PR-72
80FR14332

6

As of: 4/28/15 11:02 AM
Received: April 20, 2015
Status: Pending_Post
Tracking No. 1jz-8iem-uzuc
Comments Due: April 20, 2015
Submission Type: Web

PUBLIC SUBMISSION

Docket: NRC-2014-0275
List of Approved Spent Fuel Storage Casks - Holtec International HI-STORM Flood/Wind Cask System, Amendment 1, Revision 1

Comment On: NRC-2014-0275-0001
List of Approved Spent Fuel Storage Casks: Holtec HI-STORM Flood/Wind System; Certificate of Compliance No. 1032, Amendment No. 1, Revision 1

Document: NRC-2014-0275-DRAFT-0008
Comment on FR Doc # 2015-06366

Submitter Information

Name: Donna Gilmore
Address: United States,
Email: dgilmore@cox.net

General Comment

Does the seismic formula and analysis consider the new information from the USGS "Fukushima Lessons Learned" that one fault can jump nine feet to another fault?

Does the seismic formula and analysis assume a 100% intact MPC thin (1/2" thick) canister?

Does the seismic and other analysis take into consideration the recent information about a similar Holtec MPC thin canister that has all the conditions for chloride induced stress corrosion cracking in a canister that has only been loaded with fuel for 2 years at Diablo Canyon. See details attached at at this link
https://sanonofresafety.files.wordpress.com/2011/11/diablocanyonscc-2014-10-23.pdf

Does this approval take into consideration the critical issues identified in the attached document, linked here.
https://sanonofresafety.files.wordpress.com/2011/11/reasonstobuythickcasks2015-04-16.pdf

Should the NRC 3/6/2015 decision regarding the Holtec HI-STORM Underground Maximum Capacity (UMAX) Canister Storage System that excludes use of UMAX system at San Onofre and other high seismic areas be excluded from this approval until the MPC is evaluated with the UMAX system?
http://www.gpo.gov/fdsys/pkg/FR-2015-03-06/html/2015-05238.htm

Attachments

DiabloCanyonSCC-2014-10-23

ReasonsToBuyThickCasks2015-04-16

Diablo Canyon: conditions for stress corrosion cracking in 2 years

A limited 2014 surface inspection found sea salt crystals on a Diablo Canyon Holtec dry storage canister that had been loaded with fuel for only two years. Two canisters were inspected, ranging from 2 to 3.5 years in service with heat load of 15 to 20 kW at time of loading. The inspection was limited to temperature and surface contaminants and was performed while the steel canisters were inside the concrete cask, due to radiation and damage concerns. Temperatures were low enough to trigger the corrosive environment needed for stress corrosion cracking initiation – much sooner than expected. [1, 2] Canister measured temperatures ranged from 49°C (120°F) to 118°C (245°F). Calculated temperatures ranged from 60°C (140°F) to 105°C (221°F). Lid – measured temperatures ranged from 87°C (188°F) to 97°C (207°F). [3]

Salt deliquescence can occur on interim storage containers only over a small part of the temperature and relative humidity (RH) range that the storage containers will experience. A reasonable maximum possible absolute humidity is 40-45 g/m3 for sea salts. This corresponds to a maximum temperature of deliquescence of ~85ºC. [4]

Crack initiation at the higher end of the temperature range (up to 80°C) is likely to occur sooner than at ambient temperatures.

> *Most austenitic stainless steels vessels and piping plant experience with SCC [stress corrosion cracking] suggests that incidence of SCC rises dramatically when temperatures exceed 55-60ºC. Stainless steel items operating above these temperatures are definitely candidates for preventative measures. Stainless steel equipment operating below 55-60ºC will not be totally immune to SCC. (Occasional failures have been reported on ambient temperature equipment after 10-15 years of service).*
>
> *An increase in temperature generally aggravates the conditions for SCC, other conditions being equal. Cracking is more likely to occur at 80ºC proceeding about four times faster at this higher temperature in "wicking" tests compared with 50°C. In tests lasting 10,000 hours each, the maximum chloride concentration to initiate SCC was determined to be about 400 ppm at 20°C and 100 ppm at 100°C. These parameters however will vary with the nature of the specific chloride involved. For example, SCC has been reported at temperatures as low as -20°C in methylene chloride, where the aggressive species was almost certainly hydrochloric acid itself, formed by hydrolysis.*[5]

The Electric Power Research Institute (EPRI) sample inspection of Diablo Canyon canisters and a few other facilities' canisters provided the first look at canister conditions. However, it was limited and not intended to find stress corrosion cracks. It was a visual look at canister condition for signs of gross change or unexpected condition, and an initial data collection to understand the actual canister conditions important to CISCC [Chloride-induced stress corrosion cracking] regarding temperature and surface compositions data only**.** It was not perfect and not the final step.[6]

