Environmental Defense Institute

News on Environmental Health and Safety Issues

April 2023 **Volume 34** **Number 4**

Idaho Legislators declare nuclear energy "clean" and either don't care or don't understand the harm to human health and the unborn

Currently, construction of nuclear power plants, including small modular reactors, to generate energy is most expensive way to generate electrical energy. [1] [2] [3] [4] [5] The construction and operating costs for nuclear energy do not include the cost of indefinite storage of the spent nuclear fuel at the reactor site or a consolidated site. It also does not include the cost of spent nuclear fuel processing.

The Department of Energy conducted extensive reprocessing for its nuclear weapons programs and the radioactive waste from the reprocessing starting in the 1940s. The mess is still not cleaned up. [6] [7] [8] The problem of radioactive liquid high-level waste in tanks prone to leaking is still not solved at Hanford, for example. Past radioactive releases to air, soil, groundwater and the Columbia River from operations at Hanford are large and are continuing. Cleanup costs continue in the billions of dollars. Not often mentioned is that Washington state monitoring of

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[1] ANS Nuclear Cafe, *NuclearNewswire*, "Vogtle project update: Cost likely to top $30 billion," May 9, 2022. https://www.ans.org/news/article-3949/vogtle-project-update-cost-likely-to-top-30-billion/

[2] ANS Nuclear Cafe, *NuclearNewswire*, "Further delays, higher cost for Vogtle project announced," February 17, 2023. https://www.ans.org/news/article-4760/further-delays-higher-cost-for-vogtle-project-announced/

[3] 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.

[4] 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

[5] David Schilssel, Institute for Energy Economics and Financial Analysis, Small modular reactor project likely to end badly for utilities and worse for taxpayers, January 24, 2023. https://ieefa.org/resources/small-modular-reactor-project-likely-end-badly-utilities-and-worse-taxpayers

[6] Richard Burelson Stewart and Jane Bloom Stewart, Fuel Cycle to Nowhere – U.S. Law and Policy on Nuclear Waste, Vanderbilt University Press, ISBN 978-0-8265-1774-6, 2011.

[7] 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.

[8] Government Accountability Office, Hanford Cleanup – DOE's Efforts to Close Tank Farms Would Benefit from Clearer Legal Authorities and Communication, GAO-21-73, January 2021 at www.gao.gov (See page 29.)

infant mortality was found, early on, to be elevated in communities near Hanford. [9] [10] [11] [12] [13] [14] [15] [16]

The spent fuel from nuclear power plants is to become the taxpayer's liability when the spent fuel is transferred to the Department of Energy. While ratepayer's fees had been collected to help cover the cost of disposal of the spent fuel, the Department of Energy had to stop collecting those fees because a court found that DOE had no spent fuel disposal program. The money collected so far would likely not cover the cost of repackaging the spent fuel for disposal, as was deemed necessary for Yucca Mountain. [17] The Yucca Mountain repository was not granted a construction license and was defunded in 2010. [18] [19] [20]

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[9] 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. *Plutopia* documents the elevated percentage of deaths among infants in the Richland population in the 1950s. Elevated fetal deaths and birth defects in Richland were documented by the state health reports, yet Hanford's General Electric doctors and the Atomic Energy Commission that later became the Department of Energy failed to point these statistics out. The local newspapers failed to write of it. The Department of Energy has 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.

[10] 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. 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*.

[11] Gayle Greene, *The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation,* University of Michigan, 1999. ISBN 0-472-08783-5. 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*.

[12] Giff Johnson, *Don't Ever Whisper – Pacific Health Pioneer, Darlene Keju, Champion for Nuclear Survivors,* 2013. ISBN-10: 1489509062. 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*. *Time* magazine (around 2017) 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 deliberately omitted the truth of the birth defects.

[13] P Kaatsch et al., Int J Cancer, "Leukaemia in young children living in the vicinity of German nuclear power plants," 2008 Feb 15;122(4):721-6. http://www.ncbi.nlm.nih.gov/pubmed/18067131

[14] Spix C, Schmiedel S., Kaatsch P, Schulze-Rath R, Blettner M., Eur J Cancer, "Case-control study on childhood cancer in the vicinity of nuclear power plants in Germany 1980-2003." 2008 Jan;44(2):275-84.Epub 2007 Dec 21. http://www.ncbi.nlm.nih.gov/pubmed/18082395

[15] Chris Busby, "Infant Leukaemia in Europe after Chernobyl and its Significance for Radioprotection; a Meta-Analysis of Three Countries Including New Data from the UK," Chapter 8 of *ECRR Chernobyl: 20 Years On – Health Effects of the Chernobyl Accident*, Editors C.C. Busby and A. V. Yablokov, 2006.

