Environmental Defense Institute

News on Environmental Health and Safety Issues

September 2023 **Volume 34** **Number 9**

Top Twenty Questions Government Officials Must Answer Regarding Expansion of Nuclear Energy

Government officials and other decision-makers need to answer why they are supporting nuclear energy expansion. I put together twenty questions that every state and government official who supports expansion of nuclear power needs to answer. The top twenty questions are as follows:

1. Will building new nuclear power plants, large or small, help address climate change?
2. How many new nuclear power plants would be needed to make a difference for climate change?
3. Is the cost of nuclear power plant construction affordable?
4. Who pays for the construction cost overruns for new nuclear reactors?
5. What are the additional inevitable costs of nuclear power plants such as decommissioning, long-term storage and management of spent fuel and disposal or reprocessing of spent fuel?
6. Are nuclear power plants needed for 24/7 baseload, or art there other, more affordable and rapidly deployable solutions?
7. Does nuclear energy have a small footprint, as nuclear promoters claim?
8. How long does the spent nuclear fuel need to be isolated from the biosphere?
9. Who pays for storage of spent nuclear fuel?
10. Does the US have a spent fuel repository?
11. Is spent fuel reprocessing the answer to the spent fuel disposal problem?
12. Why do states with stranded spent fuel want it out of their state?
13. Are so-called “interim” consolidated storage sites the solution for spent fuel?
14. Are there health risks from routine nuclear reactor operations?
15. Is the push to reduce regulatory oversight a sound idea?
16. What is “high burnup fuel” and does it complicate spent fuel storage and disposal?
17. How bad is a nuclear accident? How often do major accidents occur?
18. Who pays if people must permanently evacuate their home due to a nuclear accident?

19. Are small modular reactors less expensive than large reactors?
20. Is a "small" sodium-cooled fast reactor like Bill Gates' proposed *Natrium* going to "burn the waste"?

Most meetings and presentations to state and federal decision-makers avoid discussing many of the realities of expanding nuclear energy. I have provided information about the answers to these questions in a mid-August special newsletter at the Environmental Defense Institute website. [1]

A final note, nuclear promoters are busy protecting the nuclear industry from liability and a recent article by Victor Gilinsky in Bulletin of the Atomic Scientists highlights why citizens should be concerned. [2] See the 2021 report by the U.S. Nuclear Regulatory Commission discussing the Price-Anderson Act [3] and the 2023 report by the Department of Energy. [4] Citizens cannot count on adequate compensation following a nuclear accident for a variety of reasons including evidence of harm will likely be limited to the radiation monitoring conducted by those at fault for the accident.

Department of Energy unveils its growing 'consortia' and the push to find a community willing to accept consolidated interim storage during U.S. Nuclear Waste Technical Review Board summer meeting in Idaho Falls

Two days of presentations were given to the U.S. Nuclear Waste Technical Review Board. Congress created the U.S. Nuclear Technical Waste Review Board in the 1987 Nuclear Waste Policy Amendments Act (NWPA Act) to evaluate the technical and scientific validity of activities undertaken by the Secretary of Energy to manage and dispose of the nation's spent nuclear fuel and high-level radioactive waste.

Currently, the Department of Energy is not attempting to site a geologic repository but is seeking to figure out the messaging and the incentives to get a community to sign up to allow a consolidated interim spent fuel storage facility. The DOE emphasized that it will use a flexible, adaptive, but not yet defined approach to entice a community to sign up for consolidated interim storage. **The DOE stated that it would use carefully filtered messaging in order to persuade the community's leaders.**

---

[1] Environmental Defense Institute, Special addition to the August 2023 newsletter on August 8, 2023 (with subsequent updates), "Top Twenty Questions About Expanding Nuclear Energy," August 8, 2023 at http://www.environmental-defense-institute.org/publications/News.23.AugustTwenty.pdf

[2] Victor Gilinsky, *Bulletin of the Atomic Scientists*, "Senate extends nuclear liability-limiting law without public scrutiny. Here's why we should care," August 22, 2023. https://thebulletin.org/2023/08/senate-extends-nuclear-liability-limiting-law-without-public-scrutiny-heres-why-we-should-care/

[3] H. Arceneaux et al., U.S. Nuclear Regulatory Commission, *The Price-Anderson Act: 2021 Report to Congress – Public Liability Insurance and Indemnity Requirements for an Evolving Commercial Nuclear Industry*, NUREG/CR-7293, December 2021.

