From: Karen Hadden
To: RulemakingComments Resource
Cc: Maupin, Cardelia; McCartin, Timothy; NRCExecSec Resource; OCA_Web Resource
Subject: [External_Sender] NRC Docket ID: NRC-2017-0081 RE: GTCC and TRU
Date: Tuesday, November 19, 2019 6:31:30 PM
Attachments: Marvin Resnikoff GTCC statement .docx
Barbara Warren Comments on GTCC.docx

RE: NRC Docket ID: NRC-2017-0081

Dear NRC Chairman Kristine Svinicki, Commissioners Baran, Caputo and Wright and NRC Rulemaking and Adjudications Staff,

Please halt the proposed changes that would reclassify GTCC and TRU radioactive waste and ensure that that this waste will only be disposed of in a manner currently required by federal law. This law was designed to protect living things by isolating these dangerous materials deep underground. It is essential that current law remains in place in order to protect our health and safety, all living things and our economy.

The proposal would create risks to our health, safety, the environment and the Texas economy. Transport of the waste could create accidents and risks throughout the country. Reclassifying is a disastrous plan that would allow very hot Greater-Than-Class C and TRU waste to go into shallow burial pits instead of deep underground in a geologic repository, the less risky approach currently required for safety reasons.

Texas Governor Greg Abbott recently wrote to the NRC, saying that "At this time, I oppose any increase in the amount or concentration of radioactivity for disposal at the facility in Andrews, County, Texas." He is right to be concerned. This rulemaking proposal would set in motion the larger plan to send the nation's entire inventory of this waste stream to Texas. The amount of waste analyzed in the Generic Environmental Impact Statement was 420,000 pounds and 161 million curies. This massive amount of curies is more than 28 times the full licensed capacity of WCS' huge federal waste pit and 41 times the full capacity of the adjacent Compact Waste pit.

This would be a huge increase in very hot material including irradiated metal from inside nuclear reactor cores. Shallow burial at the WCS site would be close to the nation's largest freshwater aquifer, the Ogallala, at a site prone to temperature extremes, earthquakes, floods, wildfires and tornadoes.

Some of the radioactive materials, especially Technetium-99, can volatilize. Winds could spread radioactive contaminants into the air, soil and water, leading to disaster. If containers leak due to cracks or fissures various water bodies could be impacted, as TCEQ Radioactive Materials Division staff warned against when they recommended denial of the license for WCS' low-level waste site. The bottom of the shallow burial for GTCC waste would be only 120' deep, not 2000 feet or more, as it should be. According to WCS' Environmental Assessment, 100,000 pound containers would be stacked up to seven units deep, putting them close to the surface, where radioactive materials could volatilize even more readily. Human inhalation would become a risk.

Shallow burial of highly radioactive materials in a region prone to earthquakes fails to meet the common sense test. One earthquake had its epicenter just 5 miles away from the site in Eunice, New Mexico. The Permian Basin is the nation's largest oil producing region. What would happen if such a major oil supply became contaminated?

Transport of this massive poisonous waste stream through our communities for the unjustified purpose of shallow burial should be prevented. At least 33,700 truck shipments or 11,800 rail shipments of highly radioactive waste would occur, but the public can't comment effectively since routes have not been set.

Oral Comments from the Public Meeting Held in Austin Should Count

Please include the oral comments I made on behalf of the SEED Coalition at the NRC hearing held on August 27, 2019 in Austin, Texas as part of my comments. Please also consider comments of the many others who took time to come to the hearing and and provide oral testimony. It is highly unusual and inappropriate for oral comments made at a public hearing to not be considered as official comments. To disregard them because the transcript "may not be perfect" invalidates the effort and input of concerned citizens. We were informed of this decision at the meeting, but **no notice was given beforehand that oral comments would not count** and no good reason was provided for not including them as official comments The hearing host, Chip Cameron, even noted that this would be highly unusual. This decision put an additional burden on concerned citizens to write to you, after they had already come to a public meeting and testified, assuming that their voices would be heard. Requests were made at the hearing to reverse this decision and to accept all oral comments from the public meeting, which clearly would be available through the meeting transcript, but no satisfactory response has been received by the public. Please respond with your decision on this matter.

This rulemaking would negatively impact Texas and violate the existing license for the WCS/ ISP site

This rulemaking decision will not occur in a vacuum, and related information from the Final EIS for the Disposal of Greater-Than-Class C Low-Level Radioactive and GTCC-Like Waste and the related Environmental Assessment done for the WCS site are important to consider in this rulemaking process. From these documents, several key facts emerged. :

• If the GTCC waste came to Texas, There would be 28 times more radioactivity (curies) than the Federal Waste
Facility pit in Andrews can accept. The TCEQ license does not currently allow this.
• Containers would weigh 100,000 pounds each, and be stacked up to 7 deep, starting at 120 feet below the surface – in an area prone to earthquakes.
• There would be 33,700 truck shipments or about 11,800 rail shipments of this

dangerous waste. No routes have been designated.
• No safety improvements are planned for the disposal site and no additional jobs would be created - only health, safety, environmental and financial risks for Texas!

I recently wrote to the Texas Low-Level Radioactive Waste Disposal Compact Commission on behalf of the SEED Coalition regarding these concerns, and some of the comments from that letter are included here.

"The current effort to dispose of the entire inventory of Greater–Than-Class C (GTCC) and GTCC-like waste, which includes transuranic waste (TRU), at the WCS site is incredibly dangerous, and must be halted immediately.

The site is not licensed to dispose of this waste, and should not be authorized to do so under any circumstances and whether this hotter waste goes under any revised name or title. Accepting this waste stream is not in the keeping with the "protection of health, safety and welfare" of the people of Texas.

The Final Environmental Impact Statement for the Disposal of Greater-Than-Class C Low-Level Radioactive and GTCC-Like Waste **says in Section 1.4.1 that this waste is "not generally acceptable for near surface disposal" and that the "waste form ad disposal methods must be different and, in general, more stringent than those specified for Class C."**

However, the Environmental Assessment done for the WCS site portrays a different view, one in which GTCC and GTCC-like waste can be handled just the same as the other waste they handle.

The GTCC and GTCC-like inventory is about 12,000 cubic meters in volume and contains 160 million curies of radioactivity. The plan is to send all of it to Texas.

This was made clear when the U.S. Department of Energy (DOE) subsequently published the Environmental Assessment for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste at Waste Control Specialists, Andrews County, Texas, in October 2018. It clarified that the proposal is to send the entire vast GTCC waste stream to the WCS site in West Texas, for shallow burial in the Federal Waste Facility there.

Adopting a generic EIS for this purpose is inadequate and wrong. An Environmental Assessment (EA) for WCS has been done, but the plan to bring massive quantities of extremely hot GTCC waste to Texas should require a unique NEPA process, with a full Environmental Impact analysis using updated data and opportunities for public comment and hearings. The inadequate EA relies largely on other and older analyses.

This very hot radioactive waste belongs deep underground in a geologic repository. Instead, the plan is that it would go into containers that would each weigh 100,000 pounds, stacked atop each other up to seven units high, with the bottom unit at

120’ below grade. An engineered cover of 25’- 45’ feet would be on top, which would presumably prevent infiltration of precipitation until final closure.

Nothing about this plan makes sense. It doesn’t even meet the common sense test. This is a plan designed to tempt fate, not a good idea when it comes to radioactive waste.

DOE reported to Congress in November 2017 on Alternatives for Disposal of GTCC and GTCC-like waste, noting that since “full waste emplacement operations at WIPP are not expected until the 2021 timeframe: therefore, DOE is primarily considering disposal in generic commercial facilities.” The DOE Environmental Impact Statement, from January 2016, carried the same message. However, after $2 billion or so in repairs it was announced in June 2018 that routine transuranic waste handling operations were resuming at WIPP. SEED Coalition does not recommend sending this waste to the WIPP site or any other specific site, but GTCC and GTCC-like waste is clearly not suitable for shallow burial.

The generic DOE Environmental Impact Statement determined that for the GTCC waste to go to the WIPP Site in New Mexico, **transportation would require 33,700 truck shipments or about 11,800 rail shipments.** The WCS Environmental Assessment expects that the same number of shipments would be expected if the waste went to WCS in Texas.

Here are some things to consider carefully:

The Federal Waste Facility opened in 2013 and is currently licensed for 26 million cubic feet of waste. The GTCC and GTCC-like waste would require 420,000 cubic feet, so there would be physical space, but the intense amount of concentrated radioactivity is a problem.

The Compact Facility has limits of 9 million cubic feet and 3.89 million curies. The adjacent Federal Waste Facility, where this waste would go, is licensed for 5.6 million curies. **The GTCC waste would be 160 million curies, more than 28 times the licensed amount for the Federal Waste Facility.**

This is 41 times the curies allowed for the Compact Waste Facility.

The Environmental Assessment (EA) notes that TCEQ could be asked to increase the curie limit with a license amendment. What? The Federal Waste Facility is huge to start with. It’s the largest of WCS’ three low-level radioactive waste pits, and the currently licensed 5.6 million curies is already a massive amount. How can such an enormous increase even be contemplated?

The Environmental Assessment is full of contradictions. It continually implies that nothing can go wrong, that risks are small and that this massive change of disposing of GTCC waste would not really make any difference at the site. It points out the many things that could go wrong, but these things could of course never really happen.

While there are supposed to be no significant impacts, Section 2.1.2 notes that "closure could consist of any one or a combination of the following activities: closure, dismantlement, decontamination, decommissioning, reclamation, disposal, aquifer restoration, stabilization, monitoring or post-closure observation and maintenance."

Decontamination? Aquifer restoration? Stabilization? At a site where the public is asked to believe that nothing can go wrong?

Natural Disasters and Climate Extremes

The EA notes that the site has temperature extremes and brief frequent intense thunderstorms. Andrews County experiences one flooding event per year. Will that 25' – 45' foot soil cover be able to keep moisture out for millennia to come, at a presumably dry site that already has to pump water out routinely and has ephemeral playas nearby that can hold water for two weeks?

Between 1962 and 1982 there were two F2 tornadoes, with wind speeds from 113 to 157 mph. There were nine F1 tornadoes, with wind speeds up to 112 mph and thirteen with speeds up to 72 mph. Tornadoes during the handling of this waste could be disastrous.