[16] NRC (Nuclear Regulatory Commission) 2010. NRC Asks National Academy of Sciences to Study Cancer Risk in Populations Living near Nuclear Power Facilities. NRC News No. 10-060, 7 April 2010. Washington, DC: NRC. The framework for the study was reported in "Analysis of Cancer Risks in Populations Near Nuclear Facilities; Phase I (2012). See cancer risk study at nap.edu.

[17] World Nuclear News, Zero day for US nuclear waste fee, May 16, 2014. https://www.world-nuclear-news.org/Articles/Zero-day-for-US-nuclear-waste-fee

[18] Allison Macfarlane and Rodney C. Ewing, *Scientific American*, "Nuclear Waste Is Piling Up. Does the U.S. Have a Plan?" March 6, 2023. https://www.scientificamerican.com/article/nuclear-waste-is-piling-up-does-the-u-s-have-a-plan/

A study of a variety of small modular reactors concluded that the spent fuel would exacerbate disposal problems and require far more space in a repository by factors of 2 to 30 compared to existing large reactors. [21] With existing and projected spent nuclear fuel from existing reactor, the U.S. already needs two deep geologic repositories the size designated for Yucca Mountain, but does not have even one repository. [22]

Other countries including the United Kingdom and France did reprocess their spent fuel, and reprocessed spent fuel from other countries. [23] The UK recently ended its reprocessing due to high cost. [24] In both France and the UK, reprocessing caused extensive but largely ignored radioactive airborne emissions and liquid releases to the ocean. [25] In the UK, France, and other countries that reprocess their spent fuel, they still need but do not have needed permanent repositories for their spent fuel or high-level waste from reprocessing. In addition, the hundreds of metric tons of separated plutonium is a liability to store or dispose of. [26]

In France, despite its reprocessing, their spent fuel pools are filling up with mixed-oxide (MOX) fuel that they don't reprocess and now requires about 30 years of pool cooling, rather

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[19] U.S. Nuclear Waste Technical Review Board (NWTRB), Management and Disposal of U.S. Department of Energy Spent Nuclear Fuel. Arlington, December 2017. The Nuclear Waste Policy Act remains the law; it limits the quantity of spent nuclear fuel from commercial nuclear power plants to 63,000 metric tons heavy metal (MTHM), 2,333 MTHM for DOE SNF and 4,667 MTHM for HLW. The quantity of commercial SNF, DOE SNF, and DOE-managed HWL are each greater than DOE's allotment for the first repository, which would have been Yucca Mountain, which was defunded in 2010. The Department of Energy promised to begin disposal of spent nuclear fuel by 1998.

[20] U.S. Nuclear Waste Technical Review Board, *Evaluation of the Technical Basis for Extended Dry Storage and Transportation of Used Nuclear Fuel*. Arlington, Virginia, 2010. pp. 14 and 125, (at www.nwtrb.gov) as cited in https://info.ornl.gov/sites/publications/files/Pub60236.pdf

[21] Lindsay M. Krall, Allison M. Macfarlane, and Rodney C. Ewing, *PNAS*, "Nuclear waste from small modular reactors," Received June 26, 2021, Published May 31, 2022, https://doi.org/10.1073/pnas.2111833119.

[22] United States Government Accountability Office, Report to Congressional Requesters, COMMERCIAL NUCLEAR WASTE – Resuming Licensing of the Yucca Mountain Repository Would Require Rebuilding Capacity at DOE and NRC, Among Other Key Steps, GAO-17-340, April 2017. https://www.gao.gov/assets/690/684327.pdf This 2017 GAO report stated that "nearly 80,000 metric tones of spent nuclear fuel are being stored at 75 reactor sites in 33 states. The Nuclear Waste Policy Act of 1982 limited the amount of SNF/HLW in the first repository to 70,000 metric tons heavy metal of which commercial SNF is limited to 63,000 MT and DOE waste is limited to 7 MT. Commercial nuclear power plants in the U.S. produce roughly 2,000 MT per year.

[23] Arjun Makhijani, Howard Hu, and Katherine Yih, Nuclear Wastelands – A Global Guide to Nuclear Weapons Production and Its Health and Environmental Effect, The MIT Press, ISBN 0-262-13307-5, 2000.