[4] U.S. Department of Energy, *The Price-Anderson Act Report to Congress*, January 2023.

On both August 29 and August 30, the DOE emphasized its outreach to states and tribes and its intention to have special consortia seeking to identify people and possible incentives that would be effective in gaining approval by a community to have consolidated interim storage of spent nuclear fuel. The DOE stated that consortia members will have ready access to DOE experts, special computerized tools and access to "unfiltered" information. **The non-tribal communities and tribes, it was stated, would not have access to DOE experts, special tools, or to "unfiltered" information.** The messaging and story-telling to attain siting that was most effective would be studied and applied by DOE.

With regard to transparency, the DOE also stated that the public would not be given or allowed access to information about its information gathering and discussions with consortia. The operation to convince and provide "incentives" to persuade a community into accepting a consolidated interim storage facility will be conducted in secrecy.

There remain significant gaps in the understanding of the performance characteristics in high burnup fuels now being used in U.S. commercial nuclear reactors, despite the high burnup fuels being approved by the U.S. Nuclear Regulatory Commission. These gaps mean that there is inadequate basis for concluding that spent fuel can be safely stored, transported and disposed of.

There are many variables that influence fuel cladding integrity: cladding composition and manufacturing processes, average and peak burnup while used in a reactor, primary coolant water chemistry, length of time stored in a pool, the drying process used for dry storage packaging and others. But the belated investigations of cladding are limited and may not address all cladding types, operating conditions, fuel burnups, and so on. The means that considerable uncertainty remains regarding fuel cladding performance during storage and transportation and is likely to remain even after additional but not exhaustive investigations have been conducted.

A presentation on August 30 concerning spent fuel performance during dry storage was very brief but did identify worse than unexpected performance of spent fuel cladding. Larger than expected reductions of cladding yield and ultimate strengths were found after heat treatment. The reduced material strengths can facilitate creep and may have significant implications for spent fuel performance during storage, transportation and disposal. **Reduced cladding yield and ultimate strengths may have significant implications for licensing (and relicensing) of current and future systems.**

This work is tardy, incomplete and also being conducted in ways that are prone to not produce reliable results for the wide variety of fuel burnups and conditions the fuel is exposed to. The implications of unresolved problems with continued storage of spent fuel, and especially the higher burnup fuels, in terms of accident risks and costs were not discussed. The thin-walled canisters prevalently in use are welded closed and cannot be opened to inspect the fuel. There is a wide variety of spent fuel cladding types and variable conditions that the fuel can be subjected to that may compromise its condition. **Furthermore, while the fuel can be inspected while in a storage pool, there is currently no way to inspect spent fuel stored in canisters prior to transportation.**

A presentation was also provided by the DOE on enormity of the needed investigations to evaluate the safety of spent fuel storage, transportation and disposal for the wide variety of advanced reactors being proposed. The presentation addressed the "Back-End Management of Advanced Reactors (BEMAR)." The DOE believes it must continue to accept any and all new fuel designs but it all depends on murky and inexplicable DOE's General Council for creating contracts with nuclear reactor developers.

The DOE acknowledged that it had insufficient information to assess the behavior of these proposed new or advanced reactor spent nuclear fuels. The DOE is apparently compelled to accept any and all possible new fuel designs and will not put in place research to understand the fuel characteristics needed to know the safety during storage, transportation or disposal. The DOE does not plan to commence any study of the spent fuel characteristics until the reactors are up and running and are more advanced than initial prototype reactors. The plan is to study, only belatedly, after these spent fuels are generated, the safety of the advanced fuels storage, transportation and disposal characteristics.