A 3.3 earthquake 18 years ago had its epicenter in Eunice, NM, only five miles from the WCS site, and there have been numerous earthquakes in the region for decades. (https://earthquaketrack.com/us-nm-eunice/recent)

The EA claims that the seismic hazard is low, but points out that the largest nearby was 19 miles from the WCS site, Rattlesnake Canyon earthquake in 1992, with a magnitude of 5. There has been subsidence in the region as well, including the San Simon Swale, the San Simon Sink, the Wink Sinks and a sink northwest of Jal, New Mexico. The AE says that seismic activity could potentially affect engineered barriers, but that seismic hazards have been integrated into the design, which "would not be impacted by the proposed disposal of GTC and GTCC-like waste."

How would 100,000 pound containers, stacked seven deep, fare in an earthquake? How would we know if containers were damaged as a result of an earthquake and how would we be able to access that damage? What could be done about it if there was radioactive contamination?

Worker and Public Exposures

Worker exposure has been a problem at the WCS site in the past. The excerpt below is from Good to Glow, by Forrest Wilder, in the April 4, 2008 Texas Observer. https://www.texasobserver.org/2729-good-to-glow-despite-its-own-scientistsobjections-state-regulators-are-greenlighting-a-massive-nuclear-waste-dump-in-west-texas/

> In March 2005, Waste Control began processing radioactive waste from the Rocky Flats plant, a site in Colorado that manufactured plutonium triggers for the United States' Cold War-era hydrogen bomb program. On June 2, 2005, while processing this waste, a worker known in state documents as Number 67 at Waste Control's mixed waste facility was wounded on his leg by a piece of contaminated metal. The company tested the worker's urine and feces, and found elevated levels of two plutonium isotopes, as well as americium-241. Later in June, an independent expert determined that the worker had probably inhaled the radionuclides. Over the next few months, as processing of the Rocky Flats waste continued, the investigation expanded to include eight of Number 67's co-workers. All but one tested positive for low levels of radionuclides, including one employee who hadn't worked at the mixed waste facility for three years. On September 22, Waste Control management decided to suspend operations at the mixed waste facility and expand the testing to virtually all employees.
>
> In all, 43 individuals had been exposed to plutonium and americium, company testing showed, according to documents uncovered by the *Observer*. According to Waste Control, a ventilation system wasn't working properly, allowing plutonium and americium particles to escape into the lunchroom and adjacent hallways.

A TCEQ audit later found that worker exposures might have been going on intermittently since 2002.

Again, the Environmental Assessment for bringing GTCC waste to Texas is inadequate. It relies on the DOE's generic final Environmental Impact Statement to evaluate the human health impacts that could occur with disposal of the entire inventory of GTCC and GTCC-like waste. A full-blown site specific EIS should be required in order to ensure health and safety and to minimize financial risks to the entire state, instead of relying on a generic document, especially since contamination has already been a problem in the past at the WCS site.

The Environmental Assessment relies on a previous analysis, instead of doing the appropriate updated analysis. An earlier report is referenced that says that the estimated dose to a person offsite would be below the 100 mrem dose limit for a member of the public, but this was without the much hotter GTCC waste even being in the picture yet. Even so, there were plenty of reasons for concern. The same previous 2007 WCS Environmental Report noted that there could be an explosion or fire at the Federal Waste Facility. It states that "containers could be breached by various mechanisms, including dropping, collision, crushing, container defect, or spills. These mechanisms for breaching or rupturing a container could occur during vehicle transport or handling on site during a number of operational activities. "

Potential Water Contamination

According to the Environmental Assessment, keys to isolating the waste from the public and limiting human radiological exposure are "the inherent geological features of the site in limiting the infiltration of waste into the waste, dissolving the waste, and transporting the waste via water to points where it might be consumed by individuals. Engineered features, such as waste packaging and disposal site design, liners and a closure cap limit the potential for water to come into contact and subsequently interact with waste and transport radionuclides from the disposal site." Then it says that these features may not be fully functional after institutional controls are lost.

Potential groundwater intrusion into the low-level radioactive waste facility was the reason that the entire TCEQ Radioactive Materials Division recommended (August 14, 2007) denying the license for the Compact and Federal Waste Facilities. Three professional employees resigned over the licensing.

While it would be slower than transport via groundwater, the EA also says that the other pathway for environmental contamination is by upward diffusion of radionuclides through the overlying cover system to the atmosphere (where winds could transport radionuclides) or downward to underlying groundwater. Potential radioactive exposure pathways included "inhalation of outdoor gas-phase radionuclides emanating from the closed facilities, inhalation of particulates due to resuspension of surface soil above the facilities, incidental ingestion of surface soil, external dose from the surface and near-surface soil and exposure to oil well drill cuttings in a mud pit." No new accident scenario evaluation is planned for the GTCC proposal.

The upward diffusion of volatile radionuclides could include helium-3, carbon-14, argon-39, krypton-85, iodine-120 and radon-222. These volatile radionuclides could diffuse in the air and water in the soil. The "peak dose for most receptors is dominated by upward diffusion of technetium-99." The EA says that putting the GTCC and GTCC-like waste at the bottom of the pit, with other low-level waste on top of it, would not cause any long term issues, and the upward diffusion would be further stunted with the bottom two layers being more than 100 feet underground.

Why not put this waste in a geologic repository instead of risking upward diffusion of radionuclides?

Sabotage and Terrorism Risks

The Doe's generic EIS evaluated sabotage and terrorist scenarios for GTCC and GTCC-like waste. Destructive acts could occur "during transportation of the waste to the disposal facility, while the waste containers are being handled at the disposal facility (unloading, temporary storage, and emplacement), or after emplacement." Site-specific risks for sabotage and terrorism should be updated and analyzed in a unique EIS.

No new mitigation measures are planned in light of the GTCC proposal, despite the significant increase in curies that would occur. The EA says that current and planned measures "could include design, operational and monitoring activities to prevent and provide early detection of releases of radionuclides and chemical constituents before they leave the disposal site boundary." Really? This is insane. Where are the well-defined enhanced requirements and monitoring that should be demanded, instead of vague suggestions of what could be done it anyone thought it might be nice to do so?

WCS would not hire any additional employees for disposal of GTC or GTCC-like waste, so there would be no additional jobs."

In summary, this rulemaking should be halted. The Nuclear Regulatory Commission should not allow GTCC and GTCC-like waste to be disposed of in a near-surface land disposal facility. Existing law was designed to be protective of health and safety, and should be upheld and enforced. Furthermore, there is nothing to gain and everything to lose with Importing GTCC and GTCC-like transuranic waste to Texas. The plan, starting with reclassification of the waste, could lead to disaster.

I am also including comments written by Marvin Resnikoff and Barbara Warren, which are adopted by reference and included as part of these SEED Coalition comments.

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Decommissioned Nuclear Reactors Are Hot

Marvin Resnikoff, Ph.D.
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November 2019

One inescapable fact about decommissioned nuclear reactors; they are extremely radioactive. It's not just the used nuclear fuel that remains radioactive for centuries in dry storage containers. Some metal parts of the reactor itself, called greater than class C waste (GTCC), are as radioactive as nuclear fuel and will have to be disposed of in a deep underground repository along with the used nuclear fuel. Much as Northstar would like to ship all the so-called "low-level waste" from Vermont Yankee to a landfill in Texas, GTCC is not suitable for surface burial. The proposed WCS landfill is not licensed to accept these hot reactor parts; the State of Texas has not received permission from the Nuclear Regulatory Commission to regulate GTCC at the WCS landfill. If Vermont Yankee follows the pattern at other decommissioned reactors, GTCC will be placed in concrete storage containers or casks, much as the used nuclear fuel.

Reactor Waste

For 40 or more years of operation, nuclear utilities leave waste that will remain toxic for centuries. Nuclear fuel is packaged into dry storage canisters that sit in concrete silos (named HI-STORM, Holtec designer), or horizontal concrete boxes (named NUHOMS, Orano TM designer), at 70 or so reactor sites. While the Nuclear Waste Policy Act of 1982, amended 1987, required the Department of Energy (DOE) to construct the Yucca Mountain repository in Nevada, the State strongly objected and the project has stalled. (Disclaimer: the author is an advisor to Nevada on transportation issues.)

While nuclear fuel sits in the reactor for 3 to 4½ years before being placed in a fuel pool, the stainless steel reactor components that hold the fuel within the reactor remain inside the reactor for 40 to 60 years. The stainless steel of these reactor components are activated or become radioactive. Neutron bombardment within the reactor converts non-radioactive cobalt, to radioactive cobalt-60, nickel to radioactive nickel-59, etc. In terms of gamma radiation, used nuclear fuel and activated reactor components are comparable. Gamma rays are electromagnetic radiation, like X-rays, but are more energetic and much more powerful.

In the 1970's, it was commonly understood that shutdown reactors could be sealed for 300 years before being taken apart. But in 1978, four engineering students and I at the State University of New York in Buffalo, in a paper[2] cautioned that high concentrations of Ni-59 (half-life 75,000 years) meant that reactor parts would be radioactive for tens of thousands of years. This was followed by an analysis of Nb-94 (half-life 20,000 years), in a paper by Cornell Professor Robert Pohl[3]. An article in Science magazine[4] credited us with changing the method of safely managing reactor components. In 1978, the NRC classified low-level waste into classes A, B and C, according to the concentration of gamma

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[2] (Harwood 1976)
[3] (Stephen 1978)
[4] (Science 1982)

emitting and long-lived radionuclides. Classes A, B and C could be buried in a surface landfill, such as the WCS landfill in Texas, where Northstar has partnered with other companies at the WCS facility. At present, under NRC regulations, WCS is not licensed to accept GTCC.

Radioactivity Comparison HBF vs GTCC

In Table 1 below, we compare the total fission products in high burnup fuel (HBF) (60 GWd/MTU) to the activation products in the core shroud of a PWR reactor. Note, we have not included many of the actinides in HBF because we are focused on the radionuclides that are gamma emitters. The fission products in HBF are taken from a PNL report by Roddy[5]; this is the same report used by Holtec in its HI-STORM 100 SAR. The pertinent spreadsheet pages are in the Appendix. As seen, from 10 years on, the core shroud is more radioactive than HBF. The long-lived Ni-59 (half-life 75,000 years) accounts for the long-lived radioactivity in both the core shroud and high burnup fuel. The core shroud also contains the long-lived Nb-94 (half-life 20,000 years), which is a gamma emitter. Reactor internals closest to or part of the reactor core, such as the core shroud, are the most radioactive internal components; other internals have the same activation products, but are less radioactive.

