March 28 2016

TO: Department of Energy
U.S. Department of Energy
Office of Nuclear Energy, Response to IPC
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RE: Response to IPC – DOE's radioactive spent fuel storage plan is designed to leak

Before seeking input on consent-based siting the Department of Energy (DOE) must develop a safer plan and have "informed" consent. Existing nuclear plant highly radioactive spent fuel storage facilities are not safe and the DOE's proposed pilot design models those inadequacies. The following issues must be addressed or the DOE's pilot plan is doomed to fail and leak radiation into the environment.

The majority of current U.S. irradiated spent fuel storage facilities use thin-walled (1/2" to 5/8") stainless steel canisters that the Nuclear Regulatory Commission (NRC) acknowledges are vulnerable to cracking and leaking. Once a crack initiates the NRC states it can grow through the canister wall in 16 years. *http://pbadupws.nrc.gov/docs/ML1425/ML14258A081.pdf*

A 2015 Sandia Lab report states that in hotter canisters cracks can grow through the wall even faster – less than 5 years (Attachment – Sandia Lab). These canisters have been in use for a number of years and may already have partial cracks. Partially cracked canisters are not approved for transport.

These canisters cannot be inspected (even on the outside), so no one knows the condition of the canisters. They cannot be repaired and maintained and have no early-warning monitoring system prior to a radiation leak. Most of these thin-walled canisters have not been in use long enough to leak. However, we will be reaching that point soon. Your plan to relocate these existing canisters without addressing these issues is a design to fail.

- **Storage containers**. Storage containers must be designed to be inspectable (inside and out), repairable, maintainable, not subject to structural cracks, and have early-warning monitoring prior to radiation leaks. Sites must have provisions for replacing failing fuel or failing canisters. Most other countries use thick-walled (about 10" to 20" thick) irradiated spent fuel storage casks that don't have these problems, such as in Germany, and Japan at Fukushima. Those countries also store their irradiated spent fuel containers in reinforced structures for additional environmental protection.
- **Radiation monitoring.** Near real-time radiation monitoring with public access must be required.
- **Long-term requirements**. Storage container requirements must be based on meeting short and long term needs, rather than on how much money Congress is willing to allocate each year. The DOE's current recommendation is the latter (partially due to Congress redirecting existing funds that were designated for a permanent repository).
- **Safety record**. The DOE must demonstrate that the federal government can fund, transport, and manage nuclear waste without significant radiation leaks and demonstrate that the federal government can comply with existing nuclear waste laws, contracts and agreements. They have not done this.
- **Funding.** The federal government must guarantee sufficient funds will be allocated for as long as the waste needs be transported and needs be stored -- up to 120 years for short-term storage (per NRC definition of short-term) and for long-term storage, which is basically

forever. Communities impacted by a radioactive release need to be adequately financially compensated.

- **Legal authority.** States and Tribal Nations must have legal authority to set higher standards for such things as storage and transport containers, aging management and radiation exposure levels. States must have enforcement authority for nuclear waste stored in or near their communities based on potential radioactive contamination zones. They also must have adequate funding to administer and enforce these requirements.
- **Transport**. The DOE must address major transport infrastructure issues and the safety of transporting irradiated spent fuel through our communities. Communities must have on-line access to transport accident records and status of transport infrastructure for any potential routes used for transport. Some canisters may require up to 45 years of cooling before they meet Department of Transportation radiation limits (Attachment – Transport).
- **Consent.** Regarding consent, each state and locality must be legally authorized to establish its own criteria for standing and volunteer status, and no further requirements may be set by the federal government except that any expression of interest must affirm that it is consistent with the requirements of Executive Order 12898 regarding Environmental Justice.

Until such time as these issues are addressed, it would be folly for any community to agree to be a spent fuel storage site for high level nuclear spent fuel, where each thin-walled canister contains about as much Cesium-137 as was released from Chernobyl and could start leaking after 20 years of use with no plan to mitigate leaks.

DETAILS

Current DOE sites leak radiation: Current DOE managed sites consistently leak radiation into the environment from leaking or exploding inferior storage containers, such as Hanford in Washington, Savannah River Site in South Carolina, the Waste Isolation Pilot Project (WIPP) in New Mexico, Idaho National Lab and other sites.