The nonsensical path DOE is on for "no advanced reactor left behind," no matter what it costs in terms of dollars and in safety, also did not have adequate coverage during the meeting. And despite DOE's excuses that they didn't have adequate information to know how the new small modular reactors and advanced reactors would impact obtaining deep geological disposal for the waste, other researchers have estimated that these new fuels will take up far more space in a repository, on an energy produced basis.

The nuclear waste from the variety of small modular reactors (water-, molten-salt-, and sodium-cooled SMR designs) has been evaluated and can be expected to "increase the volume of nuclear waste in need of management and disposal by factors of 2 to 30" for each megawatt produced. [5] The DOE is actively promoting reactor designs with no consideration of how this greatly increases the nation's spent nuclear fuel storage and disposal problems.

The often-repeated statements that the nuclear industry is still studying canister aging issues and the consequences of thin-walled welded canister breach or the cladding integrity issues will be of no comfort when a community is forever contaminated and lives are shortened by the breach of even just one spent fuel canister.

No government agency and certainly not the Department of Energy or the Nuclear Regulatory Commission is disclosing serious taxpayer liability issues with the existing nuclear industry or expansion of nuclear energy.

The DOE needs to explain why it continues promoting creating more and more spent nuclear fuel when it has no permanent solution for the spent fuel, for reprocessing waste, and these reactors cannot possibly be deployed in time to combat climate change. Some NWTRB board members seem to be comfortable assuming the nuclear energy is required to solve climate

[5] 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.

change and this is allowed to go unchallenged, unfortunately. Nuclear energy cannot be deployed in time to combat climate change; but making more spent fuel digs the U.S. into a deeper and more expensive problem that it is making no progress solving.

My public comment submittal concerning the issues at the NWTRB meeting is available on the Environmental Defense Institute website. [6]

Court Rules NRC License of Proposed Consolidated Interim Storage in Texas Vacated

In 2021, the U.S. Nuclear Regulatory Commission issued a license for privately owned away-from-reactor consolidated interim storage facilities in Texas. The NRC also issued a license for a similar facility in New Mexico. Subsequently, both states have now passed legislation opposing these facilities.

Now, in August, a court of appeals ruled that the NRC license for the Texas consolidated interim storage facility be vacated because the NRC did not have the authority to authorize the private away-from-reactor facility. [7]

"The Nuclear Waste Policy Act creates a comprehensive statutory scheme for addressing spent nuclear fuel accumulation," the court said. "The scheme prioritizes construction of the permanent repository and limits temporary storage to private at-the-reactor storage or at federal sites. It plainly contemplates that, until there's a permanent repository, spent nuclear fuel is to be stored onsite at-the-reactor or in a federal facility.

"In sum, the Atomic Energy Act doesn't authorize the Commission to license a private, away-from-reactor storage facility for spent nuclear fuel. And the Nuclear Waste Policy Act doesn't permit it. Accordingly, we hold that the Commission doesn't have authority to issue the license challenged here."

New Mexico has a similar case pending in the US Court of Appeals for the 10th Circuit in regard to the proposed Holtec consolidated interim storage facility.

The U.S. Nuclear Waste Technical Review Board (NWTRB) held a summer meeting August 29 and 30, 2023. None of these recent experiences in siting a consolidated interim spent fuel

[6] Environmental Defense Institute, Public Comment Submittal on the U.S. Nuclear Waste Technical Review Board (NWTRB) meeting held in Idaho Falls, Idaho on August 29 and 30, 2023, by Tami Thatcher at http://www.environmental-defense-institute.org/publications/CommentAugust2023NWTRBrev1.pdf

[7] United States Court of Appeals for the Fifth Circuit, State of Texas; Greg Abbott, Governor of the State of Texas; Texas Commission on Environmental Quality; Fasken Land and Minerals, Limited; Permian Basin Land and Royalty Owners, versus Nuclear Regulatory Commission; United States of America, No. 21-60743. Filed August 25, 2023. The court found that the Atomic Energy Act did not delegate authority to the U.S. Nuclear Regulatory Commission to license a private, away-from-reactor storage facility for spent nuclear fuel. And the Nuclear Waste Policy Act doesn't permit the NRC to authorize an away-from-reactor spent fuel storage facility. The court found that the NRC does not have authority to issue the license to the Texas consolidated spent fuel facility. The court vacated the NRC's license of the proposed Texas consolidated interim storage facility.

storage facility was discussed at the August meeting regarding state opposition to private consolidated interim storage in New Mexico and Texas.