Table 1. Fission and Activation Products (Ci)

Year	1	10	100	500	1000	10000
HBF	**6.45E+06**	**8.05E+05**	**9.11E+04**	**132**	**24.6**	**17.1**
GTCC[b]	**3.33E+06[a]**	**9.13E+05**	**1.22E+05**	**9.27E+03**	**1.98E+03**	**1.45E+03**

[a] at reactor shutdown; [b] core shroud GTCC

Direct Gamma Comparison HBF vs GTCC

In Table 2 below, we compare the direct gamma whole body equivalent dose rate on contact (1 cm off surface) from unshielded HBF and the unshielded core shroud GTCC. Note that HBF, 1 year out of reactor is extremely radioactive. A two minute contact gamma dose is likely lethal. The calculations, carried out with Microshield software is at 1 cm from the midpoint of a PWR assembly. At 10 cm from the midpoint, the dose equivalent is even greater. However, note that the gamma dose from the core shroud is more than 10 times greater for the first ten years. From 500 years to 10,000 years the dose rate from GTCC is greater than from HBF due to the presence of Nb-94 and Ni-59.

Table 2. Direct Gamma Dose Equivalent (rem/hr)

Year	1	10	100	500	1000	10000
HBF	**2.06E+04**	**3.0E+03**	**177**	**0.0235**	**0**	**0**
GTCC[b]	**2.44E+05[a]**	**6.03E+04**	**1.91**	**0.79**	**0.776**	**0.57**

[a] at reactor shutdown; [b] core shroud GTCC

The calculations in Table 2 for HBF are based on a single PWR HBF assembly. HI-STORM F/W casks contain up to 37 PWR assemblies. A simplifying assumption was also made for the core shroud. Reactor internals are in many shapes and sizes. To simplify we calculated the gamma dose at 1 cm from a 1m by 1m plate.

[5] (Roddy 1986)

Volume Considerations

We differ with the NRC's estimate of the volume of activated metals GTCC that require disposal near surface or in an underground repository. According to the NRC[6], the total GTCC volume is 880 + 370 = 1250. Based on actual experience, we estimate a volume approximately 3 times larger. At the decommissioned CT Yankee, 3 HI-STORM casks contain GTCC waste. The volume of the HI-STORM 100 canister (diameter 68 inches, length 178 inches) is 10.6 cubic meters. Roughly estimating 3 canisters at approximately 100 reactors, the total volume is approximately 3178 cubic meters, or approximately 3 times greater than NRC estimates.

Summary

Because of the high direct gamma dose rate extending out to 10,000 years, in our judgment, GTCC cannot be buried in a near surface landfill. This conclusion was made by the NRC in 1978 and is just as true today. While this report focuses on the radioactivity and dose rate, it is clear that the declining economics of nuclear power urgency is responsible for NRC's move to store GTCC in a surface landfill. While the economics of nuclear power have changed in 39 years, the physics and need to protect the public health and safety remains the same.

[6] (NRC 2019)

References

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(Roddy 1986) Roddy, JW, et al, Physical and Decay Characteristics of Commercial LWR Spent Fuel, ORNL/TM-9591/V1-R1, January 1986.

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Appendix

Isotopes the Nuclear Industry Overlooked[7]

[7] (Science 1982) Science, p. 377, January 22, 1982, p. 377.

The problem of what to do with worn-out nuclear power plants has taken on an important new dimension in the past few years, as evidence has come to light that some reactor components may remain radioactive for thousands of years after a plant is shut down. The conventional wisdom had previously been that radiation levels would decline to insignificance after several decades.

The culprits are very long lived isotopes of nickel and niobium, which are formed as the result of bombardment by neutrons. The formation of these isotopes was overlooked by the nuclear industry until the late 1970, when the problem was brought to public attention largely as the result of work by undergraduate students.

Their discovery may have an important impact on regulations governing the decommissioning of nuclear plants. In particular, the Nuclear Regulatory Commission (NRC) may forbid utilities to entomb reactors in concrete and leave them in place-an option that was long considered the cheapest way of dealing with the problem. Instead, the NRC staff is considering requiring that reactors be dismantled relatively soon after they are shut down and that the radioactive waste be shipped to a disposal site (see accompanying story). Components containing the long-lived isotopes may even have to be consigned to a geological repository when one is eventually established.

When a reactor is first shut down, the pressure vessel and other components close to the core are intensely radioactive, largely because of the presence of cobalt-60. This isotope is formed when atoms of cobalt, a constituent of most steels, are hit by neutrons from fission reactions in the reactor fuel. Because cobalt-60 has a half-life of 5.27 years, the radioactivity diminishes relatively quickly. After a century, the amount of cobalt-60 will have dropped by a factor of about one million.

Although it has always been known that isotopes of other elements would be formed by neutron bombardment, it was thought that they would be present in such tiny quantities that they would contribute negligible amounts of radioactivity. Thus, once the cobalt-60 had decayed, the reactor would be relatively harmless. In February 1976, however, Marvin Resnikoff, a physicist then on the staff of the New York Public Interest Research Group, went public with calculations indicating that nickel-59 may pose a long-term radiation problem.

Resnikoff says that he and four undergraduate students realized that nickel-59 may cause difficulties when they looked at data on the dismantling of the Elk River reactor, a small power plant in Minnesota that was shut down in 1968 after only 4 years of operation. Although only trace amounts of nickel-59 were present in Elk River components, Resnikoff calculated that significant quantities would be formed in a large power reactor during 30 years of operation.

Nickel-59 is potentially important because, although it contributes only a tiny fraction of the radiation inventory when a reactor is shut down, it has a half-life of about 80,000 years. It will therefore be around long after cobalt-60 has decayed to insignificance, giving off radiation well above permitted levels.

Resnikoff recalls that he was initially anxious about releasing his calculations because “they went against the whole mindset at the time.” The nuclear industry was then saying that if a reactor is entombed for 180 years, it will cool down to a safe level, he pointed out. Nevertheless, he published a press release challenging the industry’s plans. Resnikoff says that his calculations were vigorously attacked by the industry, but most studies since then have acknowledged the problem with nickel-59. “It is an example of what happens when you have thousands of engineers all moving in one direction, and a handful of outside critics takes a look at their work,” Resnikoff claims.

A year later, a second long-lived isotope, niobium-94 was identified as a potential problem in irradiated reactor components. Again, the discovery came from researchers outside the nuclear industry.

Robert Pohl, a professor of physics at Cornell University, said that he decided, in the light of Resnikoff’s findings, to see whether there are any hazardous activation products among trace elements in steel. An undergraduate student, John Stephens, looked through data on radioactive isotopes and flagged niobium-94 as a potential problem. It decays with a half-life of 20,300 years, emitting very energetic gamma rays. A literature search indicated that niobium is added to some steels to inhibit cracking, and that it is a trace constituent in stainless steel. Pohl and Stephens published their findings in *Nuclear Engineering and Design* in 1978.

“Nobody in the nuclear business knew of the problem at the time,” says Pohl. It is now generally accepted, however. A 1980 report by Battelle Pacific Northwest Laboratories indicates, for example, that the decay of niobium-94 will dominate the radiation dose rate from irradiated steel about 70 years after a reactor is shut down.

An environmental impact statement on reactor decommissioning, published last year by the NRC, indicates that the dose rate from niobium-94 in reactor components will be about 17,000 rems per year if the reactor is operated for 30 to 40 years. That from nickel-59 will be about 800 rems per year. “These dose levels are substantially above acceptable residual radioactivity levels,” the statement notes. Entombing a disused reactor in concrete would thus be acceptable only if the long-lived isotopes were removed or if the integrity of the entombing structure could be maintained for thousands of years, the study concludes.

After the problems with nickel-59 and niobium-94 were discovered, the NRC commissioned a study to see whether any other potential activation products may cause trouble. “So far, we haven’t identified any on the scale of those two,” says Donald Calkins, NRC’s manager of decommissioning programs.- Colin Norman.

C-11

TABLE C.1-3. Radioactivity Levels in Major Activated Reactor Components at Time of Reactor Shutdown

Isotope	Half-Life	Core Mid-Plane Radioactivities (Ci/m^3): Shroud	Lower 4.72 m of Core Barrel	Thermal Shields	Vessel Inner Cladding	Lower 5.02 m of Vessel Wall	Upper Grid Plate[(a)]	Lower Grid Plate[(a)]
^{95}Nb	35 day	2.0×10^{3}	7.6×10^{0}	3.5×10^{0}	5.6×10^{-3}	1.7×10^{-3}		
^{59}Fe	45 day	4.6×10^{4}	4.4×10^{3}	2.0×10^{3}	1.0×10^{2}	2.7×10^{1}		
^{58}Co	72 day	1.5×10^{5}	1.0×10^{4}	4.6×10^{3}	3.3×10^{2}	6.6×10^{0}		
^{95}Zr	65 day	1.1×10^{-1}	6.2×10^{-3}	2.9×10^{-3}	2.0×10^{-4}	7.2×10^{-4}		
^{65}Zn	245 day	1.2×10^{2}	1.1×10^{0}	5.0×10^{-1}	6.7×10^{-4}	3.5×10^{-5}		
^{54}Mn	~300 day	6.8×10^{4}	3.7×10^{3}	1.7×10^{3}	1.2×10^{2}	4.7×10^{1}		
^{55}Fe	2.7 yr	1.3×10^{6}	1.5×10^{5}	6.7×10^{4}	3.5×10^{3}	7.2×10^{2}		
^{60}Co[(b)] upper	5.27 yr	9.6×10^{5}	9.3×10^{4}	4.7×10^{4}	2.5×10^{3}	7.5×10^{1}		
lower		3.2×10^{5}	3.1×10^{4}	1.6×10^{4}	8.2×10^{2}	2.5×10^{1}		
^{63}Ni	~100 yr	1.2×10^{5}	1.5×10^{4}	6.8×10^{3}	3.6×10^{2}	3.8×10^{0}		
^{93}Mo	~3000 yr	3.6×10^{-1}	5.2×10^{-2}	2.4×10^{-2}	1.2×10^{-3}	1.3×10^{-3}		
^{14}C	~5,750 yr	1.5×10^{2}	1.8×10^{1}	8.3×10^{0}	4.0×10^{-1}	1.9×10^{-2}		
^{94}Nb	~20,000 yr	5.4×10^{0}	2.6×10^{-1}	1.2×10^{-1}	9.5×10^{-3}	--		
^{59}Ni	~80,000 yr	7.4×10^{2}	1.3×10^{2}	5.0×10^{1}	3.0×10^{0}	3.2×10^{-2}		
Sum (Ci/m^3)		2.97×10^{6}	3.07×10^{5}	1.45×10^{5}	7.73×10^{3}	9.04×10^{2}	2.97×10^{6}	2.97×10^{6}
Average/Peak		0.755	0.637	0.778	0.637	0.637	0.003×4.74[(c)]	0.08×4.74[(c)]
Ci/kg[(d)]		2.787×10^{2}	2.433×10^{1}	1.403×10^{1}	7.621×10^{-1}	7.164×10^{-2}	5.254×10^{0}	1.403×10^{2}
Weight of Material (kg)		12,312	26,783	10,413	2,074	245,582	4,627	3.946
Sum (Ci)[(e)]		3.431×10^{6}	6.516×10^{5}	1.461×10^{5}	1.581×10^{3}	1.759×10^{4}	2.431×10^{4}	5.534×10^{5}
TOTAL - Radioactivity					4.826×10^{6} Curies 1.786×10^{17} becquerels			

(a) Normalized to shroud

(b) Upper and lower bounds were computed using the maximum and minimum levels of ^{59}Co contaminant in the materials. All totals were computed using the upper bound values.

