UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

June 20, 2012

Rafael Flores, Senior Vice President
and Chief Nuclear Officer
Attention: Regulatory Affairs
Luminant Generation Company LLC
Comanche Peak Nuclear Power Plant
P.O. Box 1002
Glen Rose, TX 76043

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2 - NRC REACTIVE INSPECTION OF DRY CASK STORAGE ACTIVITIES - INSPECTION REPORT 05000445/2012009, 05000446/2012009, AND 07200074/2012002

Dear Mr. Flores:

A reactive inspection was conducted of your dry cask storage activities associated with your Independent Spent Fuel Storage Installation (ISFSI) on June 4 and June 7, 2012. A telephonic exit was conducted with your staff to discuss the findings of the inspection on June 20, 2012, after successfully completing the placement of Cask #9 on the ISFSI pad on June 19, 2012. The purpose of the inspection was to review your corrective actions related to a stuck port cap on Cask #9 and to observe the final helium backfill operations to verify your corrective actions were effective in maintaining a seal on the loaded canister. In addition, information was collected related to the contamination of the annulus area of the transfer cask, recent evidence that neutron activation of the low profile transporter had occurred, and information related to the recent notification by Holtec, Int. that the pins used with your lift yoke were undergoing additional analysis. The NRC has concluded that the actions taken to remove and replace the stuck port cap were successful and that the replacement port cap provided a seal that was adequate to maintain the pressure in the canister until the port cap cover plate was welded in place, providing the permanent seal over the damaged port. The contamination of the annulus area was resolved by continuing to flush demineralized water through the annulus to remove the contamination. Neutron activation of the low profile transporter was minor, but noteworthy in that you were the first to report this to the other Holtec cask users and the NRC. The re-analysis of the pins used in the lift yoke confirmed that the pins were adequately sized for the lifts that have occurred at Comanche Peak.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal, privacy or proprietary information so that it can be made available to the public without redaction.

Should you have any questions concerning this inspection, please contact the undersigned at (817) 200-1191 or Mr. Vincent Everett at (817) 200-1198.

Sincerely,

**/RA/**

D. Blair Spitzberg, Ph.D., Chief
Repository & Spent Fuel Safety Branch

Dockets: 50-445, 50-446, 72-74
Licenses: NPF-87, NPF-89

Enclosure:
Inspection Report Nos.:
05000445/2012009,
05000446/2012009
07200074/2012002

Attachment:
1. Supplemental Information
2. Loaded Casks at the Comanche Peak Site

Electronic distribution by RIV:
Regional Administrator (Elmo.Collins@nrc.gov)
Deputy Regional Administrator Art.Howell@nrc.gov)
DRP Director (Kriss.Kennedy@nrc.gov)
DRP Deputy Director (Troy.Pruett@nrc.gov)
Acting DRS Director (Tom.Blount@nrc.gov)
DNMS Director (Anton.Vegel@nrc.gov)
RSFSB Branch Chief (Blair.Spitzberg@nrc.gov)
RSFSB Inspector (Lee.Brookhart@nrc.gov)
RSFSB Inspector (Vincent.Everett@nrc.gov)
SFST Senior Inspector (Robert.Temps@nrc.gov)
Acting DRP Deputy Director (Patrick.Louden@nrc.gov)
Branch Chief, DRP/A (Wayne.Walker@nrc.gov)
Senior Resident Inspector (John.Kramer@nrc.gov)
Resident Inspector (Brian.Tindell@nrc.gov)
Senior Project Engineer (David.Proulx@nrc.gov)
Project Engineer (Jason.Dykert@nrc.gov)
Public Affairs Officer (Victor.Dricks@nrc.gov)
Public Affairs Officer (Lara.Uselding@nrc.gov)
RITS Coordinator (Marisa.Herrera@nrc.gov)
Regional Counsel (Karla.Fuller@nrc.gov)
Congressional Affairs Officer (Jenny.Weil@nrc.gov)
Regional State Liaison Officer (Bill.Maier@nrc.gov)
NSIR/DPR/EP (Eric.Schrader@nrc.gov)
OEMail Resource
OEDO RIV Coordinador (Michael.McCoppin@nrc.gov)
ROPreports

DRAFT: S:\DNMS\RSFS\!JVE\CP2012009-ISFSI-JVE
FINAL: R:\REACTORS\CPSES\2012\CP2012009-ISFSI-JVE

| SUNSI Rev Compl. | **X Yes** ☐ No | ADAMS | **X Yes** ☐ No | Reviewer Initials | |
|---|---|---|---|---|---|
| Publicly Avail | **X Yes** ☐ No | Sensitive | ☐ Yes **X No** | Sens. Type Initials | |

| RIV:DNMS/RSFS | R-IV/C:RSFS | | | |
|---|---|---|---|---|
| JVEverett | DBSpitzberg | | | |
| ***/RA/*** | ***/RA/*** | | | |
| 06/20/2012 | 06/20/2012 | | | |

