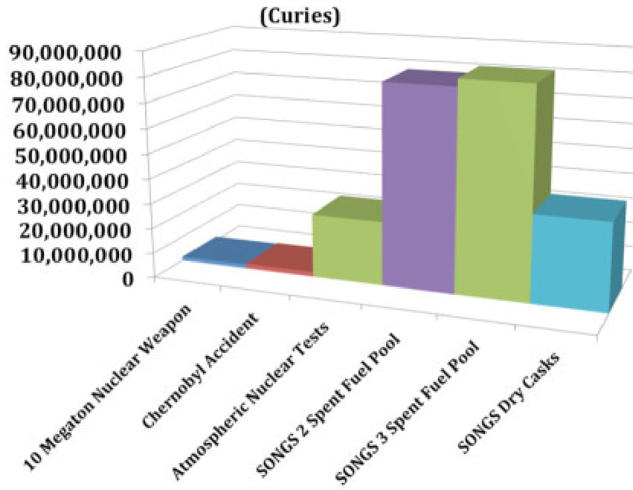
Urgent Nuclear Waste Canister Problems & Solutions

Problems



Curies of Cesium-137. Robert Alvarez, June 2013

- **May leak after 20 years:** San Onofre and most other U.S. nuclear plants store spent nuclear fuel waste in thin-walled (1/2" to 5/8" thick) welded stainless steel canisters that may crack and start leaking radiation after 20 years due to atmospheric and other corrosion factors.

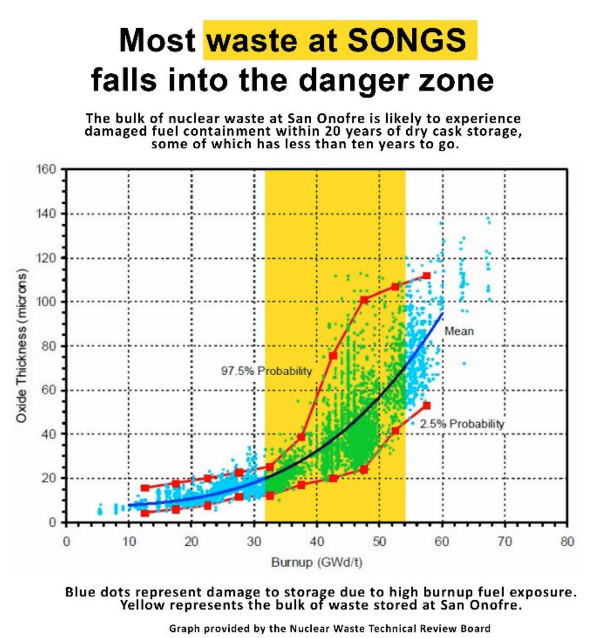
  Most thin-wall canisters have been in use less than 20 years. San Onofre canisters have been used since 2003.[1]

  Once a crack starts it continues to grow through the wall of the canister in about 16 years. A Koeberg nuclear plant component leaked in 17 years from cracks deeper than the thickness of most thin canisters. A two-year old Diablo Canyon canister has all the *conditions* for stress corrosion cracking from corrosive salt and moisture.[2]

- **Cannot be inspected:** Thin canisters cannot be inspected for even exterior cracks, so no one will know if any of the over 2000 U.S. thin canisters have cracks until they start leaking radiation. And the interior of the canisters, including the spent fuel assemblies cannot be inspected without destroying the canister. The nuclear industry promises they will eventually find a way to inspect the canisters, but even if they do, they cannot be repaired.[3]

- **Cannot be repaired:** Holtec canister vendor states even a microscopic through-wall crack will release millions of curies of radiation into the environment and even if you could find the cracks, it's not feasible to repair them without introducing another corrosion factor. [4]

- **Cannot transport if cracked:** Canisters with even partial cracks are not approved for transport. Contents need to be inspected before transport. This cannot be done with canisters welded shut. NRC Regulation 10 CFR § 71.85. Cracking can start within a few years.



- **No warning prior to radiation release:**

  Thin canisters have no continuous early warning system prior to a radiation release and no defense in depth. Thin canisters are stored in vented concrete overpacks which would allow radioactive gas releases from leaking canisters.

