

## **Public Comment Submittal from Tami Thatcher to the U.S. Environmental Protection Agency, Planned Change Request for WIPP Replacement Panels 11 and 12, Docket EPA-HQ-OAR-2024-0309**

Comment submittal due by September 16, 2024 at [www.regulations.gov/commenton/EPA-HQ-OAR-2024-0309-0001](http://www.regulations.gov/commenton/EPA-HQ-OAR-2024-0309-0001) or <https://www.regulations.gov/docket/EPA-HQ-OAR-2024-0309>

### **Background**

The Waste Isolation Pilot Plant (WIPP) in New Mexico was to remain open designated to dispose of dangerous legacy waste resulting from past nuclear weapons production only until 2033. Now the Department of Energy wants to increase the size of the repository, dispose of far more concentrated and dangerous waste, dispose of far more curies of long-lived waste, and keep WIPP open decades longer.

Citizens in New Mexico and various groups in New Mexico <sup>1 2</sup> are asking that the EPA conduct a formal Rulemaking on the Planned Change Request and take safety in New Mexico seriously.

The Department of Energy long claimed that the largest category by volume of transuranic waste destined for WIPP consisted of scrap materials, cleaning agents, tools, piping, filters, plexiglass, gloveboxes, concrete rubble, asphalt, cinder blocks, and other building materials. And the typical description of TRU wastes sent to WIPP was that the waste consisted of clothing, tools, rags, residues, debris, soil and other items contaminated with plutonium. <sup>3</sup>

The transuranic waste sent to WIPP was often laden with hazardous chemicals and toxic sludges, containing unknown amounts of americium, plutonium and other radionuclides.

The new wastes to be sent to WIPP will be more challenging to the WIPP repository than ever before. The Department of Energy is now seeking to dispose of vast quantities of surplus plutonium at WIPP and also to dispose of newly generated transuranic waste from ongoing nuclear weapons production, all while legacy waste remains unsafely stored at DOE sites around the country.

**There are regulations regarding the WIPP repository but even without disposal of surplus plutonium at WIPP, the Environmental Protection Agencies regulations for WIPP are inadequate, unsafe and unlike any regulations used anywhere in the world.**

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<sup>1</sup>See Stop Forever WIPP Coalition at <https://stopforeverwipp.org/home> and others including Southwest Research and Information Center, Conservation Voters New Mexico, Nuclear Watch New Mexico, Veterans for Peace, Citizens for Alternatives to Radioactive Dumping (CARD), and Concerned Citizens for Nuclear Safety (CCNS).

<sup>2</sup> Letter to Lee Ann B. Veal, Environmental Protection Agency, on behalf of numerous New Mexico organizations, explaining why EPA needs to conduct a formal rulemaking, June 24, 2024. See Stop Forever WIPP Coalition at <https://stopforeverwipp.org/home>

<sup>3</sup> National Academies of Science, Engineering and Medicine, *Review of DOE's Plans for Disposal of Surplus Plutonium in the Waste Isolation Pilot Plant*, Washington, DC, 2020: The National Academies Press. <https://doi.org/10.17226/25593>

## **Inadequate EPA Regulations for WIPP**

The EPA regulations apply an inadequate 10,000-year time frame not just to WIPP but for all radioactive waste disposal sites in the U.S., except Yucca Mountain. The original studies for waste migration from Yucca Mountain were expanded to the time of peak discharges beyond 10,000 years. The EPA's inadequate regulations for WIPP enable WIPP to meet compliance standards but do not adequately ensure safety during waste emplacement or after repository closure.

The radioactive half-lives of the waste, including plutonium-239 (24,000 years), neptunium-237 (2.1 million years), and others, far exceed the regulatory considerations for only 10,000 years.

Regarding nuclear criticality, the EPA's regulations may have been acceptable before but certainly are not adequate for disposal of surplus plutonium. The EPA regulations allow a high probability of nuclear criticality at WIPP, and by the way, are also inadequate for other repositories. The criticality risks for concentrated fissile material such as in surplus plutonium or spent nuclear fuel persist far beyond 10,000 years. The EPA regulations only address criticality for 10,000 years and allow criticality to be dismissed with quantitative hand-waving. Criticality events in WIPP must be required to be controlled so that they are physically precluded, now and in the distant future. The EPA must not rely on voluntary standards regarding surplus plutonium, and the EPA must require independent and comprehensive criticality review.

The transuranic waste that had been allowed in WIPP was far lower in fissile material content, and much of the waste below 200 fissile gram equivalents (FGE) of plutonium-239 than what the DOE is now seeking for surplus plutonium disposal, above 380 FGE.

There are over 500 active oil or gas drilling wells within 2.5 miles of the boundary of WIPP. Well drilling can be very deep vertically and horizontal drilling is also conducted. Pressurized brine pockets can bring waste to the land surface. Water ingress from fracking can move in unpredictable ways, moving vertically and horizontally. It is possible for releases from WIPP to occur.

