Urgent nuclear waste canister problems

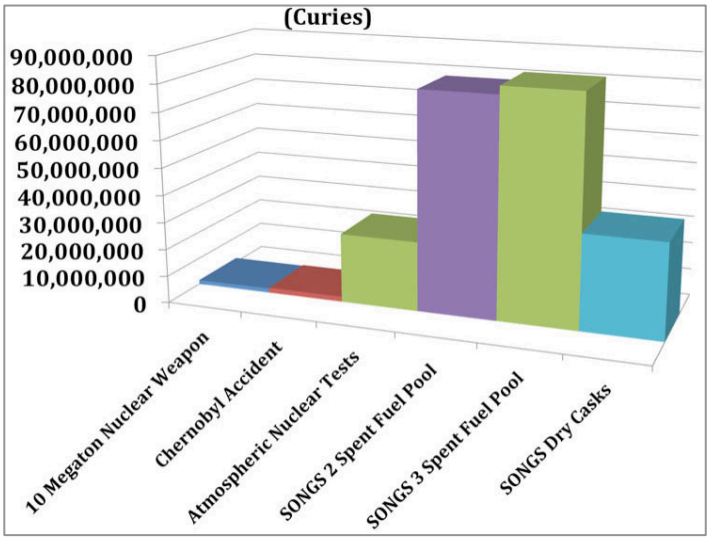
Canisters may leak radiation in 4 years and SoCal Edison has no solution.

Thin-wall (1/2" to 5/8") canisters can crack and leak radiation

- **San Onofre and most other U.S. nuclear plants store spent nuclear fuel waste in thin-wall (1/2" to 5/8" thick) welded stainless steel canisters that may crack and leak** radiation due to atmospheric and other corrosion factors.
- **The Nuclear Regulatory Commission (NRC) states the Koeberg nuclear plant had a container comparable to nuclear waste canister leak in only 17 years** with cracks deeper than most thin-wall canisters (up to 0.61" cracks). San Onofre canisters began loading in 2003, so we only have 4 years before this could happen here.
- **Once a crack starts it continues to grow through the wall of a canister in about 16 years.** A two-year old Diablo Canyon canister has all the *conditions* for stress corrosion cracking from corrosive marine salt and moisture. http://bit.ly/1uJQhLr

Canisters cannot be inspected or repaired on either the outside or inside and even microscopic cracks will release millions of curies of radiation into the environment with no warning.

- **Thin-wall 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. The NRC only requires quarterly testing for radiation leaks.
- **The interior of these welded canisters, including the spent fuel assemblies cannot be inspected** without destroying the canister. Years ago Japan banned use of aluminum baskets stating they won't last more than 60 years. Baskets keep each fuel assembly separated so they don't go "critical". The U.S. still uses aluminum baskets and the NRC has not addressed this issue. https://youtu.be/QtFs9u5Z2CA/
- **Holtec canister President Kris Singh 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. http://youtu.be/euaFZt0YPi4
- **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 more lethal radioactive Cesium-137 than released from Chernobyl**.
- **If exposed to air, spent fuel assemblies may 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 the Zirconium fuel cladding, causing it to become brittle and shatter like glass.



Transport problems unresolved.

Canisters with even partial cracks are not approved for transport (NRC Safety Reg.10 CFR § 71.85). Southern California Edison and most other decommissioning utilities have no plan in place to address this. Thin-wall canisters must be transported in transport casks and, due to weight and size, must be transported by rail. No one has addressed the U.S. rail infrastructure problems. A rail accident with one of these "Chernobyl" cans could be catastrophic with no adequate plan to manage a major accident.

Recommendations

- **Stop utilities from destroying spent fuel pools until all waste is removed from site.**

  Pools are the only NRC approved method to replace failing canisters. Crystal River is the only nuclear plant planning to keep their pools until all nuclear waste is removed from their site. The Nuclear Waste Policy Act requires Utilities to be able to retrieve fuel assemblies from the canister and place in Department of Energy approved transport casks. Without the pools, Utilities cannot comply. The Utilities have no current plan to address cracked canisters or retrievability requirements. They only have "vaporware" -- unsubstantiated promises of future solutions. Their real plan is hoping nothing goes wrong.

