PrairieIslandISFSINPEm Resource

From: Chesnutt, Samuel [Samuel.Chesnutt@xenuclear.com]
Sent: Wednesday, August 13, 2014 5:40 PM
To: Csontos, Aladar
Cc: Eckholt, Gene F.; Morrison, Tim; Nelson, Oley; Marty, Scott R.
Subject: RE: Supporting Documents From Today's 2:00 Call
Attachments: OEE 1270078-01 OE32365 seal leak r1.pdf; TN IB April 2001 Surry Events.pdf

Al,

Thanks to you and your reviewers for giving us the opportunity to explain the Prairie Island ISFSI cask lid bolt checks. As we discussed, attached are copies of:

1. TN Information Bulletin dated August 2011
2. Prairie Island Operating Experience Evaluation (OEE) 01270078 - this addresses Peach Bottom 2010 OE Report 32365 which includes lid bolts found at less than intended load

The Peach Bottom OE report is an INPO restricted document. I will check tomorrow to see about providing this document, but in the meantime, the essential elements of this report are explained in the Prairie Island OEE report as attached.

If you have any further questions, please let us know.

Best regards,

Sam Chesnutt
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-----Original Message-----
From: Csontos, Aladar [mailto:Aladar.Csontos@nrc.gov]
Sent: Wednesday, August 13, 2014 1:38 PM
To: Chesnutt, Samuel
Cc: Nelson, Oley; Eckholt, Gene F.
Subject: RE: Supporting Documents for the 2:00 Call

Thanks Sam!!

That's helpful. Can we postpone the call a little then so we can access the files. We're remote right now and need to find that response.

Can we call you between 2-3pm?

Al

Aladar A. Csontos, Ph.D

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From: Chesnutt, Samuel [Samuel.Chesnutt@xenuclear.com]
Sent: Wednesday, August 13, 2014 2:35 PM
To: Csontos, Aladar
Cc: Nelson, Oley; Eckholt, Gene F.
Subject: Supporting Documents for the 2:00 Call

Al,

For our 2:00 call, it might be useful if you could access our July 26, 2013 response to the first set of RAIs (ADAMS #ML13210A272)- specifically the leak cask inspection reports in Enclosure 2, Attachments 3 and 4. Bolt checks are addressed:

Attachment 3, CAP #01290943, Cask 1, "Notes," page 2
Attachment 4, CAP #01289682, Cask 13, "Description Notes," page 2

Thanks,

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Hearing Identifier: Prairie_Island_ISFSI_NonPublic
Email Number: 466

Mail Envelope Properties (f72e099d9f7f4ae79f80dfda4a47fd87)

Subject: RE: Supporting Documents From Today's 2:00 Call
Sent Date: 8/13/2014 5:39:43 PM
Received Date: 8/13/2014 5:39:56 PM
From: Chesnutt, Samuel

Created By: Samuel.Chesnutt@xenuclear.com

Recipients:
"Eckholt, Gene F." <Eugene.Eckholt@xenuclear.com>
Tracking Status: None
"Morrison, Tim" <Timothy.Morrison@xenuclear.com>
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Tracking Status: None

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Files	**Size**	**Date & Time**
MESSAGE	2724	8/13/2014 5:39:56 PM
OEE 1270078-01 OE32365 seal leak r1.pdf	37397	
TN IB April 2001 Surry Events.pdf	254972	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Operating Experience Evaluation

AR#: 01270078 Date: 4/08/2011

Evaluator: Gary Wheelock

OE Item Evaluated (Title): OE 32365, TN-68 Spent Fuel Cask 01 Helium Leak (Peach Bottom)

NOTE:	If a Condition Adverse to Quality or a 10 CFR Part 21 is found to be applicable to the station, return the CAP to the A-SRO queue and ensure the CAP is returned to the AR Screen Team for determination of severity and appropriate actions or write a new CAP to document the Condition.
NOTE:	Documentation should include specific procedures, training materials, or evolutions reviewed to assess adequacy of existing processes and practices.