There is a pattern of selecting inferior containers that are not even sufficient for short-term storage – containers that cannot be inspected, monitored, repaired and maintained. In essence, these storage containers are designed to fail. The DOE must demonstrate they can resolve these issues before moving forward with any consent-based siting process.

DOE pilot project is designed to fail and leak radiation: The proposed DOE irradiated spent fuel nuclear waste storage plan is designed to fail. It proposes transporting and storing existing thin-walled stainless steel canisters (1/2" to 5/8" thick) that cannot be inspected, repaired, maintained, have no early warning system prior to a radiation leak, can corrode and crack, and can start leaking millions of curies of radiation after 20 years of storage, possibly sooner. A 2015 Sandia Lab report shows that once cracks start in hotter thin-walled stainless steel canisters, they can grow through the wall of the canister in less than 5 years (Attachment - Sandia Chart).

A failure of even one of these "Chernobyl" canisters could be catastrophic. There is potential for explosions, due to the unstable and pyrophoric nature of these materials when exposed to air. (*Damaged Spent Nuclear Fuel at U.S. DOE Facilities*, *Experience and Lessons Learned*, *INL,* Nov 2005 INL/EXT-05-00760, Page 4 & 5)*. https://inldigitallibrary.inl.gov/sti/3396549.pdf*

The DOE pilot design has no provisions to address these issues and provides no remediation for failing canisters. Most of the over 2000 U.S. thin-walled canisters have been in use less than 20 years, so we have not seen through-wall cracks yet. However, the DOE must address this issue in

their plans. The NRC's initial 20-year dry storage container certification considers "out of scope" any problems that may occur after 20 years. In their relicensing the NRC aging management plan (NUREG-1927 Rev 1 Draft) requires canisters with 75% through-wall cracks be taken out of service. However, the method to accomplish this or even inspect and measure cracks does not exist for canisters filled with irradiated spent fuel. *http://pbadupws.nrc.gov/docs/ML1605/ML16053A199.html* NRC regulations do not allow the transportation of canisters with even partial cracks (10 CFR § 71.85 *Packaging and Transportation of Radioactive Materials*).

Neither the outside or inside structure of these thin-walled welded canisters can be inspected, let alone repaired. Other countries use thick-walled casks that do not have these problems.

Both the DOE and NRC have chosen to continue endorsing the inferior technology even though NRC Commissioners directed staff to "encourage the adoption of state of the art technology for storage and transportation". *Staff Requirements – COMDEK-09-0001 – Revisiting the Paradigm for Spent Fuel Storage and Transportation Regulatory Programs*, February 18, 2010 *http://pbadupws.nrc.gov/docs/ML1004/ML100491511.pdf*

> NRC Director of Spent Fuel Management Division, Mark Lombard states **inspecting these canisters "is not a now thing"** *(https://youtu.be/QtFs9u5Z2CA).*
>
> Dr. Kris Singh, Holtec thin-walled canister President, states that **even a microscopic crack will release millions of curies of radiation into the environment and that the canisters are not repairable**. *(https://youtu.be/euaFZt0YPi4).*

Canisters may need to stay on-site for up to 45 years before they are cool enough to meet Department of Transportation radiation dose requirements (Attachment – Transport).

Don't take us for a ride: Would you buy a car for your family that could not be inspected, maintained, and repaired and provided no warning before the engine or brakes failed? That is basically what you are asking our families to do with these thin-walled irradiated spent fuel storage canisters. The Delorean cars looked good until the stainless steel 304 alloy panels began corroding. This is the same material used in most of the over 2000 U.S. thin-walled stainless steel canisters. NRC material engineers state that operating experience with both 304 and 316 stainless steel alloys demonstrate these problems. Numerous environmental and other factors can initiate corrosion and cracking (e.g., corrosive salt particles and from sulfites in air pollution and vehicle exhaust).

States need legal authority: States and communities currently have no legal rights to set higher standards for storage and transport and have no legal recourse for DOE mismanaged facilities or for DOE broken promises. The State of Idaho is one of the few states with a legal agreement, yet the DOE has not met the conditions of that contract. DOE's promise to remove nuclear waste from Idaho by 2035 appears to be a goal rather than a commitment. *https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement/*

Consent-based siting meetings and process inadequate: At the first consent meeting on January 20, 2016, the question was asked about having public meetings covering technical issues. The DOE appears to want to skip over this part of the process. Instead, we were referred to another federal agency, the Nuclear Waste Technical Review Board (NWTRB) who does not have responsibility for the design and management of the sites. Their function is to perform independent scientific and technical peer review of the DOE program for managing and disposing of high-level radioactive waste and spent nuclear fuel and provide findings and recommendations to Congress, the Secretary of Energy, and public. Questions about the issues with the existing thin-walled canisters were ignored.