A July 2010 UK report by R. Parrott and H. Pitts is extremely educational on the challenges and limitations of inspecting for stress corrosion cracking in stainless steel components. It addresses components other than loaded spent fuel dry storage canisters. (There is no current inspection method for loaded canisters.) However, the method they recommend as the most reliable is not even possible with loaded spent fuel dry storage canisters. See UK report for details.[7]

Dr. Hira Ahluwalia, materials and corrosion engineer, stated in an article

> *Visual identification prior to failure is difficult due to the typical tightness of stress-corrosion cracks…Typically, evidence of corrosion, such as accumulations of corrosion products, is not observed, although stains in the cracked region may be apparent. Stress-corrosion cracks tend to originate at physical discontinuities, such as pits, notches and corners. Areas that may possess high-residual stresses, such as welds or arc strikes, are also susceptible.*[8]

In addition to footnoted references, see following reports and *SanOnofreSafety.org* website.

Calvert Cliffs Stainless Steel Dry Storage Canister Inspection Report, 2014
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001025209

Data Report on Corrosion Testing of Stainless Steel SNF Storage Canisters, D.G. Enos, et al, Sandia National Laboratories, September 30, 2013, SAND2013-8314P [Calvin Cliffs]
http://www.energy.gov/sites/prod/files/2013/12/f5/CorrosionTestStainlessSteelSNFStorContainer.pdf

EPRI Chloride Induced Stress Corrosion Cracking of Spent Fuel Canisters, December 18, 2012 slide presentation. *http://pbadupws.nrc.gov/docs/ML1302/ML13022A316.pdf*

NRC Fourth Request for Additional Information for Renewal Application to Special Nuclear Materials License No. 2505 for the Calvert Cliffs Site Specific Independent Spent Fuel Storage Installation (TAC NO. L24475), June 23, 2014 *http://pbadupws.nrc.gov/docs/ML1417/ML14175B035.pdf*

Outside Diameter Initiated Stress Corrosion Cracking Revised Final White Paper, PA-MSC-0474, October 13, 2010, Ryan Hosler (AREVA), John Hall (Westinghouse) (includes San Onofre and others).
http://pbadupws.nrc.gov/docs/ML1104/ML110400241.pdf

NDE to Manage Atmospheric SCC in Canisters for Dry Storage of Spent Fuel: An Assessment, DOE, PNNL-22495, September 2013 *http://pbadupws.nrc.gov/docs/ML1327/ML13276A196.pdf*

EPRI Failure Modes and Effects Analysis (FMEA) of Welded Stainless Steel Canisters for Dry Cask Storage Systems, December 2013, includes dates U.S. casks first loaded.
https://sanonofresafety.files.wordpress.com/2013/06/epri2013-12-17failure-modes-and-effects-analysissscanisters.pdf

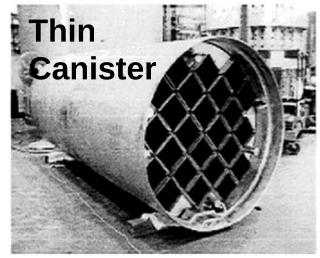
Stress Corrosion Cracking, Corrosion Morphology photos
http://abduh137.wordpress.com/2008/01/20/corrosion-morphology/

---

[1] *Understanding the Environment on the Surface of Spent Nuclear Fuel Interim Storage Containers*, Charles R. Bryan, David G. Enos, Sandia National Laboratories, June 2014 *http://psam12.org/proceedings/paper/paper_468_1.pdf*
[2] FY14 *DOE R&D in Support of the High Burnup Dry Storage Cask R&D Project*, William Boyle, DOE, NWTRB Meeting, August 6, 2014 (slide 12) *http://www.nwtrb.gov/meetings/2014/aug/boyle.pdf*
[3] *Update on In-Service Inspections of Stainless Steel Dry Storage Canisters*, EPRI, Keith Waldrop, Senior Project Manager, Presented by John Kessler, Program Manager, NEI-NRC Meeting on Spent Fuel Dry Storage Cask Material Degradation, January 28, 2014 (Diablo slides 17-19) *http://pbadupws.nrc.gov/docs/ML1405/ML14052A430.pdf*
[4] *Data Report on Corrosion Testing of Stainless Steel SNF Storage Canisters*, Sandia Lab, September 30, 2013.
http://www.energy.gov/sites/prod/files/2013/12/f5/CorrosionTestStainlessSteelSNFStorContainer.pdf
[5] *Cracked: The Secrets of Stress Corrosion Cracking,* Hira Ahluwalia, President of Material Selection Resources Inc. (MSR) *http://csidesigns.com/flowgeeks/cracked-the-secrets-of-stress-corrosion-cracking/*
[6] *Update on In-Service Inspections of Stainless Steel Dry Storage Canisters, EPRI, Keith Waldrop, Senior Project Manager*, presented by John Kessler, Program Manager, NEI-NRC Meeting on Spent Fuel Dry Storage Cask Material Degradation, January 28, 2014 (Diablo slides 17-19) *http://pbadupws.nrc.gov/docs/ML1405/ML14052A430.pdf*
[7] *Chloride stress corrosion cracking in austenitic stainless steel – recommendations for assessing risk, structural integrity and NDE based on practical cases and a review of literature*, UK, R Parrott BSc PhD MIMMM CEng, H Pitts MEng PhD, July 2010 *http://www.hse.gov.uk/offshore/ageing/stainless-steels.pdf*
[8] Stress Corrosion Cracking, Dr. Hira Ahluwalia *http://csidesigns.com/flowgeeks/stress-corrosion-cracking/*