  Each canister contains roughly the number of radionuclides (Cesium-137) released from the 1986 Chernobyl nuclear disaster.[5]

  If exposed to air, spent fuel assemblies can explode. High burnup fuel (fuel that's been allowed to burn longer in the reactor) is more than twice as radioactive and over twice as hot and can damage Zirconium fuel cladding (rods), uranium fuel pellets and fuel basket.[6]

- **NRC allows facilities to hide radiation levels:**
  NRC has discontinued requirement to measure and report radiation levels at outlet air vents. This is where levels will be highest with through-wall canister cracks. The NRC refuses to share current radiation levels from both inlet and outlet air vents of the canisters.
- **No replacement plan: Most nuclear waste generators plan to destroy spent fuel pools after decommissioning**. However, the only method they have to replace canisters is to unload the fuel in a spent fuel pool. Crystal River is the only plant planning to keep their pools until all nuclear waste is removed from their site. The NRC is now allowing nuclear facilities to load hotter fuel in dry storage to the point the pool cannot be used to unload hotter fuel. Instead, a large "hot cell" is needed. This is a dry fuel handling facility filled with an inert gas, so nothing explodes. However, no facility has plans to build a large hot cell. The last hot cell large enough to do this was destroyed in 2007 (Idaho Test Area North hot cell).

  The DOE standard contract requires utilities be able to retrieve fuel assemblies from the canister and place in DOE approved transport casks. Without the pools, they cannot comply.

  The utilities have no plan to address cracked canisters or retrievability requirements, only unsubstantiated promises of future solutions and hope that nothing will go wrong.

  No funds are allocated to replace cracked canisters, to replace spent fuel pools or for any other remediation option. Each canister would cost over a million dollars to replace and no funds are allocated for this.

Recommendations

Our elected officials must demand higher safety standards that are at least as good as what most of the rest of the world uses. Most other countries, such as Japan and Germany, use 10" to 20" thick metal storage/transport casks, with two bolted lids. They do not have any of the thin canister problems. The casks are stored in reinforced buildings (rather than outdoors) for additional environmental protection. U.S. utilities migrated from thick casks to thin canisters, choosing profits over safety.

- **Require these minimum nuclear waste dry storage and transport standards:**
  - Current ability to inspect, repair, maintain and use materials that do not crack.
  - Continuous remote early warning system prior to a radiation leak.
  - Defense-in-depth (e.g., redundancies, no single point of failure)
  - Retrievable spent fuel assemblies without destroying the container.
  - Fuel assemblies and interior of container must be inspectable without destroying the container.
  - Store in reinforced buildings for additional environmental protection.
  - Transportable.
  - Replacement plan in place (e.g., keep the spent fuel pools until after all nuclear waste is removed from the site or another option (i.e., hot cell) is on site.
  - Require any interim storage sites meet these same requirements.

- **Implement state laws requiring utilities fund state and local emergency planning and online continuous radiation monitoring until all nuclear waste is removed from the sites. Provide public online access to this data.**

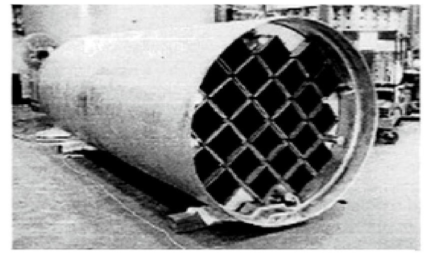
- **Require utilities develop a plan to relocate nuclear waste in safe containers to an operating nuclear reactor, away from populated areas and away from areas with high risk of coastal or other corrosion and coastal erosion.**

Reasons to require THICK casks

Safety Features	Thin canisters	Thick casks
1. Thick walls	**1/2" - 5/8"**	**10" - 19.75"**
2. Won't crack		√
3. Ability to inspect, repair, maintain (inside & out)		√
4. Pressure monitoring, pressure relief valve		√
5. Monitor system prevents leaks		√
6. ASME container certification (N3 stamp)		√
7. Defense in depth (redundancy)		√
8. Stored in concrete building		√
9. Gamma & neutron protection	Need overpack	√
10. Transportable w/o add'l cask & inspectable		√
Market leader	**U.S.**	**World**

NRC licenses thin & thick-wall containers. Process requires 18 to 30 months and costs millions of dollars. Vendors will only apply for a license if they have a customer. Most U.S. customers choose thin-wall canisters for short-term cost savings. Unlike other countries, NRC refuses to enforce safety regulations & allows exemptions to ASME pressure vessel manufacturing standards. This is a partial list of safety features. NRC only requires quarterly monitoring of radiation levels. Instead of requiring continuous monitoring, NRC allows elimination of reporting overpack outlet air vent radiation levels – where levels will be highest from through-wall cracks in canisters. SanOnofreSafety.org