There is a strong desire to remove spent fuel from communities around the country, some at reactor sites that still operate reactors and others that are called stranded fuel sites where the reactors have been decommissioned. While the NRC asserts all of these spent fuel dry storage facilities are safe, some of the dry storage such as on the Pacific Ocean coastline are vulnerable.

Moving the spent fuel to New Mexico or Texas is appealing to communities now stuck with spent nuclear fuel. The design and the safety of the existing spent fuel dry storage facilities is generally the same as proposed for New Mexico and Texas. So, the problem is merely shifted from one place to another.

The needed steps to address repackaging of aging spent fuel canisters are not being taken. And the first logical step, to stop making more nuclear waste, is being actively avoided by the nuclear promotors.

Holtec Alleged to Have Sought to Misrepresent Proposed Consolidated Spent Fuel Facility Financial Peril

Former chief financial officer for Holtec International has said in a court filing that Holtec CEO Krishna Singh and others attempted to misrepresent the profitability of the consolidated interim storage facility proposed for spent nuclear fuel storage in New Mexico. [8]

When the financial officer refused to provide untruthful and unlawful financial projections in a draft prospectus to be used to entice potential investors, he was fired.

The proposed consolidated spent fuel facility would leave thousands of metric tons of spent fuel stranded in New Mexico because there is no spent fuel disposal facility for the spent fuel. Even if there were a disposal facility, the proposed Holtec facility does not include any way of repackaging the spent fuel or repairing a compromised fuel canister.

The proposed Holtec consolidated spent fuel facility is currently is in a legal and permitting limbo, and Holtec sought to avoid admitting that the project was a money loser and was projected to lose $150 million each year of the first five years in operation.

Department of Energy Deletes 2024 WIPP Closure Date and Refuses to Admit Surplus Plutonium Disposition Impacts

Don Hancock of Southwest Research and Information Center submitted his statement on the Department of Energy's defense waste facility, the Waste Isolation Pilot Plant in New

[8] Abigail Sawyer, California Energy Markets, "Holtec Whistleblower Says NM CISF Was Among Misrepresentations in Prospectus," July 21, 2023. https://www.newsdata.com/california_energy_markets/southwest/holtec-whistleblower-says-nm-cisf-was-among-misrepresentations-in-prospectus/article_b6230b78-27f4-11ee-8872-0fa130eaf432.html

Mexico. [9] The Department of Energy continues to renege on its promise to close the Waste Isolation Pilot Plant by 2024. It also refuses to act on recommendations by a 2020 National Academy of Sciences study. [10] The Department of Energy continues expanding the amount of waste to be sent to WIPP, expanding the facility beyond what was agreed to, and plans to dispose surplus weapons plutonium that is significantly different than had been agreed to.

The WIPP facility is already overcommitted and yet WIPP is often implied as a possible disposal site for commercial spent nuclear fuel, which it is not capable of accepting.

Three Mile Island, Study Finds Radiation Caused Elevated Thyroid Cancers in Population Exposed to TMI

This is Part 5 of a series about the 1979 Three Mile Island Accident. See the earlier Parts in the May, June, July and August 2023 Environmental Defense Institute newsletters.

In the July and August TMI newsletter articles, I reviewed epidemiology studies conducted in populations living near the 1979 accident. This month, I review some studies that have found radiation-induced cases of thyroid cancers in the populations living near the 1979 Three Mile Island Accident.

To recap, unbeknownst to the nuclear plant operators, about half of the Three Mile Island Unit II reactor core melted about two hours after a reactor trip occurred due to interruption of normal condensate supply to the steam generators. Airborne radioactive emissions were released from multiple areas of the plant. The accident involved numerous plant design problems, operator training deficits, and multiple failures of the U.S. Nuclear Regulatory Commission to heed reports of safety problems even when identified by an NRC inspector.