(c) $\frac{\text{Activity (Plate Average)}}{\text{Activity (Plate Edge)}} = 4.74$, $\frac{\text{Activity (Shroud at Plate Location)}}{\text{Activity (Shroud at Axial Midplane)}} = \begin{Bmatrix} 0.005\text{, upper plate} \\ 0.08\text{, lower plate} \end{Bmatrix}$

(d) Conversion factor assumes stainless steel density of 8.038×10^{3} kg/m^3 (0.29 lb/in.^{3}).

(e) The number of significant figures carried is for computational accuracy and does not imply precision to four places.

From NUREG/CR-0130

Core Shroud **PWR**

Isotope	**Half-Life**	**Units**	**LN2/τ**	**Reactor Shutdown**	**10 yrs**	**100 yrs**	**500 yrs**	**1000 yrs**	**10000 yrs**
Nb-95	35	day	0.0198042	4.00E+03	1.62E-28	0.00E+00			
Fe-59	45	day	0.0154033	9.20E+04	3.52E-20	6.24E-240			
Co-58	72	day	0.009627	3.00E+05	1.65E-10	7.44E-148			
Zr-95	65	day	0.0106638	2.20E-01	2.74E-18	2.01E-170			
Zn-65	245	day	0.0028292	2.40E+02	7.86E-03	3.41E-43			
Fe-55	300	day	0.0023105	1.36E+05	2.96E+01	3.22E-32			
Co-60 upper	5.27	yr	0.131527	1.92E+06	5.15E+05	3.73E+00	5.28E-23	1.45E-51	0.00E+00
Co-60 lower	5.27	yr	0.131527	6.40E+05	1.72E+05	1.24E+00	1.76E-23	4.84E-52	0.00E+00
Ni-63	100	yr	0.0069315	2.40E+05	2.24E+05	1.20E+05	7.50E+03	2.34E+02	1.89E-25
Mo-93	3000	yr	0.000231	7.20E-01	7.18E-01	7.04E-01	6.41E-01	5.71E-01	7.14E-02
C-14	5750	yr	0.0001205	3.00E+02	3.00E+02	2.96E+02	2.82E+02	2.66E+02	8.99E+01
Nb-94	20000	yr	3.466E-05	1.08E+01	1.08E+01	1.08E+01	1.06E+01	1.04E+01	7.64E+00
Ni-59	80000	yr	8.664E-06	1.48E+03	1.48E+03	1.48E+03	1.47E+03	1.47E+03	1.36E+03
			Total	**3.33E+06**	**9.13E+05**	**1.22E+05**	**9.27E+03**	**1.98E+03**	**1.45E+03**

Isotope	60 GWd/MTU		60 GWd/MTU					**PWR 60 GWd/MTU**					
	W/MTU		Ci/MTU					**microCi/cc**					
	Time since discharge (yr)		Time since discharge (yr)			Half-lifet t (yr)	ln(2)/t	1 yr	10yr	100 yr	500 yr	1000 yr	10000 yr
	1	10	1	10									
C-14			2.44E+00	2.44E+00	yr	5.73E+03	1.21E-04	6.34E+00	6.33E+00	6.26E+00	5.97E+00	5.62E+00	1.89E+00
Mn-54			4.59E+02		day	3.12E+02	2.22E-03	1.19E+03	1.17E+03				
Fe-55			3.24E+03	4.76E+02	day	3.00E+02	2.31E-03	8.42E+03	2.20E+02				
Co-60	1.47E+02	4.50E+01	9.54E+03	2.92E+03	yr	5.27E+00	1.32E-01	2.48E+04	6.65E+03	4.80E-02			
Ni-59			6.40E+00	6.40E+00	yr	7.60E+04	9.12E-06	1.66E+01	1.66E+01	1.66E+01	1.66E+01	1.65E+01	1.52E+01
Ni-63			1.05E+03	9.83E+02	yr	9.46E+01	7.33E-03	2.73E+03	2.54E+03	1.31E+03	7.00E+01	1.80E+00	4.15E-29
Zn-65			4.78E+01		day	2.45E+02	2.83E-03	1.24E+02	7.99E+01				
Zr-95	1.48E+02		2.93E+04		day	6.50E+01	1.07E-02	7.61E+04	2.31E+01				
Nb-94								0.00E+00					
Nb-95	3.16E+02		6.59E+04		day	3.50E+01	1.98E-02	1.71E+05	3.72E+01				
Ru-103			2.84E+03		day	3.93E+01	1.77E-02	7.38E+03	0.00E+00				
Ru-	2.28E+		3.84E+	7.88E+	yr	1.01E+0	6.88E	9.98E+0	1.03E+	1.36E-			

106	01		05	02		0	-01	5	03	24			
Rh-106	3.68E+03	7.56E+00	3.84E+05	7.88E+02	yr	1.01E+00	6.88E-01	9.98E+05	1.03E+03	1.36E-24			
Cs-134	2.66E+03	1.29E+02	2.62E+05	1.27E+04	yr	2.06E+00	3.36E-01	6.81E+05	2.36E+04	1.69E-09			
Cs-137	1.97E+02	1.60E+02	1.78E+05	1.44E+05	yr	2.94E+01	2.36E-02	4.62E+05	3.65E+05	4.39E+04	3.55E+00	2.73E-05	
Ba-137m	6.60E+02	5.36E+02	1.68E+05	1.37E+05	yr	3.06E+01	2.27E-02	4.36E+05	3.48E+05	4.53E+04	5.23E+00	6.26E-05	
Ce-144	2.84E+02		4.29E+05	1.42E+02	yr	7.78E-01	8.90E-01	1.11E+06	1.51E+02	2.39E-33			
Pr-144	3.15E+03		4.29E+05	1.42E+02	yr	7.78E-01	8.90E-01	1.11E+06	1.51E+02	2.39E-33			
Pr-144m			5.14E+03	1.70E+00	yr	7.78E-01	8.90E-01	1.34E+04	1.81E+00	2.84E-35			
Pm-147	3.37E+01	3.12E+00	9.39E+04	8.71E+03	yr	2.62E+00	2.64E-01	2.44E+05	1.74E+04	8.19E-07			
Sm-151			5.30E+02	4.95E+02	yr	9.13E+01	7.59E-03	1.38E+03	1.28E+03	6.45E+02	3.09E+01	6.95E-01	1.48E-30
Eu-154	2.09E+02	1.01E+02	2.33E+04	1.13E+04	yr	8.62E+00	8.04E-02	6.05E+04	2.71E+04	1.95E+01	2.10E-13		
Eu-155			1.42E+04	4.05E+03	yr	4.97E+00	1.39E-01	3.69E+04	9.15E+03	3.26E-02			
Other-FP	7.25E+01	7.00E+00	7.55E+03	2.29E+02		1.78E+00	3.88E-01	1.96E+04	1.06E+02				
Other-AC			6.47E+01	4.16E+01		1.41E+01	4.91E-02	1.68E+02	1.92E+01				
TOTAL	**1.16E+04**	**9.89E+02**					**Total**	**6.45E+06**	**8.05E+05**	**9.11E+04**	**1.32E+02**	**2.46E+01**	**1.71E+01**

November 19, 2019

Secretary

ATTN: Rulemaking and Adjudications Staff

US Nuclear Regulatory Commission

Washington, DC 20555-0001

Submitted via
www.regulations.gov

Re: Docket ID NRC-2017-0081, Greater than Class C and Transuranic Waste

Introduction

Under current law and regulations, there are three classes of low level radioactive waste (LLRW): A, B & C. There are just 4 licensed facilities in the country for LLRW; Barnwell, SC, Clive, UT, Richland, WA, and Andrews County, TX. The facility in Clive, Utah only accepts Class A waste, the least concentrated. The other three accept A, B, & C LLRW.

LLRW is authorized for disposal in a land disposal facility—near-surface disposal in the uppermost portion of the earth, approximately 30 meters below the surface. Only Class A, B, and C LLRW wastes are currently allowed. Greater than Class C (GTCC) radioactive waste comprises a mix of high level radioactive waste exceeding the limits established for low level waste in the Waste Classification Tables in 10 CFR 61.55- Tables 1 & 2. Waste exceeding these limits currently requires geological disposal by law, unless the Commission licenses and approves another disposal option. (§ 61.55 iv)

The Nuclear Regulatory Commission (NRC) is now proposing to allow GTCC waste to be disposed in a near-surface land disposal facility. Therefore the proposal before the public is primarily a deregulatory one, weakening public and environmental protections. It should be noted that long term geological disposal is not considered to be land disposal.

The Regulatory Basis prepared by NRC describes the review and analyses undertaken to determine whether near- surface disposal is adequate for Greater than Class C radioactive waste. NRC has determined based on its evaluation that:

- Near-surface disposal is appropriate for approximately 80% of the overall volume of the GTCC waste stream, subject to additional controls and analysis, and
- GTCC waste could be safely regulated by Agreement States.

We believe the NRC analyses were focused too narrowly and did not adequately establish an adequate safety case for Greater than Class C radioactive waste, related to the whole spectrum of waste management pre- and post- final disposal. NRC findings of its own analyses demonstrated that near surface disposal will not isolate the waste over the long term and will expose the public to huge radiation doses exceeding 10,000 millirems as long as 10,000 years after final disposal.