Issue Summary (Provide a summary of the issue contained in the OE, including equipment, process, behavior, or organizational factors that contributed to the event.)

"On 10/22/2010, troubleshooting associated with Independent Spent Fuel Storage Installation (ISFSI) Cask TN-68-01-A identified that helium leakage from the cask main lid existed in excess of Technical Specification limits. There was no actual loss of confinement capability. Some of the lid bolts were found to be at less than the intended load. The outer aluminum lid seal had some corrosion. One or both of these conditions likely resulted in leakage from the over-pressure system. Preliminary investigation revealed that the corrosion was caused by leakage of moisture past the protective cover, which is designed to keep environmental moisture away from the lid area. The seal will be replaced, an improved bolt torquing process will be utilized, and the protective cover will be resealed. No release of radioactive material occurred as a result of this issue."

Related OE

OE 11799 - Secondary Seal Leakage in Castor Spent Fuel Dry Storage Cask (Surry), dated 01/05/2001

OE 11339 - TN-32.01 Low Pressure Alarm and Secondary Seal Failure (Surry), dated 08/28/2000

OE 30557 Dry Cask Low Pressure Alarms on 8 Casks (Prairie Island), dated 02/15/2010

Applicability (Provide a description of how the OE applies to site equipment, processes, behaviors, or organizational issues. Consider causes and lessons learned discussed in the OE.)

This OE is almost directly applicable to PI. The TN-68 cask design is essentially the BWR version of our TN-40. There are actually two issues to address in this OE and the remainder of this evaluation will have a separate heading to address each issue.

Water Intrusion

The TN-40 has the same bolted lid, double aluminum jacketed lid seal, stainless steel overlayed flange, over pressure system design, and potential for galvanic corrosion of the lid seal. The exact location where water entered was not determined but the access cover was the most suspect. The flange on the TN-68 that had water intrusion was not perfectly flat and the 11 year old rubber gasket could have been softer to provide a better seal. Prevention of water intrusion is important to preventing galvanic corrosion since it is a necessary ingredient.

Loss of Bolt Preload

The TN-40 has the same bolted lid design and is susceptible to loss of bolt preload if the final bolt torque is performed before the cask reaches thermal equilibrium. [Reference Transnuclear Information Bulletin April 2001]. Additionally the pattern and sequence of bolt torquing (Star pattern twice then circle until no bolt movement) recommended by Transnuclear (TN) needs to be reflected in the D95.3 cask loading procedure.

Extent of Condition (Discuss same and similar equipment, processes, programs, or organizational issues that may be susceptible to the failures found in the OE.)

There are currently 29 casks in service at the PI ISFSI.

Water Intrusion

The seal failure occurred after approximately 11 years of operation at Peach Bottom located 50 miles (80 km) southeast of Harrisburg in Peach Bottom Township, York County, Pennsylvania, on the Susquehanna River on the Maryland border. The oldest cask at Prairie Island has been in service 16 years and casks 1 through 12 have been in service at least 10 years. All 29 casks are built with the same base materials as the TN-68 that encountered this problem. The basic components of the access cover at the apparent breach include a rubber gasket (EPDM at PI) between a stainless steel access plate and a flat rectangular carbon steel flange on the protective cover.

The ISFSI License Renewal Baseline Inspections scheduled for June of 2011 will help determine if the TN-40 cask is experiencing water intrusion in its environment at Prairie Island. There are no repetitive tasks set up to inspect for water intrusion inside the protective cover through the access plate. There are no PMs to replace the viton (rubber) O-ring on the weather cover or the EPDM (rubber) access plate gasket. There are no rubber components in the scope of ISFSI License Renewal because they are non-safety related (NSR) / not important to safety (NITS) components and are currently not included in any aging management program. Elastomers in the scope of an aging management program are inspected and/or replaced on some frequency. The access cover flanges on all PI's TN-40s are believed to have all been machined flat but this was not confirmed.