SUMMARY

Unless the issues identified in this document are resolved, the DOE project is designed to fail and leak radiation into the environment.

The DOE must choose the best technology available internationally for interim storage and not rely on U.S. vendors for their technology solutions, as is now the case. This must be a decision based on long-term safety, not short-term cost savings, as is now the case. Anything less is unacceptable.

The DOE must exceed NRC minimum standards in order to avoid radiation leaks and potential explosions. Most of the rest of the world uses thick metal storage/transport casks (10" to 20" thick) and stores them in reinforced buildings for additional security and environmental protection. They do not have the issues of the thin-walled canisters and they are designed to be maintained. A quality engineering design has aging management built into the design. These thin-walled canisters do not meet that standard yet the DOE plans to use them.

Transportation issues are mentioned as problematic, but insufficient details are provided in terms of costs, technical and safety issues. For example, no mention has been made about the amount of cooling time required before transport (which may be over 45 years for 37-fuel assembly canisters) or how to address the fact that existing thin-walled canisters may already have cracks.

Since the interior of the canisters also cannot be examined, the condition of existing fuel assemblies is unknown. And the DOE is ignoring the DOE Standard Contract that requires fuel assembly retrievability.

Rather than consent-based siting, DOE efforts and public meetings must be focused on storage, transport, and funding; state, local and Indian Nation legal authority; and environment justice issues identified in this document.

It would be folly for any community to consent to the transportation and storage of high level irradiated spent nuclear fuel until all these critical issues are resolved.

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ATTACHMENT – Sandia Chart

Thin-walled stainless steel U.S. irradiated spent fuel storage canisters at higher temperatures will have faster crack growth rate. The Sandia Chart below shows higher temperatures can cause canisters to penetrate the wall in less than 5 years. This chart assumes canister wall is 0.625" (5/8") thick. The majority of the U.S. canisters are only 0.50" (1/2") thick. It is unknown when a crack will start, but these canisters are subject to corrosion and cracking from environmental conditions such as chloride salts, air pollution (sulfides), pitting, and microscopic scratches. The report states that canisters such as those at Diablo Canyon have temperatures in these heat ranges.

Draft Geologic Disposal Requirements Basis for STAD Specification, A. Ilgen, C. Bryan, and E. Hardin, Sandia National Laboratories, March 25, 2015, FCRD-NFST-2013-000723 SAND2015-2175R, PDF Page 36 & 46 *http://prod.sandia.gov/techlib/access-control.cgi/2015/152175r.pdf*