Thin Canister



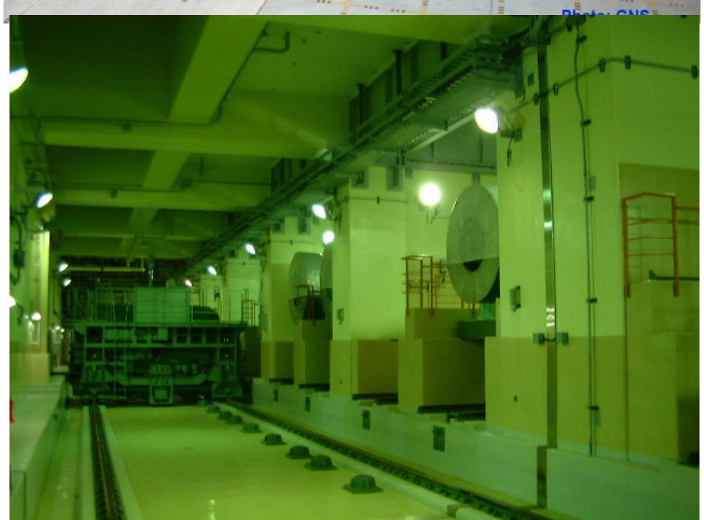
Thick Cask

Germany

Casks stored in buildings for additional environmental and security protection. Continuous remote radiation monitoring and pressure monitoring.

Japan

Casks stored in buildings survived 2011 Fukushima tsunami and 9.0 earthquake.



Nuclear waste storage myths

Myth 1. We are not aware of problems with any canisters.

No canisters have been inspected for corrosion or cracks, since there is no method to inspect them. Canisters must be inspected while inside concrete overpacks to avoid neutron and gamma ray exposure. Inspection technology for other stainless steel products is not directly transferable to canisters filled with nuclear waste.

Myth 2. We have inspected some canisters.

Visual inspection was limited to a small surface area of a few steel canisters, and only for canister temperature, surface dust and salts from a small area of the canisters. No crack or corrosion inspections. Even this limited inspection showed conditions exist for cracking at a 2-year old Holtec Diablo Canyon canister.[7] The NRC thought this would not happen for at least 30 years.[8]

Myth 3. We have technology to repair stainless steel.

That technology does not work for canisters loaded with nuclear waste, according to NRC and Holtec President.[9]

Myth 4. The public wants the fuel expedited out of fuel pools.

Yes, but not into inferior dry storage systems and not without adequate cooling of high burnup fuel.

Myth 5. Thick casks are not designed for extended storage and are not designed for welded lids.

Europe has used thick casks for over 40 years. Thick casks use bolted lids with replaceable seals. Fuel is not inspectable or retrievable with welded lids, so thin-wall canisters with welded lids is a disadvantage, not an advantage.

Myth 6. We have plans for replacing failed canisters using hot cells [dry transfer systems] or fuel pools.

There are no existing hot cells large enough to transfer fuel assemblies from one canister to another. Hot cells are extremely expensive to build and maintain. Also, there are no U.S. mobile hot cells. The French use a mobile hot cell that is too small for our needs. It is not feasible to build a mobile hot cell for the size needed. Utilities plan to destroy the fuel pools after fuel is unloaded to dry canisters. Also, repackaging in a pool could interfere with ongoing pool operations at active plants, could risk unacceptably contaminating the pool, or could challenge the fuel due to the additional stresses associated with rewetting and re-drying operations. [10]

Myth 7. All canisters and casks will eventually fail, so it doesn't matter which one we use.

Thin canisters are not maintainable, may have early failure and provide no warning before radiation leaks into the environment. Additional costs for thin canisters include transfer casks, transport casks, thick overpacks for final disposal (assuming DOE even allows these for final disposal), replacement canisters and cost to permanently store contaminated failed canisters.

Myth 8. Thick casks are not approved for transport by the NRC.

The NRC has not evaluated the thick casks for transport. Thick casks have been proven for storage and transport internationally, unlike thin canisters which have not.

Myth 9. Fukushima dry storage casks were not damaged, so canisters are safe.

Japan used Areva TN-24 thick steel casks stored in concrete buildings. Not thin canisters and none stored high burnup fuel.

Myth 10. Cracked canisters can be stored in transport or transfer casks and can be transported.

The NRC has not approved this and no vendor has submitted a plan to do this. Also, there is no plan as to what to do with the cracked canisters after that. Even partially cracked canisters are not approved for transport (NRC Reg. 10 CFR § 71.85). Neither the NRC nor the utilities have a plan in place to handle leaking canisters or have provided evidence of what will actually happen with a through-wall crack. It's possible there could be an explosion in canisters if air reaches the spent fuel. That's why canisters are filled with helium instead of air. High burnup fuel is known to degrade the highly explosive Zirconium fuel cladding. Zirconium powder is used to make fireworks.

Myth 11. Canisters will last at least 100 years.

This claim is largely based on a 2007 NRC Pilot Probability Risk Assessment[6][11] that excluded such things as aging issues and human error.

References

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