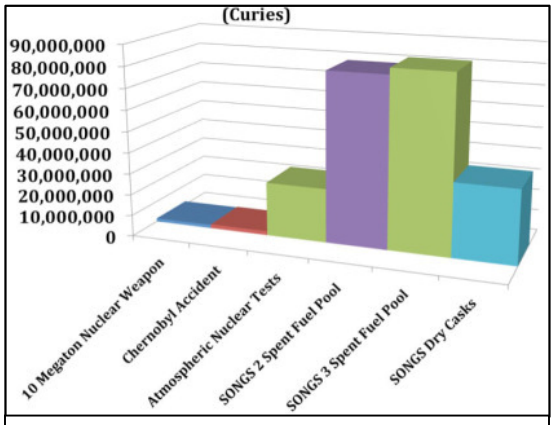
SPENT NUCLEAR FUEL DRY STORAGE FACT SHEET



Each canister holds roughly a Chernobyl nuclear disaster (CESIUM-137)

SUMMARY

The Nuclear Waste Technical Review Board December 2017 report to Congress states spent nuclear fuel and its containment must be monitored, retrievable and maintained in dry storage in a manner to prevent hydrogen gas explosions for both short-term and long-term storage and transport (NWTRB 2017). This is not currently being done and cannot be done with Holtec and other thin-wall welded canister systems. It can only be done with thick-wall bolted lid casks. This is a now problem. The consequences of failure can destroy our local, state and national economy, security, environment, and health of current and future generations.

The Department of Energy (DOE), Nuclear Regulatory Commission (NRC), Holtec and other vendors, and nuclear waste generators are ignoring these critical safety requirements and prioritizing short-term costs over safety. Thin-wall canisters are vulnerable to short-term cracking and leaking, cannot be inspected (inside or out), and cannot be maintained and monitored to **prevent** radioactive leaks. Each canister contains roughly a Chernobyl nuclear disaster (CESIUM-137).

Existing canisters are reaching the age where cracks can grow through the wall of the canister, causing radioactive releases into the environment and potential explosions and criticalities. No one knows how many canisters are cracking or how deep the cracks are. The NRC, Holtec and others will say they are not aware of any cracking canisters. They do not tell you it is because they have not and cannot inspect them for cracks or depth of cracks. Instead, they make unsubstantiated claims of longer lifespan for these canisters and unsubstantiated claims that they will be able to figure out how to repair them in the future. Kris Singh, President of Holtec, admitted even a microscopic through wall crack will release millions of curies of radionuclides. And even if you could find them, and find a way to repair them, repairing will create another area for cracking (HOLTEC VIDEO). Rather than solving these problems by requiring thick-wall casks, the NRC, vendors and nuclear waste generators continue to use and promote inferior thin-wall canister technology.

Southern California Edison, Tom Palmisano, recently admitted no U.S. nuclear facility can unload failing canisters back into spent fuel pools, in spite of this being a requirement of their licenses and in spite of having no current on-site or off-site option to replace failing canisters Holtec recently transported defectively designed canisters to a number of facilities. The problem was not caught until after four canisters were loaded at San Onofre. Claims these four canisters are safe (with bent and defective bolts (pins) falling out of the bottom of the spent fuel basket shims) are unsubstantiated. (SCE VIDEO) (NRC EMAIL 2018). Claims a leaking hot canister can be loaded inside a sealed container like a “Russian Doll” is not feasible and not approved by the NRC.

Holtec canisters arrived with basket shim support bolts bent and falling out. This is an indicator of poor design and quality control. Four San Onofre canisters with the defective design, loaded by Holtec, cannot be unloaded. Other facilities have Holtec canisters with defective new shims design.

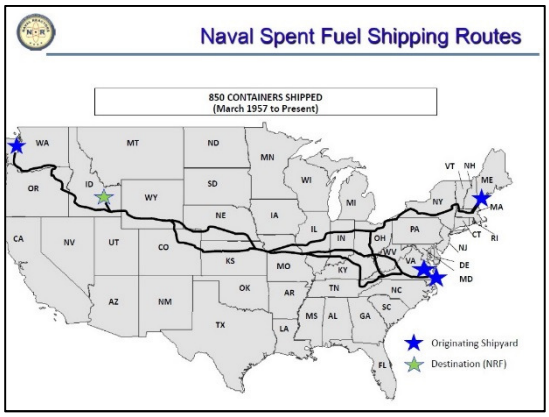
RECOMMENDATION

NWTRB recommendations should be implemented now.
Oppose H.R. 3053 Nuclear Waste Policy Amendment Act of 2018.
H.R. 3053 removes monitored retrievable spent fuel storage requirements and other critical storage, transport, and environmental safety requirements from the Nuclear Waste Policy Act as amended (NWPA). It gives total authority to the DOE, the NRC and a new Energy Czar. It removes oversite, and public input and transparency. It preempts a number of existing federal and state rights. It does not address urgent nuclear waste storage problems identified in this document. (HR3053GROUPS) (HR3053REASONS)