Recommendations: We recommend that GTCC wastes continue to be treated as high level radioactive wastes requiring disposal in a geological repository. GTCC wastes require a much stronger safety case for the long term protection of the public. NRC failed to include any defense-in-depth measures in its analysis.

Since there was some reliance by NRC on the US Department of Energy (DOE) and their Final Environmental Impact Statement (FEIS) in 2016, it should be mentioned that DOE has not yet issued its Record of Decision (ROD). DOE sent a Report to Congress in 2017 and is waiting for a response from Congress, before issuing the ROD.

The main body of our comments consists of numbered sections, each addressing a particular issue, concerning Greater than Class C radioactive waste.

Topics

1. **Disposal System Definition (1987)**
2. **Geological Repository**
3. **Greater than Class C Waste Definition**
4. **Greater than Class C Characteristics**
5. **Technical corrections needed to the waste classification tables in 10 CFR 61.55**
6. **Hazards associated with Features, Events, Processes and Site Operations.**
7. **GAO has been conducting oversight for years related to Nuclear Waste Clean-ups & Funding**

8. **Waste Isolation Pilot Project & other disasters West Valley Nuclear Waste Site, New York**
9. **West Valley Nuclear Waste Site, New York**
10. **Analysis of Public Health Protection**
    Conclusion

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1. **Disposal System Definition**

DOE issued Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste in a 1987 Report, DOE/NE-0077. Several things are especially worth noting about this report.

- The report was a requirement of The Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act).
- All references are to Greater than Class C waste. There is no reference to "GTCC-like waste," despite the fact that this is a DOE report. Apparently GTCC-like is a more recent decision by DOE.
- DOE used a broad definition for "Disposal system" as follows:

The disposal system for GTCC low level waste includes storage, treatment, packaging, transportation, and disposal. Requirements for each part of the system will place certain constraints on other parts. These constraints are discussed below:

Treatment & Storage- *The specific facility features required for storage depend upon the specific characteristics and volumes of the waste to be stored. That information determines (a) how much storage capacity is needed. (b) what kind of facility (ies) should be used. (c) where the storage facility (ies) should be located, (d) if treatment of the wastes will be necessary before storage and (e) how the wastes and packages will perform during the storage period.*
The first step in evaluating treatment and packaging needs for GTCC low-level waste is to obtain more detailed information on the waste. Mixed waste may contain hazardous organic material that needs treatment. High radiation doses may require additional shielding for the packaging.

Maintenance through storage and transportation might include more treatment and repackaging.
The above steps are straightforward. However, the key concerns are (a) container and/or waste form integrity must be maintained for the storage and transportation period. and (b) waste form and packaging requirements may differ for a disposal technology that is to be selected at some

point in the future. Both of these concerns generate a question that the waste might need further treatment or repackaging before shipment to a disposal facility.

Specific concerns identified by Brookhaven National laboratory (Siskind 1985). *Investigations have identified areas of concern for extended storage of low-level waste in general. Such concerns include radiolytic gas generation. biodegradation, container corrosion, degradation of waste form properties, and loss of strength from freeze-thaw fluctuations. Most of these concerns can be avoided by acceptance specifications on waste form and packaging. Some of the containers could require venting to prevent buildup of gases during storage, transportation, and disposal. In addition, the package design should address potential adverse radiation effects from compounded radiation fields from adjacent packages. These efforts should collectively minimize the need for future treatment or repackaging of the waste because of changes to the waste form or container during storage.*

Disposal System Definition. The DOE definition of Disposal here is broad representing an entire system in which analysis of wastes is done thoroughly to identify and implement treatment needs, including appropriate packaging to contain and adequately shield radioactivity. We believe handling and management of GTCC waste is a critical component for safety during site operations to protect workers and the public prior to disposal. Inadequate handling and management may also result in adverse outcomes before disposal. Final disposal is a more difficult concept since Greater than Class C waste radioactivity can extend for thousands to millions of years and there are unknowns attached with this broad category of nuclear wastes.

The NRC document associated with this proposal, **the Regulatory Basis**, identifies just four operating LLRW disposal facilities. One of these takes Class A waste only. Under current NRC regulations, 10 CFR 61, greater than Class C waste must be disposed in a geological repository, unless the commission approves of another disposal facility. The 10 CFR 61 regulations for LLRW disposal, promulgated in 1982, defined low-level radioactive waste as excluding high level waste, transuranic waste, spent nuclear fuel and certain classes of byproduct material. However, this NRC proposal includes transuranic waste as GTCC LLRW.

However, hundreds of radioactive waste sites are in limbo, waiting remediation and cleanup and the funding needed to accomplish the work. Greater than Class C waste may be at many sites that have not yet been fully assessed—and therefore not included in DOE estimates from the 2016 FEIS. See GAO discussion of DOE's large environmental liabilities at Topic #7.

Recommendation: We recommend that NRC continue to treat GTCC as high level radioactive waste and use a broad definition of disposal system including the components identified by DOE in 1987. Workers and the public need adequate protection from Greater than Class C wastes from generation through the entire treatment, handling, packaging, transport and disposal system.

2. Geological Repositories

Geological repositories have been the subject of a lot of serious research in Europe, which has generated more questions, especially about the permanence of geological repositories. It may be possible to identify long term repositories that are not permanent, but require active management to monitor and make corrections to address challenges over the long term. The goal would be to ensure isolation of such long term hazards from the public through active management essentially forever. This is what is suggested by research from Europe, presented to the US Nuclear Waste Technical Review Board.

NRC mentioned below ground vaults and earth- mounded concrete bunkers as possible options, but never evaluated them. Only near- surface disposal was the focus of the evaluation.

Recommendation: The current requirement for disposal in a geologic repository should be maintained until more protective options are developed. NRC and DOE should turn their attention to long term active and passive management of both High Level radioactive waste and Greater than Class C Waste to ensure that isolation is maintained to provide the necessary public protection for these extremely long term hazards.

3. **Greater than Class C Waste Definition- Classification based on agency generation or ownership**

According to DOE in the 2016 FEIS, the NRC LLRW classification system <u>does not apply</u> to radioactive wastes generated or owned by DOE and disposed of in DOE facilities. However, DOE owns or generates LLRW and non-defense-generated transuranic (TRU) radioactive waste, which have characteristics similar to those of GTCC LLRW and for which there may be no path for disposal at the present time. DOE has included these wastes for evaluation in this EIS because similar approaches may be used to dispose of both types of radioactive waste. For the purposes of this EIS, DOE refers to this waste as GTCC-like waste. The total volume of GTCC LLRW and GTCC-like waste addressed in the 2016 DOE FEIS is about 12,000 m^3 (cubic meters) or 420,000 ft^3 (cubic feet) and it contains 160 million curies of radioactivity. In its 1987 report, DOE did not even use the term GTCC-like, instead all of the material was GTCC. See Topic #1 above.

The Definition for Greater than Class C waste is problematic under the NRC proposal and needs to be corrected as a first priority. A definition should relate to a specific science and health-based determination of waste contents, reflecting important characteristics that affect health and safety and handling of the material. If DOE owns or manages GTCC or GTCC-like waste, DOE can be identified as the owner or manager, but the waste should not need a separate classification—such as GTCC-like.

DOE, as the federal agency in charge at West Valley, apparently has identified some of the West Valley waste as GTCC and other WV waste as GTCC-like. There should be some explanation for this inconsistency. See Appendix B tables in the NRC Regulatory Basis.

Recommendation: NRC should work with DOE to correct the Greater than Class C waste definition so that it is based on the technical characteristics of the waste, which would provide more accurate information to workers, emergency responders and the public. The owner/manager/shipper, including DOE, can utilize a separate label for such additional information.

4. Greater than Class C Characteristics

Greater than Class C radioactive waste, as described in multiple documents completed by DOE and NRC, identifies an extraordinary complex mixture of radionuclides that are gases, liquids and solids, that sometimes deliver high doses to humans if not handled remotely, that are sometimes contaminated with hazardous chemicals, that can contain enough special nuclear material to be a risk for a criticality, that contain very long lived radionuclides and transuranics, that decay to other radionuclides with different properties, that can generate gases in enclosed containers and create an explosion risk. Most importantly the problem of long term future risks actually increases with time beyond the 100 year institutional control period to 10,000 or more years.

Neither DOE in its 2016 FEIS nor NRC in its Regulatory Basis and Technical Analyses attempted to deal with all of the complexities associated with such a mixture. Rather than consider whether GTCC might be characterized further and separated into more specific categories based on handling, treatment or health protection needs, the Agencies continued to deal with this huge category of very different materials and properties and proceeded to analyze outcomes primarily post-final disposal. In 1987 DOE described various site operations as part of the "Disposal System".

The disposal system can involve a lengthy period of site operations that require worker protections, and preventing accidents and radioactive releases to the environment off-site prior to final disposal.

Recommendation: The NRC should seriously evaluate whether scientists and health professionals could use the various characteristics of this waste stream to divide the materials into categories most important for handling, operations and long term management of disposal in order to promote safety, avoid accidents and assure long term isolation from the public. A more detailed characterization would help facilitate safer management, storage and disposal.

5. **Technical corrections are needed to the waste classification tables in 10 CFR 61.55,** as listed below. See references.[1] [2]

    - Not all radionuclides present in GTCC waste streams were included, when the 10 CFR 61 regulation was developed, and
    - Not all of the included radionuclides have concentration limits in the regulation.
    - The half-lives of long- lived radionuclides should be used to establish the minimum period of necessary isolation from humans—approximately 10-20 half lives.

[1] Technical Analyses of the Hazards of Disposal of Greater than Class C waste (NRC,2019)
[2] NRC Regulatory Basis, Appendix B, p. B-1

Recommendation: NRC should make the needed corrections to the waste classifications including adding missing radionuclides and providing concentration limits when 10 CFR 61 is amended following this proceeding. Half-lives are a more technically sound method for establishing the period of required isolation. The effort should also consider the recommendations for Topics #3 & #4.

6. **Hazards associated with Features, Events, Processes (FEPs) and Site Operations.**

Not all FEPs were considered by DOE in the 2016 EIS and by NRC in the Regulatory Basis and associated Technical analysis. NRC assumes that all the requirements for site selection, stability, and site design have been fulfilled. Site hazards originally assessed could be significantly altered given the rapid environmental changes occurring due to climate change.