It is estimated that about 70 percent of the airborne release occurred within the first 30 hours of core melt. The call for evacuation of pregnant women and children did not occur until two days after the accident began. The release of airborne radionuclides was inadequately monitored and estimates of the radiological release are speculative. Environmental monitoring was conducted but inadequate. Assertions that the radiological releases were low and yielded less than 100 millirem radiation dose to the public from external gamma radiation was based on wishful thinking, if not outright lies. Inhaled beta radiation dose was ignored.

Some of the epidemiology for Three Mile Island found elevated cancer rates (of many types of cancer), yet it was asserted that because estimates of the radiation doses were low, the elevated number of cancers could not have been caused by the TMI accident. The epidemiologists guessed that the elevated cancers might have been due to the stress of the

[9] Don Hancock, Southwest Research And Information Center, *Stop "Forever WIPP" - Statement before the New Mexico Radioactive and Hazardous Materials Committee*, July 14, 2021. [RHC 071421]

[10] National Academy of Sciences, April 30, 2020. https://www.nap.edu/catalog/25593/review-of-the-department-of-energys-plans-for-disposal-of-surplus-plutonium-in-the-waste-isolation-pilot-plan

accident. The highly speculative radiation doses were treated as though based on sound radiological monitoring, which it was not.

A study published in 2013 found an increased incidence of thyroid cancer in counties south of TMI. The average incidence rates from 1990 through 2009 were greater than expected in York, Lancaster, Adams, and Chester Counties, compared to local and national data. The increased thyroid cancer may be due to chronic low level radiation exposure. [11]

A method exists now for examining thyroid cancer tissue and determining whether the cancer was radiation-induced. An elevated percentage of radiation-caused thyroid cancers has been found in people with thyroid cancer who were exposed to the 1979 accident. The molecular signatures of radiation-induced thyroid cancers show a lower incidence of single nucleotide oncogenic driver mutations and a higher incidence of gene fusions. [12] [13]

Thyroid tumors were examined for two groups, the at-risk group exposed to the TMI accident and who developed cancer between 1984 to 1996, and the control group. The at-risk group differed in the radiation-induced molecular markers from the control group. While an individual tumor cannot determine whether the tumor is radiation-induced, the statistical difference between the two groups indicates the TMI accident altered the molecular profile of thyroid cancers in the population surrounding the plant. [14]

Also, for the years reviewed from 1985 to 2008, the TMI population showed a higher incidence of thyroid cancer as compared to the rest of the state, according to a 2012 study. [15] "Since 1975 [through 2009], the incidence of thyroid cancer has now nearly tripled, from 4.9 to 14.3 per 100,000 individuals …. Virtually the entire increase was attributable to papillary thyroid cancer….The mortality rate from thyroid cancer was stable between 1975 and 2009 (approximately 0.5 deaths per 100,000.)" [16]

In southeast Idaho and elsewhere in the US, the thyroid cancer rates had been rising since 2006, about 3 percent annually. The counties in southeast Idaho also received weapons testing fallout from the Nevada Test Site. I compared the estimated NTS fallout doses for several

---

[11] Roger J. Levin et al., *The American Laryngological, Rhinological, and Otological Society, Inc.*, "Incidence of thyroid cancer surrounding Three Mile Island nuclear facility: the 30-year follow-up," August 2013. https://pubmed.ncbi.nlm.nih.gov/23371046/

[12] David Goldenberg et al., "Altered molecular profile in thyroid cancers from patients affected by the Three Mile Island nuclear accident," May 2017. https://pubmed.ncbi.nlm.nih.gov/28555940/

[13] David Goldenberg MD, *Cancer*, "We cannot ignore the real component of the rise in thyroid cancer incidence," July 2019. https://acsjournals.onlinelibrary.wiley.com/doi/10.1002/cncr.32123