Reasons to buy thick nuclear waste dry storage casks

Safety Features	Thin Canisters	Thick Casks
1. Thick walls	1/2" to 5/8"	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



CASTOR® - Type V/19 cask

A 2-year old Holtec Diablo Canyon canister has all the conditions for salt corrosion and cracking, **yet Edison plans to spend almost $1.3 billion to install Holtec thin canisters at San Onofre!** *http://bit.ly/1uJQhLr* A through-wall crack can release millions of curies of radiation into the atmosphere, according to Holtec President, Dr. Singh. *(http://youtu.be/euaFZt0YPi4)*

The Nuclear Regulatory Commission (NRC) decided 8/26/2014 that tons of nuclear waste may stay at San Onofre and other nuclear power facilities indefinitely. Permanent and interim sites have legal, technical and political challenges. (*http://www.nrc.gov/waste/spent-fuel-storage/wcd/documents.html)*

The NRC and California Public Utilities Commission (CPUC) should *not* approve Southern California Edison's decommissioning plan, should *not* approve use of thin canisters, and **should *not* approve releasing any of the over $3 billion of ratepayer money** in the decommissioning fund until nuclear waste storage issues are adequately addressed, including a cost/benefit analysis to the CPUC.

Edison refuses to allow thick dry storage cask vendors to bid. The fuel must cool years in the pool, so there is plenty of time to do this right. **Thick cask are needed wherever this fuel is stored**.

The NRC, CPUC and Edison have not addressed safety and cost impacts of the NRC indefinite on-site storage decision. Replacing this system will cost billions and there are numerous aging problems.

Learn what you can do to ensure California has the best nuclear waste dry storage and transport solution currently available in the world. Go to **SanOnofreSafety.org**

---

1. Thick walls: Edison chose the Holtec UMAX thin walled (1/2" to 5/8") welded canister system (37 assemblies per canister). Currently 51 Areva NUHOMS thin canisters (24 assemblies per canister) exist, loaded as early as October 2003.) Thick casks are about 9" to 20" thick. The French Areva TN series forged steel thick casks are use by the French and others, including Japan at Fukushima. Thicker German ductile cast iron casks are up to 20" thick and are the world leader. They use two double bolted sealed lids.

2. Cracks: The thin stainless steel canisters may crack within 30 years or less in marine environments due to stress corrosion cracking. A 2-year old Diablo Canyon canister showed all the environmental conditions for cracking. (*http://bit.ly/1uJQhLr)*

The NRC in August thought cracking conditions would take at least 30 years. They said canister temperature would be too high for humidity to dissolve salts. They were wrong. (*http://1.usa.gov/1zo065T)*

The thick German seamless ductile cast iron casks do not have crack issues and include a maintainable epoxy exterior and a galvanized nickel-plated interior for additional corrosion protection. More information is needed about the French TN thick steel casks.

3. Repair: Thin canister cracks cannot be repaired. Thick cask seals and lids are replaceable.

A fuel pool is required to replace canisters and casks. Edison plans to destroy the fuel pools with no other adequate plan in place. Pools have already been destroyed at Rancho Seco in Sacramento and at Humboldt Bay. Transporting cracked canisters to another facility with a pool presents numerous safety risks.

No "hot cells" (dry transfer systems) exist in the U.S. that are large enough to transfer fuel between canisters.

4. Inspect: No technology exists to adequately inspect even the exterior of thin welded canisters for cracks or other corrosion. The NRC is allowing vendors 5 years to develop something, but it will be limited. There is **no seismic rating** for cracked canisters yet the NRC plans to allow **up to a 75% crack** in these canisters. They plan to require inspection of only one canister **per plant** after 25 years and then the same canister at 5 year intervals.

The NRC plans to modify their dry storage and transportation standards (**NUREG-1927**) in 2015 with these inadequate guidelines.