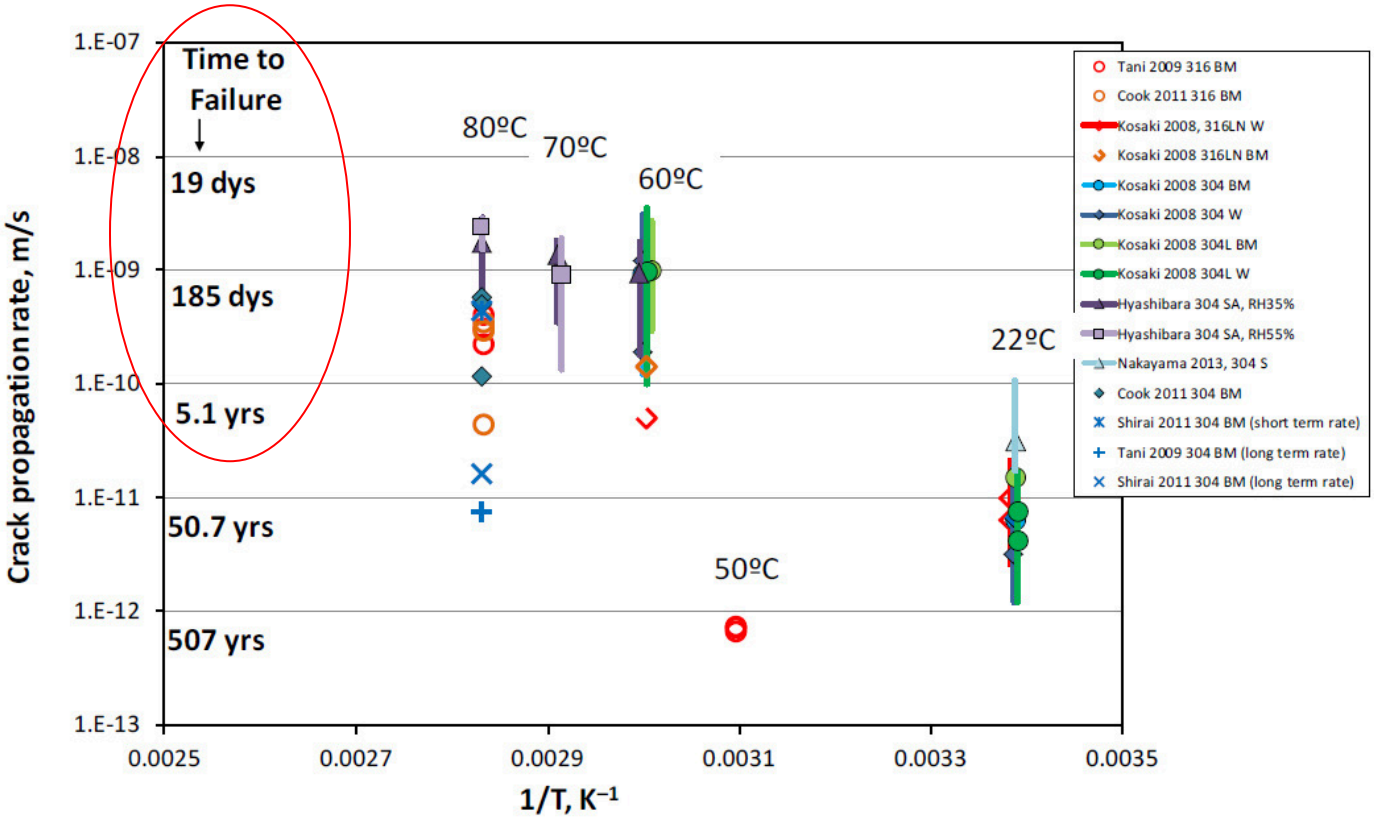

Figure E-5. SCC propagation rates for atmospheric corrosion of 304SS and 316SS. BM –base metal; W–weld sample; SA–solution annealed; S–sensitized. Bars represent reported ranges (if more than one), while symbols represent average values. Time to failure corresponds to the time required to penetrate a 0.625" thick canister wall.

ATTACHMENT – Transport

Canisters with 37 spent fuel assemblies may require up to 45 years to cool (after removal from the reactor) before they are safe enough to transport (~20 kW) per Dept. of Transportation radiation limits.

Research and Development Activities Related to the Direct Disposal of Dual Purpose Canisters, William Boyle, Director, Office of Used Nuclear Fuel Disposition R&D (NE-53), U.S. Department of Energy, Nuclear Waste Technical Review Board Meeting, April 16, 2013 *http://www.nwtrb.gov/meetings/2013/april/boyle.pdf*

Safety Evaluation Report Docket No. 71-9302, NUHOMS-MP197HB, Certificate of Compliance No. 9302, Rev. 7, Page 14
http://pbadupws.nrc.gov/docs/ML1411/ML14114A132.pdf
Note: The only NRC approved high burnup transport cask is the NUHOMS MP197HB.

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

Long-Term Performance Challenges

- **Thermal Load Management**
  - DPCs are now loaded at about 20 kW
  - Canister design storage limits are typically 24 kW, maximum currently available is rated to 40.8 kW for storage
  - Hottest waste packages considered for Yucca Mountain emplacement were 18 kW
  - Other repository design concepts call for much cooler waste packages (e.g., SKB calls for initial load per package ≤ 1.7 kW)
- **Other performance considerations**
  - Engineered barrier performance at elevated temperatures (e.g., clay-based backfill/buffer performance)
  - Criticality control

Estimated Cooling Time for PWR fuel to Reach Specified Thermal Power, as a Function of Canister Size and Burnup