[14] Matt Solovey, *Penn State*, "Possible correlation shown between TMI nuclear accident and thyroid cancers," May 31, 2017. https://www.psu.edu/news/research/story/possible-correlation-shown-between-tmi-nuclear-accident-and-thyroid-cancers/

[15] Neerav Goyal MD et al., The Largyngoscope, "Thyroid cancer characteristics in the population surrounding Three Mile Island," March 2012. https://onlinelibrary.wiley.com/doi/full/10.1002/lary.23314

[16] Louise Davies, MD, MS; H. Gilbert Welch, MD, MPH, JAMA Otolargyngol Head Neck Surg., "Current Thyroid Cancer Trends in the United States," April 2014. https://jamanetwork.com/journals/jamaotolaryngology/fullarticle/1833060

counties and the 2013 to 2017 thyroid cancer incidence rates for the counties, but the NTS fallout does not correspond to the elevated thyroid cancers in various counties.

In Idaho, in the counties surrounding the Idaho National Laboratory, there is double the incidence of thyroid cancer compared to the State and the U.S. reported for 2013 through 2017.

Counties of Butte, Bonneville, Madison, Jefferson, Bingham and Fremont had thyroid cancer incidence rates that ranged from 42.8 per 100,000 for Butte to 27.9 per 100,000 for Fremont. These cancer rates are double, or more, the US and the Idaho state average rates, with are 15.7 per 100,000 for the US and 14.2 per 100,000 for Idaho. [17] [18]

Fallout from the Nevada Test Site does not appear to be the cause. Bingham County, for example, received less NTS fallout than Bannock or Bonneville County. Bingham county and Bonneville County are closer to the Idaho National Laboratory, and both counties have higher incidence rates for thyroid cancer than Bannock County, which is farther from the INL.

Bonneville County had 30.9 per 100,000, Bingham County has 28.6 per 100,000, Butte has 42.8 per 100,000, but Bannock County has only 11.1 per 100,000, for incidence of thyroid cancer (for 2013 through 2017).

A doubling of the cancer rate is unusual and is significant. The draft Versatile Test Reactor Environmental Impact Statement included the cancer rates for some cancers in selected counties near the Idaho National Laboratory, near the Savannah River Site and near Oak Ridge. These Department of Energy sites have long histories of radiological releases. **No counties near Savannah River or Oak Ridge had a doubling of expected thyroid cancer rates.** But DOE's own draft EIS showed four counties having double the expected rate for thyroid cancer near the INL. If small population counties are included, even more counties have double the thyroid cancer rate. The Department of Energy is silent on the obviously elevated thyroid cancer rate near the INL.

The radiological releases from the INL are described in annual environmental reports that estimate the releases. The EPA airborne radiation limits allow 10 millirem to be generously given to every man, woman, and child – all based on whole-body estimated radiation doses. The calculated estimates of the radiation dose from inhalation, "shine" etc. are very small and typically below 1 millirem whole-body. The radiation doses are for "whole-body" doses and are not given for organ dose. Few people recognize that very small whole-body radiation doses can involve significant radiation doses to the thyroid.

---

[17] C. J. Johnson, B. M. Morawski, R. K., Rycroft, Cancer Data Registry of Idaho (CDRI), Boise Idaho, Annual Report of the Cancer Data Registry of Idaho, *Cancer in Idaho – 2017*, December 2019. [Cancer incidence is from 2013 to 2017.] https://www.idcancer.org/ContentFiles/AnnualReports/Cancer%20in%20Idaho%202017.pdf

[18] Environmental Defense Institute July 2020 newsletter article "Understanding the Thyroid Doses in Idaho from Past Nuclear Weapons Testing," at http://www.environmental-defense-institute.org/publications/News.20.July.pdf (For thyroid articles, see also April 2020 and FebMar 2020 newsletters.

Thyroid cancer can be treated and is less likely to result in death than many other cancers. But thyroid impairment of the unborn can also be occurring and causing health problems other than cancer. Southeast Idaho is a canary in the mine shaft, but the warning is being ignored.

Articles by Tami Thatcher for September 2023. (Minor editing corrections made 9/8/2023.)