Increased well drilling and increased waste inventory are increasing the probability of a WIPP release, so the Department of Energy's contractor, Sandia National Laboratory, has "tweaked" the Culebra groundwater modeling transmissivity values to lower the accident consequences.<sup>4</sup> Plutonium solubility is another likely area where pressure may be applied to lower estimated releases from WIPP estimated from the performance assessment and this will also require independent review.<sup>5</sup>

EPA regulations require Performance Assessment analyses to estimate the cumulative releases of radionuclides from WIPP for both undisturbed repository and disturbed repository

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<sup>4</sup> Sarah Brunell, Sandia National Laboratories, Presentation: Summary of Changes to WIPP Performance Assessment for the Replacement Panels Planned Change Request, December 7, 2023. See [epa.gov](https://epa.gov).

<sup>5</sup> Letter to Lee Ann B. Veal, Environmental Protection Agency, on behalf of numerous New Mexico organizations, explaining why EPA needs to conduct a formal rulemaking, June 24, 2024. See Stop Forever WIPP Coalition at <https://stopforeverwipp.org/home>

performance. Disturbed repository performance considered human intrusion by inadvertent and intermittent drilling and mining. Culebra groundwater flows above the WIPP disposal area and pressurized brine is below the WIPP disposal area.

**More waste is already slated for WIPP than is allowed, even with the recently contrived modification via “volume of record” accounting.** <sup>6</sup> Even so, the Department of Energy continues to claim WIPP is the disposal solution for every problem waste stream. In addition to the surplus plutonium, <sup>7</sup> the DOE continues to identify WIPP as the potential disposal site for the nation’s Greater-Than-Class-C Low-Level waste, DOE’s 10,000 metric tons of mercury, high-level waste from Hanford and West Valley, <sup>8</sup> and high-level waste from the Idaho National Laboratory’s calcine and treated sodium-bearing waste. <sup>9</sup> Even if the new counting method is approved, the amount of TRU waste already destined for WIPP from Energy Department generator sites would overflow its limited space.

In addition, the DOE continues generic spent nuclear fuel repository research, including for a salt repository and has noted that the SNF containers for commercial spent nuclear fuel don’t fit in the existing WIPP facility. The attempts to locate “interim” consolidated storage of commercial spent nuclear fuel near WIPP in New Mexico and in nearby Texas <sup>10</sup> <sup>11</sup> suggest an unstated intention to dispose of the nation’s spent nuclear fuel in salt in New Mexico.

The changes DOE proposes making to WIPP are very significant changes from the existing WIPP approval by the Environmental Protection Agency (EPA). The DOE has submitted a Planned Change Request to the EPA to expand WIPP. <sup>12</sup> In a “death from a thousand cuts” approach, DOE is emphasizing the addition of just two additional panels, Panels 11 and 12, to make up for lost panel space due to the accident DOE caused in 2014.

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<sup>6</sup> National Academies of Science, Engineering and Medicine, *Review of DOE’s Plans for Disposal of Surplus Plutonium in the Waste Isolation Pilot Plant*, Washington, DC, 2020: The National Academies Press.  
<https://doi.org/10.17226/25593>

<sup>7</sup> Public Comment Submittal from Tami Thatcher to the U.S. Department of Energy and National Nuclear Security Administration (NNSA) regarding the Draft Environmental Impact Statement for the Surplus Plutonium Disposition Program (Draft SPDP EIS) (DOE/EIS-0549), February 2023 at <http://www.environmental-defense-institute.org/publications/CommentSurplusPu2023.pdf>

<sup>8</sup> Southwest Research Information Center, “Current DOE Proposals to Expand WIPP,” 2017,  
[http://www.sric.org/nuclear/docs/2017\\_09\\_15\\_WIPP-expansion-proposals.pdf](http://www.sric.org/nuclear/docs/2017_09_15_WIPP-expansion-proposals.pdf)

<sup>9</sup> Energy Communities Alliance, “Waste Disposition: A New Approach to DOE’s Waste Management Must Be Pursued,” September 2017. The Department of Energy gave this document to the Idaho Cleanup Project Citizens Advisory Board in June 2018.  
<https://static1.squarespace.com/static/55c4c892e4b0d1ec35bc5efb/t/59ce7384cd39c3b12b97f988/1506702214356/ECA+Waste+Disposition+Report.pdf>

<sup>10</sup> U.S. Nuclear Regulatory Commission, *Federal Register*, Vol. 86, No. 178, “Interim Storage Partners, LLC; WCS Consolidated Interim Storage Facility; Issuance of Materials License and Record of Decision,” September 17, 2021. This is the consolidated storage facility proposed for Andrews County, Texas. (The consolidated storage facility could store up to 40,000 metric tons heavy metal.)

<sup>11</sup> U.S. Nuclear Regulatory Commission, *Federal Register*, Vol. 88, No. 92, “Holtec International; HI-STORE Consolidated Interim Storage Facility,” May 12, 2023. This is the consolidated storage facility proposed for Lea County, New Mexico. (The consolidated storage facility could store up to 100,000 metric tons heavy metal.)