- **Freeze procurement of Holtec canisters and force utilities to buy currently available technology that doesn't have the flaws of the thin-wall canisters: Thick-walled storage/transport casks are current world standard.**

Safety Features	Thin Canisters	Thick Casks
1. Thick walls	1/2" to 5/8"	10" to ~20"
2. Won't crack		√
3. Ability to repair		√
4. Ability to inspect exterior & interior		√
5. Continuous early warning monitoring		√
6. ASME container quality certification		√
7. Defense in depth (redundant systems)		√
8. Stored in concrete building		√
9. Market leader	U.S.	World

The NRC licensing process requires 18 to 30 months and costs millions of dollars. Vendors will only apply for a license if they have a customer. That customer needs to be our utility companies.

The U.S. migrated to thin-wall canisters due to lower short-term costs. However, thin-wall canisters will actually cost more because of their shorter lifespan.

Edison's Decommissioning Plan to the NRC and California Public Utilities Commission (CPUC) provides no funding for replacement canisters, assumes nothing will go wrong with the canisters, and assumes the Department of Energy (DOE) will remove the San Onofre nuclear waste by 2048, even though their documents to the CPUC state the date is very unlikely to be met. Each canister costs over a million dollars to replace and no funds are allocated for this. Edison refuses to share the actual cost of the Holtec UMAX dry storage system. The Holtec warranty is only for 25 years for the canisters and only 10 years for the infrastructure that holds the canisters.

The California Public Utilities Commission regulates costs. The California Coastal Commission issues development permits to build nuclear waste facilities near the coast. The California Energy Commission sets nuclear energy policy. However, until the Governor and other elected officials are supportive, efforts with these agencies appears fruitless. Public awareness of these issues needs to be increased.

- **Elected officials must demand higher safety standards for storage and transport of spent nuclear fuel.** See sample City Council Resolution.
  https://sanonofresafety.files.wordpress.com/2012/05/resolutionsample2015-04-11a.pdf
- **Propose state and federal laws requiring utilities fund state and local emergency planning and on-line continuous radiation monitoring until all nuclear waste is removed from the site.** Require public on-line access to this data.
- **Oppose legislation that does not meet nuclear waste storage safety requirements.** For example, H.R.3643 *Interim Consolidated Store Act of 2015* eliminates the safety requirements for monitored retrievable storage as defined in the Nuclear Waste Policy Act of 1982. http://www.epw.senate.gov/nwpa82.pdf

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. The NRC is allowing vendors 5 years to solve this problem. [1] However, solutions will be inadequate.

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. [2] The NRC thought this would not happen for at least 30 years.[3]

Myth 3. We have technology to repair stainless steel. That technology does not work for loaded nuclear waste canisters, according to NRC and Holtec President. [4]

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 this is not an advantage.

Myth 6. We have plans for replacing failed canisters using hot cells [dry transfer systems] or fuel pools. There are no 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.[5]

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[1] 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] that excluded such things as aging issues and human error.

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[1] NRC 8/5/2014 stress corrosion cracking meeting summary *http://pbadupws.nrc.gov/docs/ML1425/ML14258A081.pdf*

[2] Diablo Canyon: conditions for stress corrosion cracking in 2 years, D. Gilmore, October 23, 2014 *https://sanonofresafety.files.wordpress.com/2011/11/diablocanyonscc-2014-10-23.pdf*

[3] NRC 8/5/2014 stress corrosion cracking meeting summary

[4] Holtec, Dr. Singh http://youtu.be/euaFZt0YPi4

[5] Dry Transfer Systems for Used Nuclear Fuel, Brett Carlsen, et.al. May 2012, Idaho National Lab, INL/EXT-12-26218 *http://www.inl.gov/technicalpublications/Documents/5516346.pdf*

[6] NRC NUREG-1864 March 2007 *http://pbadupws.nrc.gov/docs/ML0713/ML071340012.pdf*