Climate change is magnifying the impacts of many weather events that are familiar. The nation has seen worsening fires, flooding, extreme rainfall and more powerful hurricanes. Climate change effects the integrity of disposal, potentially leading to a release of GTCC radioactive materials. Climate change should have been a major topic in the Agency analyses.

In addition, for the protection of an intruder or the offsite individual, water dependent pathways were not considered in developing the original regulations and concentration limits in 10 CFR 61.55. [3]

Recommendation: Science has advanced since the siting standards in 10 CFR 61 for LLRW only were first developed in 1982. NRC is attempting to have near-surface disposal apply to a very different waste category. However, GTCC waste is more hazardous and more long-lasting, making isolation from the public far more difficult. In addition future weather predictions are now far more uncertain. These complications were not evaluated in the NRC technical analysis, therefore the analysis is deficient. When 10 CFR 61 regulations are modified and updated they must be more protective of public

[3] NRC, Regulatory Basis, p. B-14

and environmental health and safety and include a thorough evaluation of climate change and associated impacts.

7. **The federal government's General Accounting Office (GAO) has been conducting oversight for years related to Nuclear Waste Issues and Funding.**

   In January 2019, GAO issued its harshest critique in years for DOE. After earlier identifying Environmental Liabilities for DOE as a High Risk for the Nation, in 2019 GAO said that the environmental liabilities for DOE's Environmental Management (EM) Program had reached $377 billion for FY 2018, growing by $214 billion in the previous 7 years. [4] Actual spending for the same period, which reduces environmental liabilities, was $46.8 billion. The liabilities are now 8 times annual spending.

   EM's liability does not include more than $2.3 billion in costs associated with 45 contaminated facilities that will likely be transferred to DOE's Environmental Management programs. Most of the facilities awaiting transfer are under the National Nuclear Security Administration, a semi-autonomous agency within DOE, primarily associated with the military and defense. Until these facilities are assessed in detail it is not possible for DOE to develop accurate cost estimates or to know the amount and types of radioactive wastes present so that adequate precautions can be put in place as soon as possible.

   In this report GAO criticizes DOE for continuing to ignore GAO recommendations, for failing to develop a program- wide strategy for the nation, and for not issuing informative annual reports to Congress which hinders the ability of Congress to take corrective action.

   Congress and the public need to know how many existing nuclear waste sites have not even had an initial assessment so that adequate precautions can be put in place as soon as possible. Congress must ensure that all sites have these basic assessments by a federal workforce rather than allowing delays necessitated by the contracting process. Adequate initial assessments can be facilitated by ensuring that the transferring Agency provides a set of documents with

[4] GAO-19-28 DEPARTMENT OF ENERGY Program-Wide Strategy and Better Reporting Needed to Address Growing Environmental Cleanup Liability Jan 29, 2019 https://www.gao.gov/assets/700/696632.pdf

information about the site being transferred. High priority should be given to the likely presence of Greater than Class C waste and transuranics and the need for precautions to address criticality potential.

Recommendation: Most importantly DOE must make major management changes to address GAO recommendations. It also needs to obtain essential information about new sites being transferred to its authority so that appropriate safety measures can be immediately implemented. NRC needs to have a better understanding of nuclear waste sites and their inventories in order to properly plan for a regulatory framework for GTCC waste.

8. The Waste Isolation Pilot Project (WIPP) & other disasters

The description of the WIPP disaster provided by DOE in the 2016 FEIS was completely inadequate as follows:

" It should be noted that waste disposal operations at WIPP were suspended on February 5, 2014, following a fire involving an underground vehicle. Nine days later, on February 14, 2014, a radiological event occurred underground at WIPP, contaminating a portion of the mine primarily along the ventilation path from the location of the incident and releasing a small amount of contamination into the environment." [5]

In fact the Valentine's day event was a major radioactive contamination event, an explosion of a waste container that exposed workers to airborne plutonium and contamination that shut down the entire transuranic waste disposal facility for years. As a result there was no disposal facility for transuranic defense waste anywhere in the nation due to this extensive contamination event. While now opened for receipt of waste, waste deliveries remain curtailed, because a brand new ventilation system is not yet installed. The proximal cause of this event was a serious scientific error made at Los Alamos National Lab, which approved organic kitty litter to be mixed with nuclear waste. However, in reality a whole series of reductions in safety measures had occurred due to DOE budget cutbacks over several years prior to the kitty litter decision.

Following the 2016 DOE FEIS, DOE stated in its 2017 Report to Congress that it focused on disposal in generic commercial facilities, because "**full waste**

[5] DOE 2016 FEIS Summary, p. S-22.

emplacement operations at WIPP are not expected until the 2021 timeframe". WIPP, however, has been operating at a reduced level, accepting waste for disposal, so there was no necessity to focus only on commercial facilities for the evaluation in the 2016 FEIS. [6]

DOE dismisses this event too easily and it cost taxpayers approximately $2 billion, while exposing workers to damaged health. Other adverse consequences and disasters plague our nation at many sites around the country and they occur frequently. If NRC and DOE utilized the actual record of adverse events at nuclear sites around the country to identify the root cause and used that information to prepare environmental impact statements (EISs) we might have more EISs that actually identify potential consequences, rather than EISs that provide extraordinary amounts of false assurances.

At Hanford a tunnel collapse spread plutonium for more than 3 square miles and also exposed workers. We believe every nuclear waste site has suffered accidents and adverse events associated with insufficient health and safety protections. Despite this every new environmental impact statement seems written in advance of analysis to predict zero or minor environmental and health impacts. Agency predictions of no harm should not display such a wide disparity from REALITY.

Those many realities should be effectively catalogued so they can be utilized as guidance when preparing environmental impact statements. In this way the adverse events can become the lessons learned to guide all future predictions.

It should be noted that the NRC Regulatory Basis is NOT an Environmental Impact Statement. Only a very limited health and safety analysis was performed. DOE and NRC are dealing with extraordinary hazards associated with GTCC nuclear wastes and need to appropriately analyze and evaluate such hazards in order to provide defense in depth.

Recommendation: Both of our nuclear agencies- NRC and DOE need to investigate and document all actual adverse experiences at nuclear waste sites around the nation to better inform credible safety and health analyses to

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[6] DOE Environmental Assessment for the Disposal of GTCC-like Waste at Waste Control Specialists, Andrews County, Texas, Oct. 2018, p.1-1.

properly evaluate new programs and regulatory changes, and to be equipped to reject bad ideas, projects and plans.

9. West Valley Nuclear Waste Site, New York

The sole content of NRC's Regulatory Basis related to West Valley is embodied in several tables related to the total amount of Greater than Class C waste and transuranics in the nation.

The NRC volume of 11, 285m^3 for GTCC waste is under DOE's estimate of 12,000 m^3 or 420,000 ft^3 in its FEIS. A factor of 35.31 is used to convert cubic meters to cubic feet. NRC states that the single largest amount of GTCC waste comes from the West Valley Demonstration Project. [7] The Demonstration part of the project related to vitrification of high level liquid reprocessing wastes. It should be noted that the State disposal area is included in these tables, but the state facility is independent of DOE.

A weird construct was created in the establishment of Groups I & 2 for GTCC waste. Group 2 supposedly represents "Potential waste" estimates for the future. Unfortunately all of the West Valley waste is actual GTCC waste or GTCC-like waste that must be properly managed and isolated from humans until it can be disposed. It is only "potential" waste in that regulatory agencies have not made a decision about what exactly to do with it. West Valley waste is **REAL** today!

West Valley GTCC waste amounts to 1250 cubic meters (m^3) or 25% of Group 1 waste and 5215 m^3 or 82% of Group 2 waste.

NRC's LLRW land disposal regulations 10 CFR 61 were finalized in 1982. A private operator, Nuclear Fuel Services, had been permitted to conduct nuclear reprocessing in 1966 prior to the passage of major environmental laws in 1970. After thoroughly contaminating the site the private operator decided it would be too expensive to meet new standards related to earthquakes and abandoned the site in 1972 after just six years of operation.

Since 1972 the site has been operating largely under Consent orders for remediation at the site largely under RCRA, not protective radiation standards. NRC mentions Site Operations as a key area where accidents and radioactive

[7] NRC Regulatory Basis, p. B-4

releases can occur. However, in recent proceedings, NRC and DOE have been primarily focused on what happens after Closure of a Disposal Site. **Operations involving Greater than Class C radioactive waste have been ongoing for 47 years at West Valley.** Most LLRW sites will have operations that are ongoing for a decade or more prior to closure. Why are the Agencies ignoring this lengthy period and assuming no extensive contamination occurs? A performance analysis should look at the entire system of disposal as outlined by DOE in 1987. We can attest to the fact that adverse consequences have occurred over 47 years at a site that meets almost none of the siting regulations in 10 CFR 61. The site sits on high plateaus that are extremely vulnerable to erosion. Groundwater discharges out of the side of the plateaus to waterways. Gully erosion is extensive adjacent to the State Disposal Area.

- There was a Cesium release from the main plant causing an air-borne plume which caused soil contamination by Cesium-137.

- There is a Strontium-90 Plume of groundwater contamination that covers multiple waste areas and a majority of the North Plateau at the site.

- Extensive water features on the site flooded the disposal areas with water (a moderator) despite the fact that plutonium was in both disposal areas. Plutonium in the presence of a moderator can lead to criticality. Interim remedial action was taken to limit flooding.

- After approximately 5 inches of rain fell in 1 hour in 2009 on already saturated ground, a landslide occurred at Buttermilk Creek – removing 15-20 feet of soil from the plateau bank and moving the Creek closer to the State Disposal Area where 12-15 lbs. of plutonium are buried.

- No site stability analysis has been done for the plateau where 2 disposal areas are located- the NRC disposal area and the State Disposal Area (NDA and SDA). NRC indicates in a memo, SRM-SECY-16-0106, that for Greater than Class C disposal they would plan to impose a 1000 year compliance period for site stability. However, the Technical analysis showed high dose hazards for GTCC beyond 10,000 years. If site stability is not required beyond 1000 years, GTCC waste would likely expose the public to extremely high radiation doses – including from inhalation and ingestion of alpha particles. The Site stability requirement in 10 CFR 61 states: *Areas must be avoided where* *surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts.*[8]

- Millions of dollars have been spent to provide short term remedial action addressed at only slowing the inexorable erosive processes at the site.