<sup>12</sup> See <https://www.epa.gov/radiation/wipp-news#WIPP-PCR>

DOE's revised Performance Assessment is basically doubling the size of WIPP to a total of 19 panels when only 10 panels were in the original WIPP certification. **Does the EPA think that doubling the size of WIPP is not a significant change?**

The Department of Energy operates WIPP and, unlike other Department of Energy facilities, the U.S. Environmental Protection Agency plays a special role in approving changes to WIPP. Congress required EPA to certify that the DOE's WIPP facility complies with the waste disposal regulations at 40 CFR Part 191, Subparts B and C as well as 40 CFR Part 194.<sup>13</sup> The EPA originally certified WIPP in 1998 and WIPP began defense waste disposal in 1999.

Plutonium-laden waste from various Department of Energy facilities involved in nuclear weapons production have been shipped to WIPP for disposal. These facilities include Hanford, Oak Ridge National Laboratory, Savannah River Site, Los Alamos National Laboratory, Idaho National Laboratory and others. Much, but not all, of the defense waste from the Idaho National Laboratory that is shipped to WIPP came to Idaho from the DOE's now closed Rocky Flats Plant in Colorado. The waste has included transuranic radionuclides such as plutonium, americium, curium and neptunium, and often includes large quantities of toxic chemicals associated with plutonium processing.

The incompatible combination of chemicals and high loading of radioactive waste caused the explosion of a waste drum inside WIPP in 2014. The Los Alamos National Laboratory (LANL) had packaged transuranic waste destined for WIPP and included forbidden liquid absorbent material from organic kitty litter in many TRU waste drums laden with nitrates. The Department of Energy failed at LANL and failed at WIPP to prevent the forbidden incompatible constituents in the waste. Systemic and widespread safety problems were found to be pervasive at WIPP following a vehicle fire in WIPP and then the unrelated drum explosion.

WIPP's original safety basis had been extensively reviewed, more than any other DOE facility. Reviews by the Environmental Protection Agency and by the Defense Nuclear Facility Safety Board had been conducted. But subsequent changes to the WIPP safety basis, approved by DOE had reduced safety significantly. They made the assumption that a roof fall would never occur in an open panel and had no accident analysis for this. WIPP experienced a roof fall within a couple months of not bolting the ceiling in the underground mine.

**The accident investigation report also discovered that far more plutonium/americium was released from a single drum in the February 12, 2014 event than the safety analysis predicted was possible.**<sup>14</sup> This emphasizes the inadequate characterization of waste drum contents and this does not appear to have been adequately addressed by the EPA.

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<sup>13</sup> See <https://www.epa.gov/radiation/certification-and-recertification-wipp>

<sup>14</sup> Department of Energy Office of Environmental Management, Accident Investigation Report, "Phase 2 Radiological Releases Event at the Waste Isolation Pilot Plant February 14, 2014," April 2015. [http://wipp.energy.gov/Special/AIB\\_WIPP%20Rad\\_Event%20Report\\_Phase%20II.pdf](http://wipp.energy.gov/Special/AIB_WIPP%20Rad_Event%20Report_Phase%20II.pdf) See Sections 7.1 and 7.2. The release was found to have been from a single drum with stated inventory in plutonium-239 equivalent curies of 2.84 PE-Ci. But based on contamination on filters at Station A of 0.1 curies PE-ci far from the exploded drum in Panel 7, using conventional safety analysis assumptions the expected amount of material released to Panel 7 would not have exceeded 2.84E-4 PE-Ci — far less than what was measured downstream at Station A. The

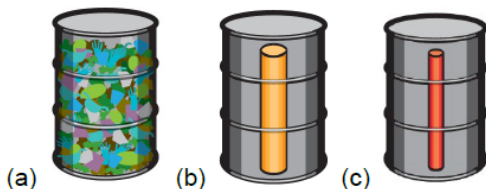
The explosion of a single drum resulted in closing some storage panels before the panels were filled to capacity. It is also important to also understand that the single drum that exploded in WIPP contained many times more radioactive material than DOE’s safety analysis deemed possible to be contained in a single drum.

Despite the paperwork on the contents of each drum and the radiation monitoring programs, alpha radiation in transuranic waste is easily shielded and the contents of waste drums is often not adequately known. Drum sampling is expensive and contents are not necessarily homogeneous throughout the waste drum. **The existence of a limit in WIPP does not mean that the limit has been met and this improper loading of waste drums must be considered in safety analyses and the Performance Assessment.**

The 2020 NAS report also discussed the Defense Nuclear Facilities Safety Board (DNSFB) concerns over how the material at risk (MAR) methodology may underestimate the quantity of material at risk within disposal areas in WIPP. Basically, the DNFSB found that in the WIPP panels, there are **clusters of containers with higher radioactivity source terms**. This means that accidents at WIPP may have higher radiological consequences than stated by the Department of Energy, both in the near term and in the long term.

DOE is seeking to dispose of vast quantities of surplus plutonium waste not previously slated for WIPP. DOE wants to dispose of 48.2 metric tons of diluted surplus plutonium that would take up 33,740 cubic meters of volume. But using the new contrived “volume of record” calculations that New Mexico’s environmental department NMED should never have approved, the volume of surplus plutonium shrinks to only 2,056 cubic meters.