6/15/2018

HOLTEC AND OTHER PROPOSED CONSOLIDATED INTERIM STORAGE SYSTEMS MAKE THE PROBLEM WORSE

- Consolidated Interim Storage facilities, such as the one proposed by Holtec in New Mexico, will transport aging canisters to New Mexico or elsewhere with no method to inspect for cracking canisters or damaged fuel.
- Holtec's plan if a canister arrives in New Mexico leaking radiation, is to return to sender. They have no on-site ability to replace cracking, leaking canisters. Canisters are stored in holes with no drains. (HOLTEC SAR 2017). The soil is highly corrosive Potash (POTASH TABLE). Holtec's claims of no canister cracking risk is not substantiated by facts.
- The NRC is still studying whether high burnup fuel (fuel burned longer in the reactor) can be safely transported without becoming damaged.
- Transport regulations require content be intact, such as no cracks. No method exists to inspect for cracks or to determine the condition of fuel in the canisters before transport. Transport casks are approved, but containers and fuel must be separately qualified for transport (HOLTEC SOS).
- Ignores NWPA requirement to minimize transport risks before selecting a site. Transport infrastructure and transport logistics are not addressed before siting a facility.
- Claims the Navy moves spent fuel all the time but does not mention the Navy only takes one set route and uses more robust systems with less fuel per cask. (HOLTEC SOS)

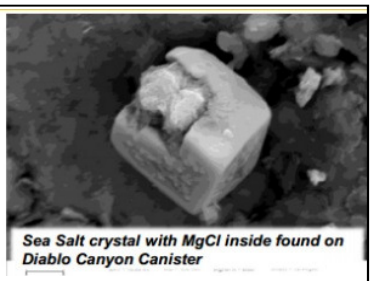


- Thousands of Holtec transports with their heavy unproven transport cask (up to 225 US tons) can degrade existing fragile rail and infrastructure systems. (HOLTEC SOS).

CRACKING RISKS OF HOLTEC AND OTHER THIN-WALL CANISTERS

- Most U.S. spent nuclear fuel dry storage facilities use welded thin-wall stainless steel canisters (1/2" to 5/8" thick). They are vulnerable to short-term cracking. They must be stored in thick overpacks that have air vents for convection cooling.
- San Onofre (CA) canisters up to 15 years old. Calvert Cliffs (MD) canisters are up to 25 years old. See (INVENTORY) for 2-page U.S. commercial dry storage container Inventory.
- Once cracks start in thin-wall canisters, they can grow through the wall in as little as 16 years. A comparable component, a Koeberg tank, leaked in 17 years with cracks longer that most thin-wall canisters (0.61"). It did not contain fuel. (KOEBERG)
- Moist salt air (chloride induced stress corrosion cracking) is one cause of crack initiation (NRC 2014). The NRC erroneously claims there is not enough humidity at San Onofre for corrosion and cracking. They ignore frequent fog, surf, and on-shore winds.

- Canisters are vulnerable to cracking in 2 years. The Electric Power Research Institute (EPRI) identified a two-year old Diablo Canyon Holtec canister that had a low enough temperature for moisture to stay on the canister surface to dissolve (deliquesce) salt particles, a major trigger for cracking. EPRI also found highly corrosive magnesium chloride (MgCl) salt particles. (DIABLO 2014).
- The NRC ignores this evidence and relies on EPRI reports that exclude the above and other evidence of premature cracking risks (EPRI 2015).



Two-year old Diablo Canyon Holtec canister has all the conditions for cracking. NRC and Holtec ignore this.

THIN-WALL CANISTERS CANNOT BE MAINTAINED

Thin-wall canisters cannot be inspected (inside or out), repaired, maintained or monitored to prevent radioactive leaks. Lids are welded, so contents (fuel assemblies, fuel baskets) are not inspectable, retrievable or maintainable. The NWPA requires monitored retrievable fuel storage. The NRC ignores this requirement (NRC ISG-2). H.R. 3053 removes these and other safety requirements. (HR3053GROUPS) (HR3053REASONS)

THICK-WALL CASKS MEET SAFETY REQUIREMENTS

- Safety requirements can only be met with thick-wall casks. Fukushima thick-wall casks survived the 2011 earthquake and tsunami. Most other countries and a few U.S. facilities use proven thick-wall metal bolted-lid casks.
- Thick casks are 10" to 19.75" thick. They do not require overpacks for storage or transport. They do not have cracking vulnerabilities. They have continuous monitoring to **prevent** radioactive leaks and continuous radiation monitoring.
- Other countries store casks in hardened buildings for additional environmental and security protection. U.S. facilities do not.
- Large dry fuel handing facilities (hot cells) are needed for both thin-wall canister and thick-wall cask systems for replacing containers, parts and contents.