[24] Samanth Subramanian, *The Guardian*, "Dismantling Sellafield Epic Task," December 15, 2022. https://www.theguardian.com/environment/2022/dec/15/dismantling-sellafield-epic-task-shutting-down-decomissioned-nuclear-site

[25] Pete Roche et al., Greenpeace France, *The Global Crisis of Nuclear Waste – A Report Commissioned by GP France*, November 2018. "In addition to direct discharges of nuclear waste via pipelines, and atmospheric releases of radioactivity, reprocessing produces multiple other waste streams, the most hazardous of which are liquid high level wastes." Difficulties with designing permanent disposal facilities are also described.

[26] Frank N. von Hippel and Masafumi Takubo, International Panel on Fissile Materials (IPFM), *Banning Plutonium Separation*, 2022.

than the typical five years, prior to dry storage. [27] They are now facing an emergency in the need to build another refrigerated pool for storage of spent MOX fuel as they continue to struggle to obtain a disposal repository. [28] [29] The short-sightedness of the nuclear industry is not limited to the U.S. [30] [31]

An extensively reviewed study in Germany found elevated childhood cancers and leukemias near nuclear power plants. Following the 1986 Chernobyl nuclear disaster, a comprehensive study also found a spike in perinatal mortality (still-births plus early neonatal deaths) in several countries that received airborne radioactivity from Chernobyl. The amount of airborne radioactivity to cause this was far smaller than generally assumed. [32]

The front-end of the nuclear fuel cycle is the dirty mining, milling, conversion and uranium enrichment plants. The back-end is the storage, possible reprocessing, perhaps multiple repackaging of the spent fuel while waiting for a repository and the hope that the disposal of spent nuclear fuel and high-level waste will confine the waste. [33] [34] Throughout, accidents pose the risk of wide-spread radiological contamination. [35]

So far, no country has achieved any reasonable level of assurance that its proposed permanent repository will safely confine the waste. Future generations will be faced with the

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[27] Institut de Reioprotection et de Surete Nucleaire, IRSN, Assessment of dry storage possibilities for MOX or ERU spent fuels, IRSN Report No. 2019-00903, French Issue April 2019, English translation of 2019-00265 also issued April 2019.

[28] Benjamin Mallet, LA HAGUE, France (Reuters), Syndicated Content, wtaq.com, "France seeks strategy as nuclear waste site risks saturation points," February 2, 2023. https://wtaq.com/2023/02/02/france-seeks-strategy-as-nuclear-waste-site-risks-saturation-point/

[29] Reuters.com, "French nuclear waste agency applies for new storage site," January 17, 2023. https://www.reuters.com/business/energy/french-nuclear-waste-agency-applies-new-storage-site-2023-01-17/

[30] Department of Energy, Disposition of Surplus Plutonium, Appendix J, Evaluation of Select Reactor Accidents With Mixed Oxide Fuel Use at the Browns Ferry [Alabama, BWR] and Sequoyah [Tennessee, PWR] Nuclear Plants, 2015. This appendix gives a history of MOX fuel testing in the US up to 2015.

[31] *Friends of the Earth*, "Duke Energy Abandons Plutonium Fuel (MOX) Testing Program in South Carolina Reactor," circa 2008, https://foe.org/news/2009-11-duke-energy-abandons-plutonium-fuel-mox-testing-prog/ [accessed February 27, 2023]

[32] Alfred Korblein, "Studies of Pregnancy Outcome Following the Chernobyl Accident," from *ECRR Chernobyl: 20 Years On – Health Effects of the Chernobyl Accident*, Editors C.C. Busby and A. V. Yablokov, 2006.

[33] Blue Ribbon Commission on America's Nuclear Future for the U.S. Department of Energy, *Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy*, 2012. This report documents the extensive amount of radioactive waste created by spent nuclear fuel reprocessing, as well as inventories of spent nuclear fuel.

[34] Committee on Waste Disposal, National Research Council of the National Academies, *Disposal of Radioactive Waste*, 1957. The report stated that, "unlike the disposal of any other type of waste, the hazard related to radioactive waste is so great that no element of doubt should be allowed to exist regarding safety …Safe disposal means that the waste shall not come in contact with any living thing." The report recognized the danger of wide-spread radiological releases from above ground storage and hoped, without any research of the challenges, that deep geological disposal could isolate the waste.