The so-called “diluted” surplus plutonium waste is still so concentrated and creates such a high criticality risk that to obtain the necessary separation of fissile material, a 6-inch diameter, 26-inch-long containers rests inside each 55-gallon drum. **So, the proposed surplus plutonium would take a large number of drums, 160,667 drums, a large number of shipments and takes up a huge amount of space in the repository. And the diluted surplus plutonium will be 85 percent of the plutonium-239 in WIPP, see Table 1.**<sup>15</sup>



Characteristics	(a) Direct-loaded	(b) Pipe Overpack Container	(c) Criticality Control Container/Criticality Control Overpack (CCC/CCO)
Inner dimension	N/A	12-inch-diameter pipe	6-inch-diameter pipe
Physical volume	0.21 m <sup>3</sup>	0.21 m <sup>3</sup>	0.21 m <sup>3</sup>

inventory in the drum appears to have been much higher than stated for WIPP drum and the release fractions may also be incorrect and DOE does not conservatively bound the radionuclide contents in the drums.

<sup>15</sup> National Academies of Science, Engineering and Medicine, *Review of DOE’s Plans for Disposal of Surplus Plutonium in the Waste Isolation Pilot Plant*, Washington, DC, 2020: The National Academies Press. <https://doi.org/10.17226/25593>

**Table 1.** Contact-handled TRU waste drums compared Pipe Overpacks and to Diluted surplus plutonium waste drums.

	<b>CH TRU Waste</b>	<b>TRU Waste in Pipe Overpack Containers (POCs)</b>	<b>Criticality Control Containers/Criticality Control Overpacks (CCC/CCOs)</b>
Waste Composition	Variable; contaminated clothing, tools, rags, residues, debris, soil, and other items	Plutonium residues, heterogeneous debris, salts, and sealed sources	Diluted Surplus Plutonium
Physical volume (outer container)	0.21 m <sup>3</sup>	0.21 m <sup>3</sup>	0.21 m <sup>3</sup>
Total number of emplaced containers	97,928	27,025	160,667
Total amount of plutonium-239	1.6 MT	3.2 MT	48.2 MT
Percentage of plutonium-239 at 10,000 years	15	(included in CH TRU)	85
Fissile gram equivalent (FGE) per container	14.4 g/ <200 g, FGE	117 g/ <200 g, FGE	300 g (nominal)/ <380 g, FGE
Actual volume of waste containers	175016 m <sup>3</sup>	(included in CH TRU)	33,740 m <sup>3</sup>
After contrived “volume of record” calculations that include only inner container volume	130186 m <sup>3</sup>	(included in CH TRU)	2,056 m <sup>3</sup>

Source: National Academies of Science, Engineering and Medicine, *Review of DOE’s Plans for Disposal of Surplus Plutonium in the Waste Isolation Pilot Plant*, 2020, Washington, DC: The National Academies Press.

<https://doi.org/10.17226/25593> Note: the ever-evolving and full amount of waste to be emplaced at WIPP is not included here. The comparison of typical TRU waste and diluted surplus plutonium is the focus of the table. Also, it should be noted that the legislated capacity for WIPP is 175,564 cubic meters even though the normal way of computing the waste volume has been manipulated by the DOE to allow more waste to be placed in WIPP.

The TRU waste with lower fissile grams fissile material per container pose far less criticality risk than the surplus plutonium the DOE wants to dispose of in WIPP. The surplus plutonium disposal in WIPP greatly increases the importance of independently reviewed criticality evaluations as well as overall migration of the waste that assure safety in the near term and over the long term.

The review by the National Academies of Science in 2020 belatedly obtained some of the criticality studies for WIPP but concluded that they did not have the time and budget to conduct comprehensive independent technical review of those criticality reports. “Nevertheless, reasonable doubt or concern over stated assumptions or assessments with the reports may be

noted by the committee.” Some of those criticality analyses are still not available to the public. The EPA must see that independent reviews of the criticality evaluations of WIPP are conducted, with the addition of surplus plutonium, and available to the public.

**There are many variables that influence nuclear criticality, especially over the lifetime of the repository.** The bags of magnesium-oxide, MgO, that are placed inside WIPP are intended to absorb CO<sub>2</sub> produced by the decay of carbon-based materials such as wood, paper, plastic, rubber, etc. But the MgO also makes a good neutron reflector and/or moderator, according to a study by Brickner at the Oak Ridge National Laboratory.<sup>16</sup>

The rooms in the excavated storage panels at WIPP are dry initially, but the salt tends to compress the rooms vertically more than horizontally. Roof collapse can occur, as can entry of brine. The plutonium spacing between the drums will be reduced. Typically, water ingress is a moderator that increases the change of nuclear criticality, but chlorine in the salt brine can reduce the likelihood of criticality. The iron in the steel of the material surrounding the plutonium can also influence the likelihood of criticality. **Beryllium enhances the ability for the fissile material to go critical and while the WIPP has limits on beryllium in the waste, beryllium is not detectable inside the packages.**

The Idaho Cleanup Project deliberately ignored the possible beryllium in some of its waste packages<sup>17</sup> because failure to meet the WIPP limits on beryllium would have meant expensive repackaging or inability to dispose of the waste at WIPP. The inadequate control of waste barrel contents was not random — it was to avoid the inconvenience and cost of compliance.

