Zion plans to destroy spent nuclear fuel pools this year

Pools are the only viable option to replace cracked nuclear storage canisters

PROBLEM

- Zion and other Illinois nuclear plants store spent nuclear fuel waste in thin-walled (1/2" thick) stainless steel canisters that are subject to stress corrosion cracks from atmospheric and other corrosive conditions.
- The utility has no plan in place to deal with failed canisters.
- These thin canisters cannot be inspected for cracks, cannot be repaired, have no early warning prior to a radiation release, have no defense in depth. Most other countries use thick (10" to 20") metal casks without these problems.

URGENT ISSUE

Microscopic stress corrosion crack

- The only way to mitigate a failed canister is to return the canister to the spent fuel pools, remove the fuel and load into a new canister. Zion plans to destroy these pools this year.
- Similar components have leaked from cracks in 17 years. The Koeberg nuclear plant had a component leak in 17 years that was thicker than these ½" thick canisters. This corrosion cannot be prevented and could occur 20 years from canister loading.
- The utility has no plan to deal with cracked canisters, only unsubstantiated promises of future solutions.

IMPACT

- Each canister contains more radiation (Cesium-137) than released from Chernobyl. Thick concrete overpack air vents will allow radiation releases from failed canisters.
- Canisters cannot be transported if they have even partial cracks.
- The DOE standard contract requires Zion to be able to retrieve the fuel assemblies from the canister and place in DOE approved transport casks. Without the pools, they cannot comply.
- Rebuilding a spent fuel system or a dry transfer system estimated cost $250 to $500 million and would require considerable lead time. It has never been done at any nuclear plant.

RECOMMENDATION

- **Stop Zion from destroying spent fuel pools until they address the above issues**.
- Crystal River is keeping their empty pools to deal with the above issues. So should Zion.

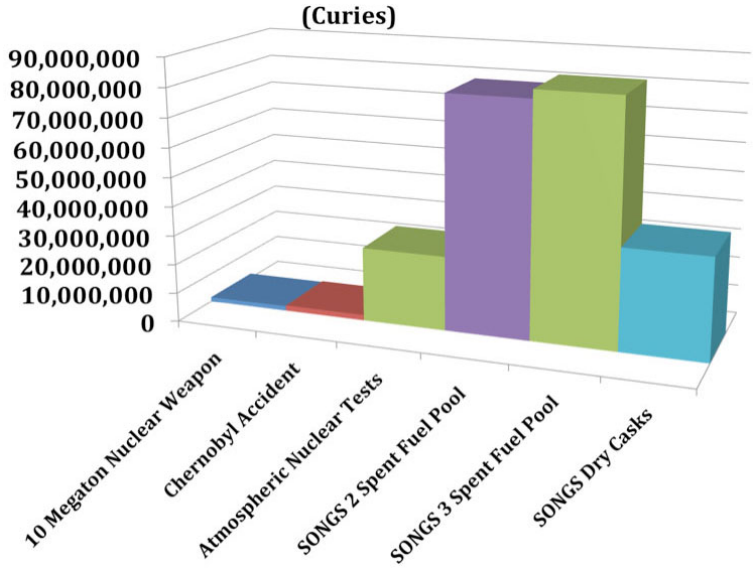
ILLINOIS STORAGE CANISTERS FIRST LOADING*		
Illinois Plants	**1st Loading**	**Canister System**
Braidwood	2011	Holtec HI-STORM 100S MPC-32
Byron	2010	Holtec HI-STORM MPC-32
Clinton	Pending	Holtec HI-STORM FW MPC-89
Dresden	2001	Holtec HI-STORM MPC-68
La Salle County	2010	Holtec HI-STORM MPC-68
Quad Cities	2005	Holtec HI-STORM MPC-68
Zion	2014	NAC MAGNASTOR 37 (61 canisters loaded, 1 with GTCC waste)

*Failure Modes and Effects Analysis (FMEA) of Welded Stainless Steel Canisters for Dry Cask Storage Systems EPRI Technical Final Report 3002000815, Dec 2013