Loss of Bolt Preload

The TN-40 has the same bolted lid design and is susceptible to loss of bolt preload if the final bolt torque is performed before the cask reaches thermal equilibrium. The Peach Bottom cask loading procedure did not adequately address this and other bolt torquing recommendations. Prairie Island's D95.3 procedure was updated (Revision 9) after the TN Information Bulletin April 2001 was received but casks 1 through 12

were loaded prior to these changes. Casks 1 through 12 were not checked for loss of bolt preload based on review of XOE Condition Report 20002411 completed 8/31/2001.

Evaluation (Discuss how current equipment, processes, programs, organization, and behaviors either protect from a similar event or if there are vulnerabilities that need to be addressed.)

Water Intrusion

While the protective cover is not safety related it performs and important function to keep out moisture. Corrosion of the outer seal is very likely to occur if moisture does get inside the protective cover. In this situation the OP system low pressure alarm will alert the site to the issue and the inner seal will maintain the confinement function. The nuclear safety significance of such an event is low but would require significant work to bring the cask back into the spent fuel pool to change the seal. Additionally, there would be a large potential that a Tech Spec action statement would need to be entered and notification to the NRC would be required.

Although the rubber O-ring and gasket on the protective cover are non-safety related (NSR) / not important to safety (NITS) they perform an important function to protect components with a SR / ITS function. There are no repetitive tasks set up to inspect for water intrusion inside the protective cover through the access plate. Simple inspections performed more frequently could allow the replacement frequency of the O-ring to be longer and prevent long term degradation of a lid seal. The casks are passive and can provide many years of trouble free service if properly maintained. Repetitive tasks to perform inspections and replace the rubber O-ring on the protective cover and the rubber access plate gasket on some frequency is prudent regardless of their inclusion into a License Renewal Aging Management Program.

TN recognizes that controlling the softness (durometer rating) of the rubber gasket on the access cover could improve water tightness. A change to their specification for this material may be forthcoming. There is likely a tradeoff with the life of an elastomer and its softness. Prairie Island will follow the recommendations of TN on this issue and no action will be taken associated with the rubber softness. There is not sufficient evidence to determine this could be a corrective action required to prevent recurrence. The inspections and periodic replacement actions recommend below will help determine this.

Loss of Bolt Preload

The bolts are slightly cantilevered from the metal to metal contact between the lid and the flange. Analysis has shown this geometry has the potential to allow the bolts to loose preload if the bolts are torqued when the inside of the cask is going through a thermal transient where the inside gets hotter and the outside is not yet at equilibrium, such as after cask draining. This geometry also causes a previously torqued bolt to become loose once neighboring bolts are torqued.

The current (rev 18) D95.3 procedure was reviewed against the April 2001 TN Information Bulletin (IB) and this OE. The D95.3 procedure requires multiple passes (two following the pattern then a step to "Verify Torque in a Circumferential Pattern") during the final torque. This is consistent with the recommendations of the OE and the IB except that it does not explicitly state "until no bolt movement is observed".

Although it has been my observation that the machinists perform the step until no bolt movement is observed, a PCR will be generated to add this to step 8.3.24 as and enhancement.

The other concern for the bolt torque procedure is the cask being at thermal equilibrium. The D95.3 procedure flow has been verbally discussed with TN and they concur that the current sequence allows adequate time for the cask to reach thermal equilibrium. A review of the typical loading schedule revealed that the final bolt torque is typically performed approximately 22 hours after the cask is drained. This is well above the 12 hours suggested in the TN IB.

Actions (Determine actions required to address vulnerabilities. Consider corrective actions described in the OE to formulate appropriate actions. Utilize the SMARTS actions criteria found in FP-PA-ARP-01 when developing actions. Include action identifiers from Passport.)

Water Intrusion

Assignment CA 1270078-02 has been made to the FS system engineer to review this OEE and any new information gathered from the Peach Bottom extent of condition and the PI ISFSI LR Baseline Inspections in June 2011 and generate periodic inspections for water intrusion and/or replacement of the rubber components as necessary. This is consistent with the OE recommendations. Determining the maintenance strategy of equipment involves System Engineering qualifications.