For adequate safety, it cannot simply be assumed that WIPP limits on beryllium content have been met. **There needs to be positive verification before that waste is placed in WIPP or conservative analyses showing that the present of forbidden material or excess quantities is acceptable.**

A study by Saylor at the Oak Ridge National Laboratory found that the addition of 50 g of B<sub>4</sub>C per container intermixed with the plutonium waste form would be able to maintain subcriticality.<sup>18</sup>

If boron carbide (B<sub>4</sub>C) is added to the surplus plutonium, will the proper addition of boron carbide be verified? Can the boron carbide addition create any other hazards such as flammable gas problems during any phase of operation, including transportation?

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<sup>16</sup> Bret D. Brickner, Oak Ridge National Laboratory, *Post Placement Nuclear Criticality Evaluations Involving 6- and 12-Inch Pipe Overpack TRU Waste Containers at the Waste Isolation Pilot Plant*, ORNL/TM-2019/1222, October 2019. Note that this report addresses containers limited to 200 fissile gram equivalents (FGE) and does not address the surplus plutonium disposal which is a higher fissile content per container of 380 FGE.

<sup>17</sup> Idaho Cleanup Project Core, “Formal Cause Analysis for the ARP V (WFM-1617) Drum Event at the RWMC,” October 2018. [https://fluor-idaho.com/Portals/0/Documents/04\\_%20Community/8283498\\_RPT-1659.pdf](https://fluor-idaho.com/Portals/0/Documents/04_%20Community/8283498_RPT-1659.pdf)

<sup>18</sup> Ellen M. Saylor, Oak Ridge National Laboratory, *Nuclear Criticality Safety Assessment of Criticality Control Containers without Moderation Control at the Waste Isolation Pilot Plant*, ORNL/TM-2020/1713, September 2020.

Regarding the inadequate EPA regulations for WIPP, are the strange “EPA Units.”<sup>19</sup> The DOE’s Performance Assessment is a contrived analysis using “EPA Units” as a sliding metric for 10,000 years after WIPP’s closure. **The more waste disposed of at WIPP, the more waste the EPA’s regulations allow WIPP to release.**

The post-closure performance criteria for WIPP from 40 CFR 191.13 set normalized standards for cumulative radionuclide releases to the accessible environment over 10,000 years. **Unlike any other repository in the world, WIPP’s performance is not keyed to radiation protection standards based on dose limits.** As if the bar for repository performance was not low enough already, the EPA regulations are created such that the more waste disposed of in WIPP, the higher the allowed radiological releases.

The fact that plutonium-239 has a 24,000-year half-life and the EPA’s period of interest is only 10,000 years is not just arbitrary, but contrived. The excuse by the EPA is that geologic stability is too hard to know, past 10,000 years, so EPA argues, why try? The EPA and the DOE apparently don’t think anything matters after their short life times end.

The truth is that the EPA’s lousy regulations allow pollution of our air, soil and drinking water now, today, from the nuclear industry. It’s not just plutonium-239. The decay products of plutonium-238, and curium-242, are like that of uranium-238 and include radium-226 and radon-222. The decay products of plutonium-240 and uranium-236 are like that of thorium-232 and include radium-224 and radon-220. The Department of Energy already has a policy of ignoring its and nuclear industry contributions to **elevated levels** of various radionuclides, including radium in drinking water. The EPA already allows unidentified alpha-emitting radionuclides in our drinking water and around southeast Idaho, the unidentified alpha is often americium-241 and plutonium-239. Monitoring programs for WIPP assure the public that americium and plutonium detected near WIPP are simply not attributed to WIPP.

The 2020 NAS report suggests that because of the tremendous changes to the waste composition from the proposed disposal of surplus plutonium, the elevated criticality risk, the greatly increased radioactivity of the waste, and the challenges of extending WIPP’s operation for decades, there should be the resurrecting of the Environmental Evaluation Group (EEG). It is important to understand that the contractors like Sandia National Laboratory strive hard to come up with the answers desired by the DOE. There are important examples from the Yucca Mountain repository effort that found contractor assumptions and modeling changes gave DOE desired answers but were documented by independent review as being technically indefensible. DOE simply withheld the independent reviews from the state of Nevada and went forward with technically indefensible and non-conservative modeling.

**The need for massive redo of the Performance Assessment for WIPP should be considered a significant change by the EPA. The pending changes to the underground configuration of WIPP should be considered a significant change to WIPP. The EPA needs**

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<sup>19</sup> Environmental Protection Agency, *The Geochemistry of the Waste Isolation Pilot Plant*, EPA-402/R-21/002, November 2021. <https://www.epa.gov/radiation/epas-role-waste-isolation-pilot-plant-wipp>



**to take safety seriously and needs to take transparency seriously. More independent technical reviews are needed and the EPA must conduct a full rulemaking on WIPP.**

The EPA held informal and non-transcribed meetings in Santa Fe on August 28 to discuss the technical issues and listen to public comment. The EPA claimed that its regulations for WIPP are conservative. That statement alone speaks volumes about the EPA.