OFFICIAL RECORD COPY T=Telephone E=E-mail F=Fax

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

| | |
|---|---|
| Docket: | 50-445, 50-446, 72-74 |
| Licenses: | NPF-87, NPF-89 |
| Report Nos.: | 05000445/2012009, 05000446/2012009, and 07200074/2012002 |
| Licensee: | Luminant Generation Company LLC |
| Facility: | Comanche Peak Nuclear Power Plant, Units 1 and 2<br>Independent Spent Fuel Storage Installation (ISFSI) |
| Location: | FM-56 Glen Rose, Texas |
| Dates: | June 4, 2012 and June 7, 2012 |
| Inspector | Vincent Everett, Senior Inspector, RIV<br>Repository and Spent Fuel Safety Branch |
| Approved By: | D. Blair Spitzberg, Ph.D., Chief<br>Repository and Spent Fuel Safety Branch<br>Division of Nuclear Materials Safety |

## EXECUTIVE SUMMARY

Comanche Peak Nuclear Generating Station
NRC Inspection Report 50-445/2012-09, 50-446/2012-09, and 72-74/2012-01

Successful loading of eight Hi-Storm 100 casks had been completed by Comanche Peak. Cask #9 was in-process and had been backfilled with helium in preparation for welding the port cap cover plates and the outer lid. Prior to welding, during the attempt to close the port caps, the drain line port cap became stuck in the open position, resulting in the inability to seal the canister. This prevented sealing the required amount of helium in the canister. The licensee re-flooded the canister with water, removed the damaged port cap, conditioned the damaged threads on the drain line, replaced the damaged port cap with a new one, and successfully sealed the canister with the required amount of helium. During the period that the spent fuel inside the canister was being cooled in preparation for replacing the damaged port cap, leaks occurred in the cooling system resulting in contaminated water leaking into the annulus region between the canister and the transfer cask. This resulted in contaminating the surfaces of the canister and transfer cask, which required cleaning.

In addition to the main focus of this inspection, two other issues are documented. One related to the discovery that the low profile transporter was susceptible to neutron activation from the spent fuel in the canister. The other issue related to a notification by the cask vendor, Holtec Int., that new analysis of the lift yoke pins was needed to verify the adequacy of the pins for their rated load. As a result of the analysis, a reduced load rating has been applied to the Comanche Peak lift yoke.

Operation of an ISFSI at Operating Plants (60855.1)

- A stuck drain port cap on Cask #9 prevented the licensee from completing the helium backfill of the canister. The stuck drain port cap was successfully removed, but in the process the threads on the drain line were damaged, requiring them to be reconditioned. A new port cap was placed on the drain line and tightened to 85 foot-pounds (ft-lbs) as a test to demonstrate that the reconditioned drain line threads were adequate to achieve a seal. The canister was backfilled with helium and a pressure test performed to demonstrate the seal was not leaking (Section 1.2.a).

- A water leak of the canister cooling system for Cask #9 resulted in contaminated water being introduced to the annulus region between the canister and the transfer cask. This resulted in contamination of the canister. Flushing of the annulus area with clean water was performed over several days before the canister was down-loaded into the Hi-Storm storage cask. However, surveys of the bottom lid of the transfer cask after the download was completed found contamination levels above the Technical Specification 3.2.2 limits. The transfer cask and bottom lid were cleaned and the canister returned to the transfer cask and flushing continued. Upon completion of the second round of flushing, contamination smears of the top of the canister, the inside of the transfer cask after the canister was downloaded into the Hi-Storm storage cask, and of the bottom lid on the transfer cask confirmed that the contamination had been successfully removed (Section 1.2.b).

- Very low radiation levels that could not be attributed to contamination or background radiation were found during the survey of the low profile transporter after the fourth cask had been removed. Arrangements were made to conduct a gamma analysis of the low profile transporter after a subsequent cask was removed. The gamma analysis found radiation from Manganese-56, which was an activation product of natural manganese in the stainless steel in the transporter. The half life was 2.6 hours. The low levels and short half-life did not present a radiological concern. The discovery was noteworthy of the level of attention and inquiring attitude displayed by the radiological safety staff in making the discovery (Section 1.2.c).

- Comanche Peak was notified by the cask vendor, Holtec Int., that the pins used with the lift yoke and lift yoke extension that provided the connection between the crane hook and the transfer cask had been identified as requiring additional analysis to confirm their load rating. Until the analysis was completed, the lift yoke and yoke extension were limited to a reduced load rating. This reduced load rating prevented lifting any newly loaded casks from the spent fuel pool at the maximum weight that would be experienced with water in the canister. Cask #9 was below the reduced load rating and could still be moved, since no water was inside the canister. On June 7, 2012, Holtec Int. completed the additional analysis using the newer computer model which verified that the lifts that had occurred at Comanche Peak for the first nine casks were within the rated capacity of the yoke and yoke extension. However, the analysis showed that the lift yoke rated load needed to be reduced from 250,000 pounds to 245,000 pounds (Section 1.2.d).