Loss of Bolt Preload

PCR 01279834 was generated to add "until no bolt movement is observed." to step 8.3.24 as an enhancement.

No other actions will be generated. Casks 1 through 12 were torqued prior to the implementation of the improved torquing procedure. No corrective action is needed to generate work orders to check the bolt torque of casks 1 through 12 since WO 402864 already exists and includes checking the torque of Cask 1. This work order is part of the ISFSI license renewal baseline inspections scheduled in June of 2011. Extent of condition will be determined through the corrective action and work control process if the bolt torque of Cask 1 is found to be below acceptable values. The extent of condition would investigate casks 2 through 12 first. A similar work order for Cask 13 will help validate that loss of bolt preload is not aging related and is event driven and is the first ISFSI License Renewal inspection scheduled. These WOs will be cross referenced to this CAP OEE since this evaluation is taking credit for them.

Existing ISFSI License Renewal Work Orders with Bolt Torque Check in Scope:

WO 402864, MECH-LEVEL II INSPECT UNDER WEATHER CVR OF CASK TN-40 01

WO 402863, MECH-LEVEL II INSPECT UNDER WEATHER CVR OF CASK TN-40 13

Transnuclear, Inc.

Information Bulletin
April 2001

The purpose of this bulletin is to inform Transnuclear storage cask users of two issues that have occurred at Dominion's Surry Power Station. The issues involve operation of Dominion's TN-32 Storage Casks.

The first issue concerns the Helicoflex metallic seals that are utilized in the cask lid. Beginning in December 1999, five low-pressure alarms (overpressure monitoring system) occurred over a six-month time period from three TN-32 casks stored on the Surry ISFSI. The low-pressure alarms were investigated and attributed to loose or leaking pressure switches, which were replaced at the ISFSI pad. The pressure switches were also found to have set-point drift in the non-conservative direction. An investigation by Dominion and TN recommended replacing the existing Ashcroft pressure switches with a Wasco pressure switch for the TN-32 casks at Surry and North Anna. The pressure switches on the TN casks at Surry have been replaced and the pressure switches will be replaced on the casks at North Anna in the near future. Transnuclear casks in production are using the new Wasco pressure switch. Recent experience shows that the Wasco switches do not exhibit setpoint drift. However, some TN-32 casks continued to experience low pressure conditions even after the Ashcroft pressure switches were replaced, and further investigation was necessary.

Five TN-32 casks have been brought back to the station from the Surry ISFSI and had their lids removed. The double Helicoflex metallic lid seals were removed and examined both visually and microscopically. The examinations revealed that the outer metallic seal contained small thru-wall holes caused by corrosion of the outer aluminum jacket on the seal. No corrosion was observed on the inner containment seal nor was any leakage detected past the inner seal; therefore containment of the cask was never compromised. Corrosion was also observed on two of the five casks on the lid edges where metallic spray and/or paint did not fully cover the lid surface. The casks showed evidence of water intrusion and/or high humidity inside the protective cover. In some cases, residue from standing/pooling water under the lid was observed. In the presence of water, the galvanic couple between aluminum and stainless steel is sufficient to cause corrosion. It has been concluded that the TN-32 design with aluminum metallic seals is sensitive to galvanic corrosion occurring if standing water or humid conditions (near saturation) were experienced under the protective cover.

The TN-32 casks currently at Surry are a unique design in terms of the protective cover and the overpressure (OP) system. The OP system utilizes pressure switches attached directly to the OP tank with electrical wires emerging from the top of the weather cover through a Conax fitting. Observations of the casks discussed above showed that water had entered the weather cover through the Conax fitting at the apex of the dome. The water intrusion was attributed to Conax connectors, which were not properly installed on the casks. Dominion and Transnuclear are currently in the process of retrofitting a new protective cover/OP system to the existing casks. This new protective cover/OP system design is consistent with other Transnuclear metal storage casks that have an instrumentation box located on the side of the cask, which is connected with tubing to the OP tank through a bolted and gasketed cover plate located on the protective cover.