[35] Anthony V. Nero, Jr., *A Guidebook to Nuclear Reactors*, University of California Press, ISBN 0-520-03482-1, 1979.

health harm of radiological releases and/or the cost of continual repackaging or disposal of the waste.[36] [37]

House Bill 96 seeks to label nuclear energy as "clean" energy because they care most about the nuclear industry's health. Anyone wanting to label nuclear energy as "clean" is severely misinformed or must not care about the health of babies, children, women or men, now and far into the future. [38] [39] [40]

Idaho National Laboratory releases inadequate draft Environmental Assessment on proposed Molten Chloride Reactor Experiment

The Idaho National Laboratory has released an inadequate draft Environmental Assessment on the proposed Molten Chloride Reactor Experiment (MCRE) in March and gave a scant two weeks for the public to comment.

The Department of Energy's draft Environmental Assessment (EA), DOE/EA-2209, is for a "relatively small, low-power density, low burn-up" 200-kilowatt thermal nuclear reactor experiment fueled with a molten uranium chloride salt.

[36] U.S. Nuclear Waste Technical Review Board, nwtrb.gov, *A Report to The U.S. Congress and The Secretary of Energy- Board Activities for the Period January 1, 2019-December 31, 2021*. November 2022. Among needs for a permanent geological disposal repository are adequate estimates of barrier degradation rates and an adequate understanding of the effects of criticality events. Note that while the U.S. Nuclear Regulatory Commission tends to define High-Level Waste as either spent nuclear fuel or the waste from reprocessing spent nuclear fuel, the Department of Energy tends use high-level waste as not spent nuclear fuel, but the waste from reprocessing spent nuclear fuel. Far more types and volumes of waste are created by the reprocessing of spent nuclear fuel (or weapons material or the separation of other irradiation targets).

[37] U.S. Nuclear Waste Technical Review Board, nwtrb.gov, *Designing a Process for Selecting a Site for a Deep-Mined, Geologic Repository for High-Level Radioactive Waste and Spent Nuclear Fuel: Detailed Analysis*, 2015. https://www.nwtrb.gov/docs/default-source/reports/siting_report_analysis.pdf?sfvrsn=9

[38] Rebecca Casper, *The Idaho Falls Post Register*, "Guest editorial, House Bill 96 expands from renewable energy to clean energy," March 8, 2023.

[39] Trust for America's Health, *Birth Defects Tracking and Prevention; Too Many States Are Not Making the Grade*, 2002. https://collections.nlm.nih.gov/catalog/nlm:nlmuid-101143813-pdf And it should come as no surprise that Idaho rates a grade "F" for tracking and prevention of birth defects because elevated rates of birth defects can be expected with increasing environmental radiological contamination.

[40] Elevated rates of thyroid cancer incidence are common to every county surrounding the INL compared to the rest of the state and the country. See the July 2020 Environmental Defense Institute newsletter for more information about the elevated rates of thyroid cancer in the countries surrounding the Idaho National Laboratory. "Counties near the INL have double the thyroid cancer incidence while other counties in Idaho did not approach these high thyroid cancer incidence rates. The counties near the INL listed in the table [in the newsletter for 2017] are Butte, Bonneville, Madison, Jefferson, Bingham and Fremont counties, which ranged from 42.8 per 100,000 for Butte to 27.9 per 100,000 for Fremont. These cancer incidence rates are double, or more, the US and the Idaho state average for incidence of thyroid cancer which are 15.7 per 100,000 and 14.2 per 100,000." Bonneville country's thyroid cancer incidence rate in 2017 was 30.9 per 100,000.

A 1000-megawatt electric generating station, depending on plant efficiency would be over 3000 megawatts thermal power. Indeed, the experiment, if connected to a generator might power about 600 100-watt light bulbs.

The project does not disclose the planned nuclear fuel burnup or a full listing of radionuclides that will become radioactive waste needing disposal. Without this information, the radionuclides and curie amounts of each, its proper waste disposal cannot be assessed. The draft EA is withholding information.

The chloride waste and its radioactive contents will likely end up staying in Idaho. I suspect that the plan is to bury the waste at the US Ecology Grand View hazardous waste dump. The Grand View dump is not even a low-level radioactive waste dump, yet it accepts even "special nuclear material" including plutonium, with open arms. The US Ecology waste dump had a spectacular explosion in 2018 and the reasons for the explosion and the waste involved have never been disclosed. The US Ecology Grand View site is accepting radioactive waste from around the country and from around the world.