5. Early warning: Thin canisters remotely monitor canister temperature. This does not provide early warning before a radiation leak. The NRC requires canister radiation monitoring only a few times a year by an employee with a "monitor on a pole."

Once fuel pools are empty, the NRC has allowed all other radiation monitoring at plants to be shut down (e.g., Humboldt Bay). Thick casks have pressure monitoring in the lid. A pressure change is an early warning of potential helium leaks. And thick casks have continuous remote radiation monitoring.

6. ASME certification: Thin canisters do not have American Society of Mechanical Engineer (ASME) certification (N3-stamp) and do not meet ASME standards. Thick casks have ASME certification and international quality certifications.

7. Defense in Depth. Zirconium fuel cladding is one of two levels of radiation protection. Damaged fuel assemblies lose this protection. Unless damaged fuel assemblies are sealed, this level of protection is lost. The thick ductile iron casks store damaged fuel rods and assemblies in individual sealed containers prior to loading them into the cask. Holtec uses unsealed cans. Areva does not even use cans -- only unsealed caps. San Onofre has **31 damaged fuel assemblies in the pools and 95 damaged fuel assemblies in canisters**.

Thin canisters provide only partial radiation protection (e.g., Cesium) and require thick concrete overpacks or casks. The concrete overpacks/casks are unsealed, vented and provide only gamma and neutron shielding. Thick casks do not require concrete overpacks/casks.

Note: no vendor has addressed how to handle **high burnup fuel** cladding that may degrade shortly after dry storage. High burnup fuel burns longer in the reactor, resulting in fuel over twice as radioactive, hotter and unpredictable in storage and transport. It requires more years to cool in the fuel pools for storage and even more years to cool before it can be transported. No U.S. geological repository designs address high burnup fuel.

8. Concrete buildings: Thick casks are stored in reinforced concrete buildings for additional environmental protection.

9. *NRC License: Areva and Holtec thin canister licenses are pending NRC approval for the models Edison is considering.

Thick cask system vendors do not have a current general license and will not request an NRC license without a customer, such as Edison. The expensive licensing process takes 18 to 30 months. If Edison wants the casks, the vendor will apply for a license. The NRC has never turned down a license. Edison thinks the process may take longer than 30 months, but the fuel needs to cool in the pools for many years. The thick casks have international storage and transport licenses and better manufacturing standards. The German vendor, Siempelkamp, is confident it can meet and exceed current NRC requirements.

The Areva TN thick casks have a site specific license at Prairie Island nuclear power plant. The Castor V/21 German thick ductile cast iron cask was approved by the NRC for storage at the Surrey nuclear power plant years ago, but the license expired. U.S. utilities did not want to pay any increased price for a safer product. Ironically, a Castor V/21 was used to "demonstrate" all other canister designs are safe.

10. Market leader: The thin canisters are the market leader in the U.S. because utility companies based decisions on cost. The thick casks are the market leader in Europe and other countries because those countries will pay more for quality and safety. Prices for thick ductile cast iron casks are now lower than they were many years ago, but unless Edison allows them to bid, we will not know the cost. Steel costs have risen significantly. Cost for the thin systems is just under $4 million each. Prairie Island paid $5.96 million for each TN-40 steel cask.

Myths about nuclear waste dry storage

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 are limited.

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 cast iron casks are not designed for extended storage and are not designed for welded lids. Germany is using ductile cast iron casks for extended storage and is evaluating them for final disposal. Welded lids can be added to the ductile cast iron casks for final disposal.

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. Edison plans to destroy the fuel pools after fuel is unloaded to dry canisters. There are no pools at Rancho Seco in Sacramento or at Humboldt Bay. 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 ductile cast iron casks are not approved for transport by the NRC. The NRC has not evaluated the current ductile cast iron casks for transport. Ductile cast iron casks (manufactured by Siempelkamp) are certified for transport by American and international standard setting bodies. A Sandia Lab report shows ductile cast iron casks perform in an exemplary manner and exceed NRC's current standards for embrittlement. Studies cited show DI [ductile iron] has sufficient fracture toughness to produce a containment boundary for radioactive material transport packagings that will be **safe from brittle fracture.** Studies indicate that even with drop tests **exceeding the severity of those specified in [NRC regulation] 1 OCFR7 1 the DI packagings perform in an exemplary manner**. Low temperature brittle fracture is not an issue. The DCI casks were tested **at -29°C and -49°C exceeding NRC requirements**. Conclusions shared by **ASTM, ASME, and IAEA.**[6]

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.

---

[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] Fracture Mechanics Based Design for Radioactive Material Transport Packagings Historical Review, Sandia Labs, SAND98-0764 UC-804, April 1998 *http://www.osti.gov/scitech/servlets/purl/654001*