  A key question for West Valley is – **Where are the transuranics now?** The containers were moved from the Main Plant Process Building to a storage building. However we cannot clearly identify it because the charts in the Regulatory Basis do not list a storage building.

The Transuranics

The DOE Inspector General in April 2017 [9] identified significant contract management problems related to DOE management. These were not the first management problems. GAO and DOE both addressed management problems for correction over many years in the past. The Office of the Inspector General noted in 2017 that after approving a $333 million contract for Phase I work at West Valley, the contractor identified missing items from the scope of work. The important item for this discussion is that DOE omitted the task which involved relocation of the transuranic waste out of the Main Plant Process Building--

"Omitted the relocation of 222 containers of high-dose, remote-handled transuranic waste stored in the main plant building, yet it required the Contractor to demolish that building." p. 2 of the Acting Inspector General's letter.

As a result of the omissions from the work scope, a significant cost increase of $196 million was added to the $333 million dollar contract and a nearly 3-year schedule extension to the contract occurred. p. 1 of Detailed Findings

Unfortunately, because the information is limited in the Appendices to the Reg Basis we are unsure whether these transuranics are represented in the NRC waste inventory. It should also be noted that the 2003 Final Waste EIS for West

[8] *Technical analysis, p.52*
[9] https://www.energy.gov/sites/prod/files/2017/04/f34/DOE-OIG-17-05.pdf

Valley said that these transuranics would be sent off-site for disposal within 10 years, which would have been by 2013. There are no current plans for disposal.

We can draw some important conclusions from the environmental analyses performed by DOE and NRC.

West Valley meets almost none of the siting regulations under 10 CFR 61 and therefore cannot meet the performance requirements for even LLRW for its 2 disposal areas.

This made West Valley a logical place for DOE and NRC to review the operations there and the potential for releases of GTCC waste to the environment especially to offsite people, such as those living downstream within Seneca nation territory or drinking water from Lake Erie. The lack of site stability at this site means that landslides are a major concern for the spread of radiological contamination. The Oso Landslide in the State of Washington with similar soils caused significant loss of life. A landslide could dump the contents of the State disposal area entirely or a landslide could affect the integrity of both the SDA and NRC Disposal Areas.

Unfortunately the Agencies environmental analyses were limited almost entirely to final near-surface disposal – not the broader term of disposal system as DOE described in a 1987 report, discussed above under Topic # 1. It also restricted the scenarios considered.

Site Operations for GTCC were acknowledged by NRC as a cause of concern for accidents and releases. However most of the analyses were focused on Post-Final Disposal issues—failing to adequately analyze impacts of site operations, which may be ongoing for years or decades prior to final closure of a disposal facility.

10. Analysis of Public Health Protection

Alternatives and Regulatory Changes.[10]

[10] NRC Regulatory Basis, p. 35-49.

NRC does not provide the public and health professionals any reasonable options that encompass appropriate regulation of Greater than Class C waste. NRC original regulation in 10 CFR 61 addressed LLRW, and these regulations do not address GTCC waste. None of NRC's options include maintaining geological disposal for GTCC waste. All of the options involve allowing near-surface disposal. None of the options include amending the regulations to address appropriate levels of protection for the public from this much more hazardous radioactive class of nuclear waste, which requires isolation from humans forever.

The three alternatives are:

1) Applicants can make an application for a near-surface disposal facility to the Commission. With no changes to the regulations, the Commission can make a Case by Case determination whether to approve.

2) The Commission can issue guidance for applicants to assist them in applying for a permit and make no changes to the regulations and do case by case determinations for approvals.

3) The NRC can promulgate regulations and develop guidance specifically for a near- surface disposal facility. This would also allow Agreement states to regulate the GTCC disposal facilities.

However, the analyses conducted by technical consultants and NRC staff point to needed corrections and updating for 10 CFR 61 regulations, regardless of the final decision related to near-surface disposal of GTCC. The 10 CFR 61 regulations were written to address LLRW. GTCC waste is not adequately addressed in the regulations or the Tables there. We have highlighted some of these needed changes to the regulations in these comments.

In addition it is apparent that changes to 10 CFR 61 have been in process for some extended time period. The Commission and staff discussed issuing new regulations prior to dealing with GTCC. A more recent memo from the Commission changed the order of work so that GTCC would be dealt with prior to finishing a revised 10 CFR 61- in order for NRC to solicit public input on the regulations.

NRC has indicated that no regulatory changes would be one option. However, given the history of Commission directives, and discussions regarding the need for updating 10 CFR 61, we question how no regulatory changes could actually be one of the options.

Transuranics

"The Low Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA) requires that the disposal of LLRW result in the 'permanent isolation' of the LLRW.[11] The principal objective of LLRW disposal is protection of public health and safety for long periods of time when the waste may remain hazardous as the half-lives of some of the radionuclides that comprise LLRW are on the order of thousands of years and longer."

NRC maintains that because the 1985 revision to the LLRWPAA did not expressly exclude TRU waste, the NRC could proceed to revise 10 CFR 61 to include TRU as LLRW. The inclusion of transuranics creates a mixture that is hazardous for very long time periods – beyond 10,000 years, when site integrity no longer exists.

The NRC analysis of GTCC hazards

Near Surface disposal options included:

- shallow land burial in trenches up to 5 meters deep (could be less than 3ft. from surface)
- below ground vaults
- earth- mounded concrete bunkers
- disposal cells
- boreholes

Trenches are most common. NRC determined that borehole technology had not been adequately demonstrated. However, there was no real analysis of the other alternatives. NRC focused on shallow land burial for Near Surface disposal. NRC's analysis resulted in adjustments for Near-surface disposal requiring deeper burial of wastes to <u>a minimum of 5 meters below the cover</u>, and requiring <u>a 500 year intruder barrier</u> as a final cover.

[11] 42 USC. §2021b (7) Definition of disposal.

NRC Findings regarding impacts

The NRC found that 1) the majority of GTCC is potentially suitable for near surface disposal and 2) GTCC could be safely regulated by agreement states.

NRC identified ensuring long term protection as difficult for certain GTCC waste streams:

Waste Streams excluded related to Critical Mass issues:

- Sealed sources associated with neutron irradiators and remote-handled waste from WV decontamination activity are not suitable for near surface disposal related to operational accidents and theft or diversion.
- An additional waste stream from Mo-99 production is not suitable for Agreement state regulation.[12]

Assumptions

NRC assumed that GTCC waste would meet all 10 CFR 61 requirements for waste characteristics. The inclusion of Transuranics alone means that GTCC cannot meet the existing requirements under 10 CFR 61.2, Waste *means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in paragraphs (2), (3), and (4) of the definition of* Byproduct material *set forth in § 20.1003 of this chapter.*

In addition, as discussed under Topic #5 not all radionuclides were included when the regulations were developed and some need concentration limits.

The institutional control period is considered to be 100 years. 10 CFR 61.7 *(5) Waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste. This waste is disposed of at a greater depth than the other classes of waste so that subsequent surface activities by an intruder will not disturb the waste. Where site conditions prevent deeper disposal, intruder barriers such as concrete covers may be used. The effective life of these intruder barriers should be 500 years.* ***A maximum concentration of radionuclides is specified for all wastes so that at the end of the 500 year period, remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety. Waste with***

[12] NRC Regulatory Basis, p.24

concentrations above these limits is generally unacceptable for near-surface disposal. *There may be some instances where waste with concentrations greater than permitted for Class C would be acceptable for near-surface disposal with special processing or design. These will be evaluated on a case-by-case basis. Class C waste must also be stable.*

NRC in its own analyses found doses of 10,000 millirems/year, 10,000 years after final disposal. The acceptable dose of radiation is 25 millirems. NRC' own regulations make GTCC waste unacceptable for near-surface disposal.

Post closure period

NRC has difficulty rationalizing the problem of long lived radionuclides that can expose the public to high dose exposures as far into the future as 10,000 years post closure. Such a lengthy time period induces a great deal of uncertainty, for example- the Great Lakes were formed about 10,000 years ago. DOE's FEIS analysis also found doses as large as 10,000 mrem/year. Despite such alarming findings, NRC hangs on to an erroneous belief that engineered barriers and ideal physical site conditions can secure the waste and protect public health with reliance on passive management only, in the absence of ongoing active measures to secure the waste.[13]

Hazards to offsite Individuals during the post closure period.

Technical Analysis

The technical analysis was limited in multiple ways. Only Near-surface disposal was evaluated. The main variables evaluated were the depth of disposal of the waste and the presence of a robust intruder barrier. However, the contractors noted that "the amount, concentration and form of waste disposed can play an important role in determining the hazards of GTCC waste disposal. [14]

As discussed earlier, not all radionuclides present in GTCC waste were analyzed when 10 CFR 61 was developed. See Issue #5 above. The particular radionuclides present and their concentration can be considerably different in different waste streams and this can influence the types of hazards and their potential impacts.

Three classes of waste were originally defined: Class A, B and C. At the time the regulations were developed LLRW was envisioned to be waste that decayed to

[13] Ibid, Section 3.1.4, p. 22

[14] Ibid, Appendix, p, B-2.

acceptable levels by either 100 years for Class A or B or 500 years for Class C. The structure of NRC regulations was developed around this concept.[15]
NRC never talked about acceptable exposure levels for GTCC – the doses are significantly higher than for Class C LLRW and provide higher doses up to and beyond 10,000 years when any remaining disposal site integrity is unlikely.

Important Findings in the Technical Analysis

The methods for exposure analysis originally developed in Part 61 were quite different than they are today. In addition, previously exposure scenarios did not include water dependent pathways. [16] The older methods were used for the analyses. See discussion of differences in exposure analyses.

Some GTCC waste streams emit such high dose rates that they can only be handled with remote equipment to avoid high exposures. This is displayed for all to see in NRC tables, RH = Remote handled.

Some GTCC streams pose criticality risks due to Special Nuclear Material.

Some GTCC waste streams have large quantities of Transuranic materials. Some of these are long lived and pose unique hazards for inhalation and ingestion as alpha emitters. However, it is not clear that the weighting factor of 20 for alpha particles was applied in the exposure assessment.

A limited set of operational accidents were analyzed – damage to a waste container from dropping or low speed vehicle collisions.