It appears that the EPA plans to approve DOE's Planned Change Request (PCR) without any rigorous review of the Department of Energy's claims or its Performance Assessment for WIPP and with minimal transparency.

Numerous unrealistic and non-conservative assumptions are typical of DOE Performance Assessments that seek to achieve a very low bar – that of making a plausible cause for reasonable assurance of adequate performance of the waste dump.

WIPP was called a “pilot” plant because the DOE was claiming it would also seek another defense waste disposal facility, but DOE has not sought another facility. If the previous promises made to the State of New Mexico by the Department of Energy are understood, regarding the mission of WIPP, the limited duration of its operation and the limited transportation of radioactive waste through the state are understood, the lesson to be learned is quite simple: **agreements made with the Department of Energy cannot be trusted by citizens in any state.**

### **History Relevant to WIPP and EPA Regulations**

Some relevant history regarding the U.S. Environmental Protection Agency's tendency to contort human protection criteria toward the Department of Energy's desires comes from the history of regulations proposed for the Yucca Mountain repository.

The regulations for the proposed Yucca Mountain repository involve standards created by the U.S. Environmental Protection Agency as well as the NRC. The National Academy of Sciences did not support limiting the concern for repository performance to only 10,000 years. When a court ruled that the recommendation of the National Academy of Sciences had been stipulated as needing to be followed and the doses after 10,000 years needed to be considered for Yucca Mountain, the EPA modified its regulation to limit an individual's exposure from Yucca Mountain trickle out contamination from water that infiltrates the repository from 15 mrem/yr for the first 10,000 years to a two-tier regulatory scheme that allowed more contamination exposure to individuals after 10,000 years.

In the EPA's initial draft of the two-tier scheme, **the limit for exposure after 10,000 years was an obscene 350 mrem/yr,**<sup>20</sup> which the nuclear industry doesn't even like to talk about now.

After public backlash, the EPA backed it down from 350 mrem/yr to 100 mrem/yr after 10,000 years, see Table 2. Why didn't the EPA just apply the same 15 mrem/yr dose that the EPA considered safe for the entire duration that the waste was toxic? It appears that the

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<sup>20</sup> U.S. Department of Energy, *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, DOE/EIS-0250F-S1D, October 2007. [https://www.energy.gov/sites/prod/files/EIS-0250-S1-DEIS-Summary-2007\\_0.pdf](https://www.energy.gov/sites/prod/files/EIS-0250-S1-DEIS-Summary-2007_0.pdf)

Department of Energy’s modeling which had accepted escalating radiation releases after 10,000 years, did not think that estimated doses could be kept below 15 mrem/yr after 10,000 years. It appears to me that the EPA was under the influence of the Department of Energy when its two-tier radiation standard was issued.

The 2007 Draft Yucca Mountain Environmental Impact Statement read as follows:

“To obtain NRC authorization to construct the Yucca Mountain repository, DOE must demonstrate that the proposed repository meets the regulatory individual radiation protection standards set by EPA and NRC. Under the existing standards, estimated repository performance will be compared to a mean annual dose of 15 millirem for the first 10,000 years after closure. Under the proposed standards, estimated repository performance will be compared to a median annual dose of 350 millirem for the post-10,000-year period.”

**Table 2.** History of EPA radiation standards for Yucca Mountain.

<b>Standards</b>	<b>History</b>	<b>Citation</b>	<b>Apply to</b>	<b>Key Provisions</b>
Generic radiation protection standards	Original 1985 Vacated 1987 Revised 1993	40 CFR 191	WIPP, potential non-NWPA repositories, monitored retrievable storage facilities, private interim storage	1993 standards: exposure limits to any individual, 0 – 10,000 years: 15 mrem/yr *
Yucca-specific standards, draft	Initial two-tier draft, 2007	40 CFR 197	Yucca Mountain	2007 draft standards: exposure limits to “reasonably maximally exposed individual,” 0-10,000 years: 15 mrem/yr; 10,000 – 1,000,000 years: 350 mrem/yr **
Yucca-specific standards	Original 2001 Vacated 2004 Revised 2008	40 CFR 197	Yucca Mountain	2008 standards: exposure limits to “reasonably maximally exposed individual,” 0-10,000 years: 15 mrem/yr; 10,000 – 1,000,000 years: 100 mrem/yr **

Table notes: Some information in the table is based on Richard Bureson Stewart and Hane Bloom Stewart, *Fuel Cycle to Nowhere – U.S. Law and Policy on Nuclear Waste*, Vanderbilt University Press, 2011. But *Fuel Cycle to Nowhere* did not discuss the proposed 350 mrem/yr EPA individual dose limit.

\*The exposure limits apply to all individuals outside the controlled area, defined as an area no more than 100 km<sup>2</sup> extending no more than 5 km from the site (40 CFR 191.12. Annual exposure to any individual is limited to 25 mrem (40 CFR 191.03).

\*\* Typically, the EPA defines the controlled area around a toxic waste site as no more than 300 km<sup>2</sup> extending no more than 5 km from the site. For Yucca Mountain, the distance in the direction of groundwater flow was extended to 18 km. Human intrusion limits not included in the table.