The Department of Energy's draft EA admits that it has yet to complete a seismic analysis for the INL facility it will be located in, an aging facility that had to have its leaking roof repaired.

The DOE's foot-dragging on completing seismic analyses for its nuclear facilities is a long-standing problem. And that the DOE would publish this draft EA without completing the seismic analysis for the proposed building is signaling that the analysis will not yield an adequately safe result.

The draft EA tries to portray the INL as not very seismically active. If so, it should be a simple matter to provide a high level of seismic robustness and the analyses upon which to base such a conclusion. The fact is that providing the level of seismic design adequacy at the INL is not easy because of rather large seismic forces at relatively high likelihood. The DOE must provide a completed seismic analysis. This draft EA does not actually commit to providing adequate seismic safety. Importantly, it also does not recognize the safety problem at a facility with multiple nuclear facilities with regard to the difficulty of responding to a seismic event that may affect multiple facilities.

In an emergency, the small MCRE experiment may, in fact, divert scant and precious resources needed to protect other nuclear hazards at the Materials and Fuels Complex from a fire and/or seismic event. The draft EA is yet another example of inadequate safety analysis and hazard mitigation at Department of Energy facilities.

The MCRE project will also use glove boxes and take scant resources away from other DOE projects. The DOE's National Nuclear Security Administration (NNSA) gave the excuse for accepting extraordinarily high offsite radiological doses (and permanent contamination) around the Los Alamos National Laboratory (LANL) because they found it difficult to procure or to upgrade their gloveboxes. Gloveboxes toppled from a seismic event may result in a large release

of radionuclides at LANL, but obtaining seismically capable glove boxes was deemed just too difficult and protecting the public just wasn't that important.

The EA fails to acknowledge the decades of repeated inadequate emergency preparation at the Idaho National Laboratory for site emergencies in terms of training, decontamination, radiological medical treatment, and inadequate emergency radiological monitoring during and after the emergency.

Worker radiation doses are said to be low, yet the fuel they plan to use is high in uranium-234 and uranium-236 (and uranium-232). This may mean significant amounts of penetrating gamma radiation from bismuth-214 and thallium-208, for preparing the unirradiated fuel. Furthermore, DOE's radiological monitoring is inadequate for these "natural" uranium and thorium decay chains.

The radioactive waste is stated to become the responsibility of the Department of Energy. As the record at the Idaho National Laboratory and other DOE sites has long shown, this is no assurance whatsoever that the waste will be timely and properly dealt with.

Butte County, Idaho is suing DOE over storage of Three Mile Island Unit 2 spent fuel at INL

Butte County, Idaho, has filed a lawsuit over the storage of Three Mile Island Unit 2 spent fuel. The nuclear fuel debris resulted from the nuclear meltdown in 1979 at the Three Mile Island nuclear plant in Pennsylvania. [41]

The Department of Energy initially brought fuel debris samples to the INL for examination, but later agreed to remove the problem from Pennsylvania and store the fuel debris from the accident, as much as could be removed from the core, and keep it in Idaho.

Early estimates of the amount of fuel damaged in the March 28, 1979 accident tended to be overly optimistic. But at least 45 percent of the TMI-2 core melted. The fuel relocated, some of it to the bottom of the reactor vessel.

The lawsuit finds the de facto permanent disposal in Butte County to have detrimental effects. And importantly, that the Department of Energy had the authority to make payments to local communities where special burdens have been placed.

The TMI-2 dry fuel debris storage at the INL is unlike other spent nuclear fuel storage. It is not welded closed and it leaks radionuclides to the Idaho skies. One of the radionuclides that was held up in the debris is iodine-129, with a 16-million-year half-life.

[41] Jeff Robinson, *The Idaho Falls Post Register*, "Butte County sues DOE over nuclear waste storage issues," March 8, 2023.

The annual estimated airborne release of radionuclides from the Three Mile Island Unit 2 core debris stored at the Idaho National Laboratory are significant, especially the release of iodine-129. [42]

The airborne releases from many operations at the Idaho National Laboratory vary each year. The estimated releases are reported in annual environmental monitoring reports by the Department of Energy's environmental monitoring contractor and some reports can be found at idahoeser.com.

The horizontal storage modules (HSMs) provide a structure to protect the canisters containing the TMI-2 spent fuel debris. The first dry shielded canister containing Unit 2 core debris was moved to the Idaho facility in March 1999. Three Mile Island Unit 2 core debris canisters for Independent Spent Fuel Installation were loaded and placed at the Idaho National Laboratory between 1999 to 2001.