NRC LOWERS SAFETY STANDARDS

- The NRC solutions for adequate inspection and repair do not exist for canisters loaded with fuel. No loaded canisters have been inspected for cracks or depth of cracks. Visual exams with cameras cannot find cracks or depth of cracks, yet this is what the NRC is approving as acceptable for license renewals (CALVERT CLIFFS).
- Other environmental and manufacturing conditions can cause thin-wall canisters to crack. The NRC is ignoring these vulnerabilities. KCl(3) Potassium Chlorate (potash) at all concentrations and at any temperature has severe risk of pitting and crevice corrosion of stainless steels used in thin-wall canisters (304/304L/316/316L SS). See Corrosion Resistance Table for details and other corrosion risks (POTASH TABLE). New Mexico ranks first in U.S. production of potash, amounting to 75% of domestic production (POTASH BLM).
- The NRC does not require and does not consider aging management in the initial 20-year dry storage license (HOLTEC UMAX 2015). License renewals require aging management. Canisters with 75% through-wall cracks must be taken out of service. However, nuclear facilities have no on-site or other method to do this, even if they could find and measure cracks. The NRC only requires limited "inspection" of one canister at each site (NRC NUREG-1927).
- There is no seismic earthquake rating for a partially cracked canister. The NRC is ignoring this issue.

NO PLAN TO PREVENT OR STOP RADOACTIVE LEAKS, EXPLOSIONS OR CRITICALITIES

- No facility in the U.S. can unload canisters back into the pool, even though this is required for their license. Tom Palmisano, Southern California Edison, admitted they cannot return spent fuel assemblies to the pools without a "reflooding" problem. Four defective recently loaded San Onofre Holtec canisters cannot be unloaded. They are 200 to 300 degrees C. Water boils at 100 degrees C. He said no facility in the U.S. can do this (SCE Video 2018). The NRC is ignoring this issue (NRC EMAIL 2018). The NRC allows facilities to destroy spent fuel pools once the fuel is all in dry storage containers, by falsely assuming nothing can go wrong in dry storage (DECOM 2016).
- The only other approved method to unload thin-wall canisters or thick-wall casks is in a dry fuel handling facility (hot cell). No ISFSI facility has a hot cell. No U.S. hot cell exists that is large enough to transfer fuel from one container to another. The last large hot cell that existed, the INL Test Area North (TAN) hot cell was destroyed in 2007 (INL HOT CELL). MPR Associates SONGS Used Fuel Management Defense in Depth white paper recommends using the TAN hot cell, even though the MPR reference says it was destroyed in 2007 (MPR 2017). This is the same company Southern California Edison hired to claim the four defective Holtec canisters are safe.
- Vendor claims a leaking canister can be stored inside an overpack (e.g., transport cask) are not feasible. No cask is approved for this purpose. The fuel would likely overheat, since there are no air vents, normally required for the canister overpack for convection cooling. Transport casks are not designed to be used for higher heat loads or for

storage. The NRC evaluated this situation years ago and determined it would only be a matter of months before the canister and fuel overheated. And this was for much cooler fuel than is used now.

- If a canister has a through wall crack, (unborated) water entering the canister will cause a criticality – an uncontrolled nuclear fission reaction. The NRC assumes there will never be through-wall cracks but have not provided evidence to support those claims. (MAPS GILMORE).
- Fuel burned longer in the reactor (high burnup fuel) can damage the fuel rods (cladding), the uranium fuel pellets and the aluminum baskets. Hydrides created by high burnup fuel can increase risk of explosions, if fuel rods are exposed to air at any temperature [HIGH BURNUP].

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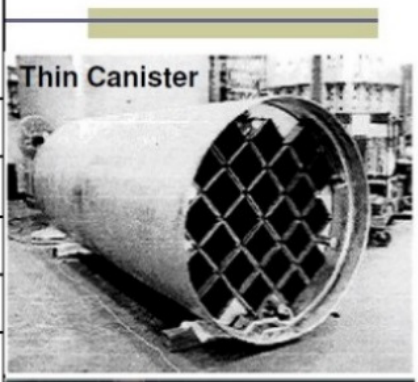
Additional resources and information at SanOnofreSafety.org

Reasons to require thick casks

Safety Features	Thin canisters	Thick casks
Thick walls	1/2"- 5/8"	10"- 19.75"
Won't crack		√
Ability to repair, replace seals		√
Ability to inspect (inside & out)		√
Monitor system prevents leaks		√
ASME container certification		√
Defense in depth (redundancy)		√
Stored in concrete building		√
Gamma & neutron protection	With concrete overpack	√
Transportable w/o add'l cask		√
Market leader	U.S.	World



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Thick casks in buildings for security & environmental protection

Japan – thick-wall casks in building at Fukushima

Survived 2011 Great Earthquake and tsunami

Germany – thick-wall casks in building at Gorleben

Stored for over 40 years without major problems