rev. 1, September 2006. Table B-2-4. https://inldigitallibrary.inl.gov/sites/sti/sti/3661678.pdf

would be undetected. Subsequent illness compensation claims may never factor in their possible unrecorded inhalation internal radiation doses.

Articles are by Tami Thatcher, for September 2017.