The annual dose of 100 mrem/yr commencing to a child, embryo or fetus and continuing over a lifetime would assure a significantly higher rate of cancer and disease. The annual dose rate from the ingestion of radionuclides, of 350 mrem/yr would be a health catastrophe. That EPA's regulation allows the 95<sup>th</sup> percentile doses to be as high as the sky and for years on end shows that the EPA's regulation had little concern for life on the planet Earth. (See our August 2020 newsletter and other articles on the Environmental Defense Institute website to better understand the harm of radiation exposure.)

The Department of Energy's modeling of the trickle out of radionuclides from the disposal of spent nuclear fuel at Yucca Mountain made it problematic to achieve 15 mrem/yr to an individual living 18 km downgradient of Yucca Mountain. But as water seeps into the porous volcanic "tuff" of the mountain and the waste containers inevitably corrode, the radionuclides trickle out, moving with groundwater. The degree of "sorption" of radionuclides to the soil along the way has been modeled based on contrived laboratory tests and often over zealously is modeled to sorb to the soil rather than reach the person drinking water 18 km from the disposal site.

The water infiltration model was thought by one prominent geologist, Lynn W. Gelhar, to underpredict the groundwater flow and the estimated annual radiological dose, as he explained in Chapter 14 of the book *Uncertainty Underground*.<sup>21</sup> But something would happen to drastically lower the Department of Energy's trickle out radiation doses between 2007 and 2008 when the DOE submitted its license application for Yucca Mountain to the NRC. I had trouble understanding how the predicted doses dropped to less than a mrem/yr for post-10,000-year time frame. Both the earlier and later submittals had assumed perfect titanium drip shield performance, despite the implausibility of ever installing them in the repository. I finally found the answer in a letter on the State of Nevada's website for Yucca Mountain.<sup>22</sup>

An independent review of DOE's calculations had been contracted by the DOE but withheld from the State of Nevada. The review's conclusion was that the Department of Energy's modeling of water infiltration to the disposed of waste **did not provide a credible representation of water infiltration at Yucca Mountain**. In other words, because the periodic

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<sup>21</sup> Edited by Allison M. Macfarlane and Rodney C. Ewing, *Uncertainty Underground – Yucca Mountain and the Nation's High-Level Nuclear Waste*, The MIT Press, 2006. ISBN 0-262-13462-4. Chapter 14 by Lynn W. Gelhar, *Containment Transport in the Saturated Zone at Yucca Mountain*. He concludes that the DOE calculations "could easily be three orders of magnitude larger than the DOE predicts (see figure 14.3). Figure 14.3 shows radiation dose versus time with the dose peaking after 10,000 years from closure. The DOE prediction was from 2001, DOE/RW-0539. Gelhar also points out the looseness of the EPA's standard "that probabilistic results be interpreted by applying the numerical standards to a "reasonable expectation" prescribed to be the mean is troubling." Figure 14.3 shows DOE's model yielded 95<sup>th</sup> percentile doses above 1000 mrem/yr after 100,000 years.

<sup>22</sup> Senate Hearing 109-523, Yucca Mountain Repository Project, May 16, 2006.  
<https://www.govinfo.gov/content/pkg/CHRG-109shrg29473/html/CHRG-109shrg29473.htm>

spikes in water infiltration had raised the estimated radiation dose, the water infiltration spikes were simply removed from the modeling in order to drive the estimated radiation exposures down. The contamination trickle-out problem that had previously estimated 95<sup>th</sup> percentile radiation doses above 1000 mrem/yr (yes, one thousand mrem/yr) and would struggle to meet the 100 mrem/yr median requirement by EPA regulations now had contrived the modeling to slash the estimated radiation dose to a person living 15 km (or 11 miles) downgradient to less than 1 mrem/yr.

The DOE's problem of meeting the regulatory standards for Yucca Mountain was easily solved by the use of technically unsupportable assumptions, which naturally the NRC had no problem with. The NRC would tell the media and the Government Accountability Office that there were no technical reasons to object to the repository at Yucca Mountain and that the Yucca Mountain repository would be "safe."

The State of Nevada, however, had noted that in addition to the contrived modeling of the trickle out from Yucca Mountain, that other essential aspects of the license application for Yucca Mountain were technically unsupported and lacked design details or even the identification of applicable codes and standards. The Department of Energy has no technical basis to support the claims in its 2008 Yucca Mountain License Application about corrosion resistance of the metal waste packaging and drip shield and had not corrected the situation even after strong urging from the U.S. Nuclear Waste Technical Review Board.<sup>23 24</sup>

The proposed Yucca Mountain disposal site has a tunnel but was never granted a license to construct. The technical flaws in the various proposed concepts for Yucca Mountain are even more problematic than the political problems. The State of Nevada was astutely aware that the analysis claims for container robustness against corrosion and the claimed limited water infiltration and trickle-out were not just unreliable, the claims were known to be scientifically unjustified. The final stated low radiation doses from the trickle-out of radionuclides relied on the installation of thousands of undesigned and impossible to install titanium drip shields.