Reasons to use thick spent nuclear fuel storage casks

Safety Features	Thin Canisters	Thick Casks
1. Thick walls	1/2"	up to 20"
2. Won't crack		√
3. Ability to repair		√
4. Ability to inspect exterior		√
5. Early warning monitor		√
6. ASME canister or cask quality certification		√
7. Defense in depth (redundant systems)		√
8. Stored in concrete building		√
9. Licensed in U.S.	*	*
10. Market leader	U.S.	World

- **The Koeberg Nuclear Power Plant had a similar thin container crack and leak in 17 years**. The container had multiple cracks up to 0.61" thick – thicker than most U.S. thin (0.50") canisters. Koeberg is located in South Africa in a coastal environment; one of the conditions for stress corrosion cracking. Other conditions, such as air pollutants can also cause cracking.
- **A 2-year old Diablo Canyon Holtec thin canister has all the conditions for cracking**. Once a crack starts, it can grow through the canister wall in 16 years. *http://bit.ly/1uJQhLr*
- **Each thin canister contains more radiation (Cesium-137) than released from Chernobyl.**
- **Holtec President (canister vendor) states a microscopic through-wall crack will release millions of curies of radiation into the environment and it's not feasible to repair them.** *http://youtu.be/euaFZt0YPi4*
- **Thin canisters cannot be inspected so we will only know after they leak radiation.** Technology has not been adapted to inspect canisters filled with nuclear waste.
- **Destroying spent fuel pools eliminates the only viable method to replace failed canisters.**



- **Dept. of Energy (DOE) contract requires utilities to move spent nuclear fuel assemblies to be retrievable so they can be loaded into a DOE transport cask**. This cannot be done without pools.
- **Canisters may already be cracking.**
- **Cracked canisters cannot be transported.** NRC Regulation 10 CFR § 71.85
- **No funding exists for transporting and storing waste** at interim sites and no one has agreed to assume liability for transporting the waste. No funding provided for needed infrastructure improvements.

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. The German thick casks can have a welded lid added.

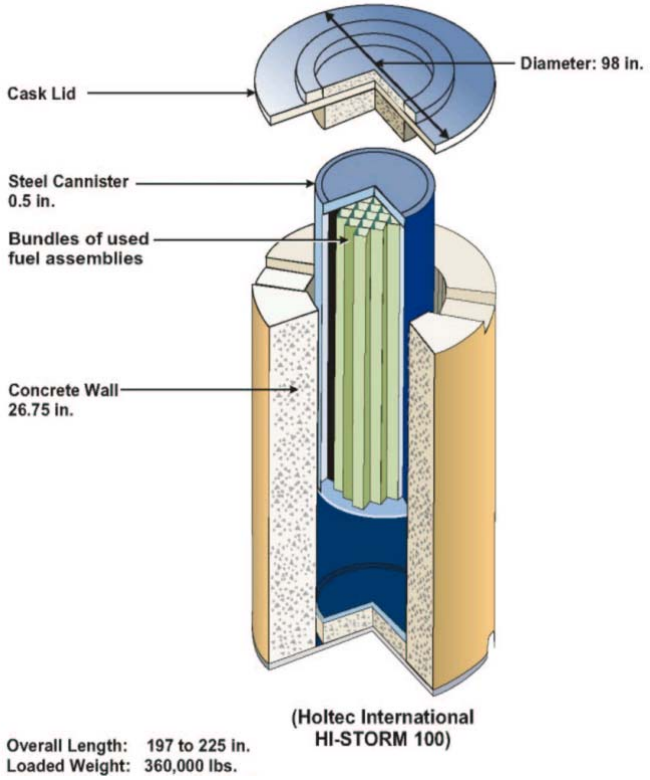
Myth 6. We have plans for replacing failed canisters using hot cells [dry transfer systems] or fuel pools. There are no hot cells large enough to transfer fuel assemblies from one canister to another. Hot cells are extremely expensive to build and maintain. Also, there are no U.S. mobile hot cells. The 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. Utility plans 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) and replacement 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.

Thin canister design



[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*