From:	Wise, John
To:	"Donna Gilmore"; Tom Palmisano; Layton, Michael
Cc:	Street, Joseph@Coastal; Ken Alex; Barker, Kevin@Energy; Griffith, Andrew; Tiseman2; Peter Lam; Per Peterson; Dayna Bocheo; Cy Oggins; Toni Iseman; Lori Donchak
Bcc:	Rahimi, Meraj; Dunn, Darrell
Subject:	RE: Criticality impact of thin-wall dry storage canisters
Date:	Thursday, December 21, 2017 2:15:00 PM

Donna,
I'm responding on behalf of Mike Layton regarding your December 13, 2017, email (below) on the potential for canister cracks to impact criticality in the HI-STORM UMAX spent fuel storage system. I'll do my best to address your larger points.

The HI-STORM UMAX system does credit the use of borated material within the canisters for neutron absorption. The canisters use fixed borated neutron absorbing material in the fuel basket to provide criticality safety control of the contents during storage. In addition to using fixed borated neutron absorbing material, PWR spent fuel pools use borated water that is present during loading operations, however, the borated water is removed from the canister prior to storage. The fixed borated material remains in place within the canister throughout the storage life. However, as you note, the criticality safety control during storage does rely on the exclusion of water from the canister, and that is what led the NRC staff to ask Holtec to evaluate how criticality will be prevented.

The UMAX system uses the double contingency principle, which requires at least two unlikely independent events to occur simultaneously before a criticality event would be possible. For the HI-STORM UMAX system, the unlikely events are the flooding of the Cavity Enclosure Container (CEC) and a breach of the canister sufficient to allow ingress of water. As described in the Holtec letter you referenced (ADAMS ML13032A008), Holtec provided an evaluation to justify the unlikelihood of flooding scenarios for the CEC and the water intrusion scenarios for the canister. The NRC staff evaluated Holtec's justification and found it to be acceptable before approving the UMAX design.

With regard to one aspect of the double contingency principle, canister breach, the NRC has previously addressed your concerns related to the conditions for cracking of the Diablo Canyon canister and timeframe for the growth of a through-wall crack. In each case, the NRC staff found no technical basis to support these positions. The NRC evaluations of these topics are documented in the response to your comments on ISG-2, Revision 2 (ADAMS ML16117A082, Comments 19 and 29).

Finally, as you are aware from your participation in our recent public meetings, the NRC has issued aging management guidance in NUREG-1927 and Draft NUREG-2214 that includes periodic canister inspections to provide early detection of flaws in the renewed storage period. When finalizing Draft NUREG-2214, the NRC staff will evaluate all submitted public comments on the proposed aging management activities to address cracking of stainless steel canisters. If you haven't already done so, please use this comment opportunity to provide any new information that you believe the NRC should consider in finalizing the canister inspection guidance.

Thank you for your interest in this matter,

John

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John Wise, PhD, PE
Sr. Materials Engineer, Renewals and Materials Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission

References

Response to stakeholder comments received on Interim Staff Guidance (ISG)-2, Revision 2, "Fuel Retrievability in Spent Fuel Storage Applications," ADAMS ML16117A082.

NUREG-1927, Revision 1, "Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel," ADAMS ML16179A148.

NUREG-2214, "Managing Aging Processes in Storage (MAPS) Report – Draft Report for Comment," ADAMS ML17289A237. (Comment at www.regulations.gov; Docket ID: NRC-2016-0238)

From: Donna Gilmore [mailto:donnagilmore@gmail.com]
Sent: Wednesday, December 13, 2017 10:52 AM
To: Tom Palmisano <Tom.Palmisano@sce.com>; Layton, Michael <Michael.Layton@nrc.gov>
Cc: Street, Joseph@Coastal <Joseph.Street@coastal.ca.gov>; Ken Alex <ken.alex@gov.ca.gov>; Barker, Kevin@Energy <Kevin.Barker@energy.ca.gov>; Griffith, Andrew <ANDREW.GRIFFITH@nuclear.energy.gov>; Wise, John <John.Wise@nrc.gov>; Tiseman2 <tiseman2@aol.com>; Peter Lam <peterlam1@aol.com>; Per Peterson <peterson@nuc.berkeley.edu>; Dayna Bocheo <dayna.bocheo@coastal.ca.gov>; Cy Oggins <cy.oggins@slc.ca.gov>; Toni Iseman <tiseman2@aol.com>; Lori Donchak <loridonchak@gmail.com>

Subject: [External_Sender] Criticality impact of thin-wall dry storage canisters

In this Holtec document to the Nuclear Regulatory Commission, Holtec admits a criticality (uncontrolled radioactive release) can occur if fresh (unborated) water enters the MPC (multi-purpose thin-wall canister).

> Holtec Response to First Request for Additional Information (RAI) for HI-STORM UMAX Canister Storage System (TAC No. L24664), January 30, 2013 (ML13032A008).
> https://www.nrc.gov/docs/ML1303/ML13032A008.pdf

I have recently learned that no credit is given by the NRC for the borated material in the dry storage canister. It is there only for loading spent fuel from the borated spent fuel pool into the canister and transferring the canister to the concrete storage overpack.

Therefore, if there is a through-wall crack in the canister that eventually allows unborated water inside the canister (from rain, fog, on-shore surf, tsunami or other cause) and there is a criticality, please provide information as to what exactly will happen and what possible remediation plan can be used and will be used at San Onofre, if any. With the Holtec UMAX system, since there are no drains in the UMAX holes where the canisters sit, this appears to be even more problematic.

As you know, a two-year old Diablo Canyon canister was found to have all the conditions for cracking in a two-year old canister. Temperature low enough for moisture to dissolve salt particles. Corrosive magnesium chloride salt particles were found.

https://sanonofresafety.files.wordpress.com/2011/11/diablocanyonscc-2014-10-23.pdf

Both Diablo Canyon and San Onofre are located in a similar Coastal environment with frequent on-shore surf and frequent fog. See Climate Zone 5 and 7 on this California Climate Zones document.

https://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf

San Onofre has a history of stress corrosion cracking on similar materials, according to the NRC.

I realize you do not know if any thin-wall canisters in the entire U.S. have started to crack since you have no way to and have not inspected any for cracks or depth of cracks. You are only able to check for some visual precursors for cracks, but as you know, this is not a reliable method to find cracks or know depth of cracks.

Since the thin-wall stainless steel canister designs are relatively new (most systems in use are less than 12 years old), we are just reaching the timeframe where through-wall cracks are more likely to occur.

https://sanonofresafety.files.wordpress.com/2015/10/d32-caskinventorybystate2017-05-18.pdf

This 2014 NRC 8/5/2014 meeting summary document states once cracks start they can grow through the wall of the canister in 16 years. The original estimate for cracking initiation by the NRC (in this same 2014 document) was 30 years. This was based on the assumption the canister temperature would be too hot for moisture to stay on the canister long enough to dissolve the salts for at least 30 years. I participated in that 8/5/2014 meeting. As you know, that 30 year assumption is wrong due to temperature conditions found on the two-year old Diablo Canyon canister (loaded with high burnup fuel). https://www.nrc.gov/docs/ML1425/ML14258A081.pdf

Thank you,

Donna Gilmore
SanOnofreSafety.org
949-204-7794