A review of Sandia's modeling for Yucca Mountain that yielded estimates of low radiation doses from water contamination from the trickle out of radionuclides found that the Sandia models were technically indefensible.<sup>25</sup>

That independent review of DOE's calculations had been contracted by the DOE but withheld from the State of Nevada. The review's conclusion was that the Department of Energy's modeling, by Sandia, of water infiltration to the disposed of waste did not provide a credible representation of water infiltration at Yucca Mountain.

In other words, because the periodic spikes in water infiltration had raised the estimated radiation dose, the water infiltration spikes were simply removed from the modeling in order to

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<sup>23</sup> State of Nevada to Chairman of the Nuclear Waste Technical Review Board, October 8, 2008.  
<http://www.state.nv.us/nucwaste/news2008/pdf/nv08108nwtbr.pdf>

<sup>24</sup> See the State of Nevada website, including the "Key Technical Issues" webpage at  
<http://www.state.nv.us/nucwaste/technic.htm>

<sup>25</sup> Senate Hearing 109-523, Yucca Mountain Repository Project, May 16, 2006.  
<https://www.govinfo.gov/content/pkg/CHRG-109shrg29473/html/CHRG-109shrg29473.htm>

drive the estimated radiation exposures down. The contamination trickle-out problem that had previously estimated 95<sup>th</sup> percentile radiation doses above 1000 mrem/yr (yes, one thousand mrem/yr) and would struggle to meet the 100 mrem/yr median requirement by EPA regulations now had contrived the modeling to slash the estimated radiation dose to a person living 15 km (or 11 miles) downgradient to less than 1 mrem/yr. <sup>26</sup>

**The Department of Energy’s rapidly evolving waste emplacement concepts continued to evolve as every assumption about how the Yucca Mountain repository would contain the waste didn’t hold up.** Also, no utility has packaged its spent nuclear fuel into DOE’s recommended “transport, aging and disposal” TAD canister.

Regarding criticality issues, the Department of Energy initially hand-waved away criticality concerns in the Yucca Mountain repository. After analyses were finally conducted especially for the use of higher enriched or “high burn-up” fuels, the agency began claiming that multiple criticalities in the waste repository wouldn’t add that much harm to a disposal repository’s already estimated harm. Criticality risks for commercial spent nuclear fuel peak in 25,000 years, despite government standards for criticality risk ending in 10,000 years.

The Environmental Protection Agency’s approval of the West Lake Landfill in Missouri is also informative. The EPA and State of Missouri approved the disposal cover for the West Lake landfill in 2008, containing both have buried chemically laden and radioactive waste. The West Lake landfill in Missouri failed within a couple years of installation, and has had underground fires burning since December 2010 that no one knows how to extinguish. <sup>27 28</sup> The EPA has told residents near to West Lake Landfill, to stay indoors and close the windows...

“Atomic Homefront,” a documentary about the uranium processing waste dumped into the West Lake Landfill. The documentary includes footage of Environmental Protection Agency officials downplaying and denying the health problems associated with the radioactive waste.

Over the Environmental Protection Agency’s history, the EPA has often made inadequate regulations and delayed making needed regulations. Even with adequate regulations, the EPA’s enforcement has often been tardy or absent. So, when the EPA holds meetings and postures that its regulations are conservative and that the public should trust the EPA, like EPA did last August in New Mexico about changes to WIPP, the EPA has signaled its intent to rubber-stamp

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<sup>26</sup> Letter from Council for the State of Nevada to Secretary of the U.S. Nuclear Regulatory Commission, State of Nevada’s Supplement to its June 4, 2008 Petition Asking the NRC to Reject DOE’s Yucca Mountain License Application as Unauthorized and Substantially Incomplete, July 21, 2008. The letter cites the review of DOE’s infiltration model performed at DOE’s request by ORISE (Oak Ridge Institute for Science and Education). ORISE provided the results of this independent review to DOE on April 30, 2008. <http://www.state.nv.us/nucwaste/news2008/pdf/nv080721nrc.pdf>

<sup>27</sup> Robert Alvarez, Bulletin of the Atomic Scientists, “West Lake story: An underground fire, radioactive waste, and governmental failure,” February 11, 2016. <https://thebulletin.org/2016/02/west-lake-story-an-underground-fire-radioactive-waste-and-governmental-failure/>

<sup>28</sup> Veronique Lacapra, St. Louis Public Radio, “Confused about Bridgeton, West Lake landfills? Here’s what you should know,” October 20, 2015. <https://news.stlpublicradio.org/post/confused-about-bridgeton-west-lake-landfills-heres-what-you-should-know>

any Department of Energy proposal and abdicated its needed role in protecting the public and the environment.

### **Summary**

Rather than a piecemeal approach to disaster at WIPP, the EPA must conduct a formal Rulemaking on the Department of Energy's Planned Change Request.

*These comments are from Tami Thatcher, who was a qualified nuclear safety analyst for a Department of Energy nuclear reactor facility at the Idaho National Laboratory. Many of her reports and articles are at [www.environmental-defense-institute.org](http://www.environmental-defense-institute.org).*

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