This design eliminates the potential leak path through the Conax fitting connection at the top of the protective cover. With the elastomer seal in the cover flange and an elastomer seal in the cover plate, the two potential protective cover leak paths are bolted and sealed to prevent water intrusion during storage. Dominion is also placing desiccant under the protective covers to eliminate the potential for a humid environment causing the galvanic corrosion of the seals.

The Surry site may exacerbate the corrosion due to the brackish environment in the area. The presence of chlorides in water from precipitation or humidity would accelerate a galvanic reaction. Dominion and Transnuclear are currently evaluating the use of a Helicoflex metallic seal containing a silver outer jacket in lieu of the current aluminum-jacketed seal. The galvanic coupling between silver and stainless steel is significantly less than for aluminum and stainless steel; therefore, this change would significantly reduce the potential for corrosion of the seal. Assuming qualification testing is successful, Dominion plans to utilize silver-sheathed metallic seals in future TN-32 casks. It is Transnuclear's opinion that the use of silver seals in place of aluminum seals should be considered an upgrade/enhancement for the metal storage casks.

The second issue was identified while addressing the low-pressure alarm condition. Upon returning the cask to the fuel pool area to remove the lid, it was discovered that some of the lid bolts on three TN-32 casks did not have the torque value applied to them prior to placement of the cask into storage. In fact, lid bolts could be removed by hand on two TN-32 casks. An additional six TN-32 casks were checked on the Surry and North Anna ISFSI pads. Three of the six casks exhibited similar conditions. Altogether, this phenomenon has been observed on five casks at Surry and just recently on one cask at North Anna. In all cases there is no evidence that the lid metallic o-rings lost their seal due to the reduced torque found in the lid bolts. For one cask, approximate lid bolt torque values were measured before removal. Only two of the 48 lid bolts were found to have a torque in the proper range. Many of the bolts had a torque value of around 300 ft-lbs and about 20 bolts were found to be hand tight or less than 100 ft-lbs. A majority of the hand tight bolts were identified at locations that are tightened very early in the star sequence. Evaluations were performed by Transnculear which confirmed that the lid seals would remain compressed in a sealing condition and that the containment would be maintained in a tip over accident.

In an effort to discover the cause of this condition, Dominion and Transnuclear performed testing on a production cask at the fabricator's facility. Tests were performed utilizing different lubricants and methods of applying the lubricant, to confirm bolt torque versus preload, with bolt elongation being measured directly. Loc-Tite N-5000 lubricant was the lubricant selected to proceed with further testing. From the testing, a nut factor of 0.127 was determined for this lubricant. Metal-to-metal contact of the lid and flange was also confirmed by direct feeler gage measurements. The test program provided confirmatory design data but did not identify possible causes for the loose bolting observed in the field.

Evaluations are currently being performed to determine the cause of the loose lid bolts. Several possibilities are being investigated including thermal expansion and the necessity for making multiple passes in tightening the bolts. At this time, no definite conclusions have yet been reached. However, Transnuclear has not identified any areas in the design of the bolted flange/seal that would cause the bolt preload to decrease over time.

There is a consensus that a change in operational steps that can be taken to mitigate the possibility of thermal expansion causing bolting problems. As is common practice for our parent company, Transnucleaire, the final torque on the lid bolts should be applied after thermal equilibrium of the cask is obtained. This would translate into using an intermediate lid bolt torque of approximately 600 ft-lbs during the draining and vacuum drying operations. After backfilling with helium and waiting at least 12 hours, the lid bolts should be torqued to their final nominal torque of 930 ft-lbs. A minimum of two passes should be utilized in the star pattern and additional passes, as necessary, should be made until there is no further movement of the bolts.

Additionally, lubricant should be put under the head of the bolt and special attention paid to the calibration of the bolt torquing equipment. Transnuclear recommends use of Neolube or Loc-Tite N-5000 as the preferred lubricants.