The estimated airborne releases from the Three Mile Island Unit 2 fuel debris stored in unseals canisters at the INL's CPP-1774 are shown in Table 1 and are compared to the total INL releases for 1997 and 2005.

The TMI-2 fuel debris is not sealed due to potential hydrogen off-gassing but the airborne release of radionuclides is not related to the extensive concrete degradation that began shortly after the fuel debris storage was constructed.

By 2000, concrete cracks were reported in the spent nuclear fuel storage system that consists of rectangular reinforced concrete vaults with the fuel debris storage canister resting horizontally on internal rails inside the NUHOMS-12T horizontal storage modules. [43] [44]

In 2000, the licensee concluded that the cracks in the concrete were cosmetic and insignificant. However, in 2007, the licensee observed continued cracking, crazing and spalling as well as increased efflorescence on the HSM surfaces. The licensee performed an evaluation in 2007, during which it determined that the HSMs were capable of performing their design basis functions.

But in 2008, the licensee noted that 28 of the 30 HSMs had cracks, mostly emanating from the anchor bolt blockout holes with widths up to 0.95 centimeters (0.38 inches). At that time, the licensee determined that the HSMs appeared to be prematurely deteriorating and that continued crack growth could impact the ability of the HSMs to fulfill their originally planned 50-year design service life.

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[42] G. G. Hall, CHP, Idaho National Laboratory, Annual Radiological Environmental Monitoring Program Report for the Three Mile Island, Unit 2 Independent Spent Fuel Storage Installation, February 2012. ML12066A171. Table 4, based on the 1998 TMI Environmental Impact Statement.

[43] NRC Information Notice 2013-07: Premature Degradation of Spent Fuel Storage Cask Structures and Components from Environmental Moisture, April 16, 2013, at NRC.gov Adams ML12320A697. Three Mile Island, Unit 2 ISFSI at the Idaho National Laboratory Site.

[44] Additional information is available in "Three Mile Island, Unit 2, ISFSI—NRC Inspection of the Independent Spent Fuel Storage Installation—Inspection Report 07200020/2012-001," dated August 14, 2012 (ADAMS Accession No. ML12228A457).

Subsequent evaluations were initiated and repairs were made to address the concrete degradation. These examples show that concrete degradation can occur rapidly and that aging issues are important for dry spend nuclear fuel storage.

Table. 1. Three Mile Island Unit 2 (TMI-2) ISFSI Estimated Airborne Radioactive Material Releases (Ci/y).

Radionuclide	TMI-2 canister releases, curies each year	Total 1997 INL airborne releases (before TMI canisters)	Total 2005 INL airborne releases, (includes TMI-2 canisters)
Am-241	4.1E-5	unspecified	2.12E-3
Co-60	7.1E-5	unspecified	6.35E-2
Cs-134	2.8E-7	unspecified	5.37E-4
Cs-137	**1.5E-2**	7.1E-3	1.95E-1
Eu-154	4.4E-5	unspecified	2.21E-1
Eu-155	1.5E-5	unspecified	2.20E-2
H-3	**200**	426	802
I-129	**3.0E-2 (High contributor to radiation dose)**	5.8E-2	5.97E-2
Kr-85	**1,400**	3,579	5,190
Ni-63	1.4E-4	unspecified	1.31E-3
Pm-147	2.3E-5	unspecified	1.04E-3
Pu-238	**7.4E-5**	5.1E-6	5.55E-4
Pu-239	**3.2E-4**	1.6E-6	2.68E-3
Pu-240	1.6E-4	unspecified	5.94E-6
Pu-241	6.1E-3	unspecified	1.51E-2
Sb-125	2.1E-6	2.7E-5	6.04E-3
Sm-151	**2.4E-4**	unspecified	4.51E-4
Sr-90	**1.2E-2**	7.0E-4	1.66E-1

Table notes: Shown in bold, the curie release estimate for TMI-2 dry storage canisters at the INL are roughly double, or more, of the total estimated INL release in 1997. Source: G. G. Hall, CHP, Idaho National Laboratory, Annual Radiological Environmental Monitoring Program Report for the Three Mile Island, Unit 2 Independent Spent Fuel Storage Installation, February 2012. ML12066A171. Table 4, based on the 1998 TMI Environmental Impact Statement.

Articles by Tami Thatcher for April 2023.