Due to large doses of radioactivity in GTCC waste, the impacts of accidents are larger and the margin for operation or system error significantly smaller compared to Classes A, B and C waste. Therefore the management controls and other systems must be more robust.[17]

A fire analysis revealed that a release via fire could expose people to 16 Rems of radioactivity, a significant exposure, far above allowed worker annual exposure levels. GTCC with high TRU content was not evaluated in this exercise. However, a real operational accident (non-fire) at Hanford that contaminated

[15] Technical Analysis, p. 2.
[16] Appendix B p. 10-11.
[17] NRC Regulatory Basis, p. B-10

workers with plutonium and spread the contamination for over 3 square miles did occur this year.

Special phenomena related to GTCC waste disposal were not evaluated: Heat generation, radiolytic gas generation and criticality. These phenomena could affect the release rates from the disposal facility and the impacts to offsite members of the public or an intruder.

Most of the evaluation focused on post-closure of a near-surface disposal site. The operational period of receiving, assessing, sorting and placing waste into the disposal location and the length of the period in years was not evaluated.

While a few natural phenomena were considered, climate change impacts related to worsening or exacerbating weather events were not. Extreme rainfall could have impacts on GTCC waste and its containment prior to final closure of a disposal site.

NRC focused on small sealed sources, neutron irradiators, but did not consider large sealed sources containing cesium chloride. Sealed sources can be damaged or may not remain intact under disposal conditions. Cesium chloride is highly mobile in water and can even diffuse through concrete.

The inadvertent intruder could experience a dose of 500 mrems at 500 years after closure. Well -drilling would result in doses larger than 500 mrems. NRC assumed only 1 layer of waste for this scenario. Multiple layers would deliver higher doses.

Some GTCC waste has enough long- lived radionuclides that the hazard can remain for thousands of years.

Some GTCC waste carries high external radiation doses, such as Cobalt-60.

"Whereas doses to a hypothetical inadvertent intruder are generally decreasing with time, doses to an offsite individual from GTCC waste disposal are generally increasing with time up to 10,000 years after disposal." [18]

The inadvertent intruder excavation results show large impacts exceeding 10,000 mrem doses, which persist for more than 10,000 years for over half of the GTCC waste streams.[19] Excavation might occur for home construction.

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[18] NRC Regulatory Basis, p. B-18. See Figure B-5.

[19] NRC Technical Analysis, p.55

The dose for exposure is the result of the likelihood of exposure times the radionuclide concentrations. Because GTCC waste streams have much higher concentrations than Class, A, B and C, even infrequent events could contribute more significantly to total exposure and risks. [20]

It should be noted that the methodologies and results in the Technical Analysis are not always clear. NRC informs us that to see the contractor results we have to pursue 2 other references. The contractor analyses are documented in (Laplante, 2019) and (Wittmeyer, 2019). Only select results and inputs are discussed in the Technical Analysis document according to NRC.

Given time constraints and multiple documents that were relevant, this was not possible for us. The results in the Technical Analysis document are some combination of NRC staff and contractor work. While there may be some shortcomings, the selected findings demonstrate very high radiation exposure – beyond 10,000 years.

Conclusion

In 1987 following the passage of the LLRWPAA of 1985, NRC recommended to DOE disposal of GTCC waste in a high level waste geologic repository. NRC added that roughly 85% of the 2000 m^3 GTCC waste projected by DOE to the year 2020 is expected to contain large quantities of transuranic or other long-lived radionuclides of concern. In addition, NRC noted that the regulatory criteria for disposal of GTCC waste in a high level repository already exist at EPA and NRC.[21]

We are forced to question what occurred to affect such a substantive change in NRC's view of Greater than Class C radioactive waste since 1987. We are aware of government- wide deregulation efforts under the current Administration and it is a possible explanation. Enabling commercial entities to profit from cheaper disposal solutions is another possible rationale. NRC should require any commercial entity that plans to handle long term hazards like GTCC to ensure

[20] Ibid, p.51
[21] NUREG-1213, Rev. 1, Aug. 1987, p.10

adequate funds are set aside for maintenance and security of disposal in perpetuity to provide adequate public protection.

NRC should supply a complete explanation for recommending such weak and inadequate protection for the public from the hazards of GTCC waste.

Despite the existing limits of the safety analyses, we have very clear results that tell us the extreme hazard that the Greater than Class C radioactive waste mixture represents. NRC failed to complete a detailed defense in depth analysis for this proposal. Yet NRC did not alter its original objective based on the analyses and continues to propose near-surface disposal. There is no possible way for the NRC to legitimately argue that this mixture can be managed in near surface disposal facilities, except by ignoring science and health considerations and the findings from the Technical analysis.

NRC must maintain its existing requirements for geological disposal for this GTCC waste. Anything less that isolation of this waste from humans for as long as the hazard exists represents "intergenerational injustice," by transferring the harm to future generations. The current NRC proposal for inadequate isolation for GTCC also cannot suffice as a basis for transfer of responsibility to the state level.

We need NRC to articulate the extreme nature of the hazard and how exactly the long term hazard will be actively managed in order to provide permanent isolation of Greater than Class C radioactive waste from any future contact with the public for a period of time greater than 10,000 years, including via all possible exposure pathways. In 1991 Sierra Club developed their Low Level Radioactive Waste Policy which reflects considerable public concern about the proper management of radioactive waste. The policy states that waste with a hazardous life of greater than 100 years should be treated as "high- level" wastes. See attached policy.

We hope you will seriously consider our concerns and recommendations. Thank you for your consideration. If there are questions, please email or call B. Warren at 845-754-7951 or warrenba@msn.com

Respectfully,

Barbara Warren, RN, MS
Executive Director
Citizens' Environmental Coalition
New York

Encl.

Low Level Radioactive Waste

Sierra Club Policy

March 16-17, 1991

I. Goals

1. The public policy goals regarding "low-level" radioactive waste should be the termination of production of fuel cycle wastes and the isolation of such wastes in the safest and least environmentally damaging way achievable.
2. Congress and the Nuclear Regulatory Commission (NRC) should exclude from their definition of "low-level radioactive waste" any waste having a hazardous life* greater than a 100-year institutional control period.

a. Wastes with a hazardous life of less than one year shall be stored at the place of use or distribution until the end of that hazardous life.

b. Wastes with a hazardous life between one and 100 years shall be stored in specifically licensed facilities. Such waste shall not contain more than 10 nanocuries per gram of transuranic elements. Deliberate use of dilution to reduce the concentration of radioisotopes is unacceptable.

c. Wastes with a hazardous life greater than 100 years should be treated as "high-level" wastes.

II. Technology

1. "Low-level" wastes, as presently defined by the NRC, should be isolated by technology that results in zero-release of radioactivity over the hazardous life and one that minimizes inadvertent intrusion. Reliance cannot be placed on continuation of the present hydrogeology of sites. This is particularly true because global climate change will alter sea level and water tables. It is therefore essential that the waste be enclosed in a multi-barrier, water-impermeable system using materials with proper chemical and environmental stability. Whatever substances are used must be rigorously characterized

regarding stability, impermeability and resistance to the radiation levels and chemicals that will be encountered.

2. Federal sponsorship of generator-funded research and development should be provided for new engineered, site-specific waste isolation techniques. These techniques shall have the necessary water impermeability and structural resistance to seismic and other events to ensure isolation of the stored wastes for their full hazardous lives.
3. Sea, freshwater or space disposal of radioactive wastes should be completely prohibited.

III. Institutional Issues

1. Monitoring and the possibility of corrective action should be maintained prior to and for as long as socially possible after site closure.
2. Source and volume reduction of radioactive waste streams should be required, providing that reduction techniques and policies do not result in release of radioactivity to the environment or other adverse environmental and health impacts.
3. Siting and technology choice processes should provide full public participation through public notification of meetings, open meetings, access to documents, and procedures in conformity with the Federal Administrative Procedures Act. There should be opportunity for full litigative participation in all licensing actions.
4. State health, siting and other laws more stringent than federal law or compact provision should not be preempted.
5. Compact commissions, if any, and state waste management authorities or personnel should be prohibited from accepting private donations or grants. Petition and recall procedures should be provided for compact commissioners.
6. An environmental and health impact statement should be required for each radioactive waste storage, treatment or isolation facility. Pre- licensing baseline health studies and ongoing health monitoring studies should be required at all radioactive waste storage, treatment, and isolation sites.
7. Compliance with compact, federal and state guidelines and regulations should be facilitated by the enactment of strong, clearly defined penalties and disincentives for compliance failure by generators, processors, transporters, and radioactive waste storage and isolation facility builders and operators. During facility operation, the site operator should assume liability by means of rebuttable presumption in law.
8. No state should be required to take title to, possession of, or liability for radioactive wastes in the absence of full authority to regulate their generation.

IV. Financial Issues

1. The full cost of LLW isolation and monitoring should be borne by the generators of the waste. An extended care fund, paid for by charges imposed on generators, should cover the costs of site cleanup, decommissioning and active long-term monitoring, storage and health/environmental studies.

2. A long-term liability fund, paid for by charges imposed on generators, should compensate for personal injury and property damage in the event of leakage and provide the maximum third party liability insurance. During operation, cleanup, and decommissioning, the site operator should assume full liability through means of rebuttable presumption in law.
3. A fair and equitable mechanism for shared liability should be established among party states.
4. Disposal fees should be based on volume, radioisotope concentrations, and hazardous life of the wastes.

V. NRC policy on 'Below Regulatory Concern'

The Sierra Club urges Congress:

1. to repeal provisions of the Low-Level Radioactive Waste Policy Amendments Act of 1985 that require establishment of deregulation of some "low-level" nuclear wastes;
2. to remove federal preemption over radiation standards and radiological safety regulations so that states may set standards and regulations that exceed minimum federal ones; and
3. to revoke existing 1986 and 1990 Nuclear Regulatory Commission policy statements on Below Regulatory Concern and Expanded Exemptions of Practices.

The Sierra Club recommends that radioactive material and wastes that the NRC, Department of Energy or other agencies classified as radioactive materials or low-level radioactive waste as of January 1, 1989, shall continue to be classified as radioactive materials or low-level radioactive waste, to be isolated only in facilities licensed specifically for that purpose. The Sierra Club recommends that radiation- generating practices of licensees, including brokers, not be deregulated.

*Hazardous life -- the time required for the concentration of radioactive materials within a package to decay to the maximum permissible concentrations given in 10 CRF 20, App. V, Table 11.

Adopted by the Board of Directors, March 16-17, 1991 [replaced polices of May 1983 and December 1984]