## Report Details

### 1 Operations of an Independent Spent Fuel Storage Installation (ISFSI) at Operating Plants (60855.1)

1.1 Inspection Scope

The Holtec 100 cask system was being used at the Comanche Peak site under Certificate of Compliance 1014, Amendment 7 and Final Safety Analysis Report (FSAR), Revision 9. Eight casks had been successfully loaded when a problem with a stuck drain line port cap occurred with Cask #9. Although no required reporting criteria was met, the NRC regional office was notified by the licensee. Because this issue directly affected the ability to comply with a technical specification requirement that was important to the long term storage of the spent fuel, the NRC Region IV office initiated an onsite inspection of the actions underway to correct the problem. Discussions were held with the licensee concerning the corrective actions being implemented and how the licensee planned to verify that the technical specification related to the helium backfill requirement would be fully met. The inspection included NRC observation of the removal of the damaged port cap and visual examination of the threads remaining on the drain line. After the licensee reconditioned the drain line threads and performed a test with a new port cap to confirm the remaining threads were capable of maintaining a seal, the NRC inspector observed the installation of the new port cap and the leak test performed to verify the cap was maintaining a seal. During the time the seal issue was being resolved, contaminated water from the recirculation cooling system used to keep the spent fuel cool inside the canister leaked and contaminated the clean water in the annulus between the canister and the transfer cask wall. A significant effort was required to clean the canister to meet the smearable contamination technical specification limits allowed for the canister. The NRC inspector reviewed numerous smear survey results and water samples of the annulus water during flushing to verify the licensee had adequately cleaned the canister prior to movement to the ISFSI pad.

While onsite observing the work related to the stuck port cap and the contamination issue, two other issues were reviewed and are documented in this inspection report. These involved the discovery of activation of the low profile transporter from the neutron flux of a cask left on the transporter over the weekend and notification by the cask vendor that further analysis was being performed on the pins on the lift yoke. The load rating for the lift yoke was reduced as a result of the re-analysis.

1.2 Observations and Findings

a. Drain Line Port Cap on Cask #9 Cannot Be Closed

On May 24, 2012, the ninth cask being loaded in the current loading campaign had been dried and backfilled with helium. The next task involved remotely closing the vent port cap and drain port cap on the canister lid using the removable valve operator assembly (RVOA) operating rod. Two RVOAs are screwed onto the lid and are used during water recirculation, drying, and helium backfill operations to provide a connection between the vent port and the drain port on the canister lid with the hoses to the various systems. The vent port and drain port are on opposite sides of the canister lid and are recessed in the lid to provide the ability to weld a plate on the canister lid over the port caps that will be flush with the top of the canister lid. The RVOA operating rod protrudes out of the top of the RVOA and can be extended down to the port cap. Turning the operating rod will turn the port cap and is used to open or close the port cap. A seal prevents leakage around the RVOA operating rod. A seal is also provided between the RVOA and the canister lid to prevent leakage as well as seals associated with the various hoses and pressure gauges that are connected to the RVOA. The RVOA can be removed at any time water is in the canister or when the port caps have been closed after filling the canister with helium. The port caps must be closed and providing a good seal when the canister has been filled with helium. Air cannot be allowed to enter the canister and come into contact with the spent fuel. This could result in oxidation issues with the zircalloy fuel rods that presents long term storage issues with the integrity of the fuel rods.

Once the canister is backfilled with helium to the pressure required by Technical Specification Table 3-2 "MPC Helium Backfill Limits," and the two port caps (vent and drain) are closed, the RVOA is removed and the port cover plates are welded over the port caps, providing the first of two sealed barriers over the port caps. The port caps act as a temporary closure that must maintain a seal on the canister's vent line and drain line to keep the helium inside the canister until the port cover plate is welded in place. Later an outer lid is also welded in place which provides the second seal over the drain port and vent port.

During the operation to remotely close the port caps on Cask #9 (Canister # 198) on May 24, 2011, using the RVOA operating rod, the drain line port cap became stuck before it closed all the way. An extensive effort to close the drain port cap was unsuccessful. Condition Report CR-2010-5288 was issued on May 24, 2012, to document the problem. Holtec issued Field Condition Report (FCR) 1937-Loading-10 on May 25, 2012. Procedure DCS-301 "DCS Equipment Malfunction, LOOP, LOCA, and Contingencies Guidance," Section 8.14 "Removal of Leaking/Stuck MPC Port Cap," provided instructions for removing a stuck port cap and examining the threads of the drain line. Procedure DCS-207 "Unloading a Loaded MPC" provided instructions for re-flooding the canister and re-establishing cooling. On May 25, 2012, the canister was reflooded with water from the spent fuel pool to allow the RVOA to be removed to inspect the drain port cap. Cautions were provided in Procedure DCS-207 concerning possible pressure increases as the water was introduced to the dry canister and directed workers to monitor the system pressure gauges. The canister lid temperature was over 250 degree F. Actual pressure increase was less than two psig during water insertion. After a period of time, the water exit temperature dropped to 110 degree F. The inlet water temperature of the spent fuel pool water was 90 to 95 degree F. The heat load for the canister was 27.6 kW. Attempts to remove the drain port cap by connecting a wrench directly to the cap failed. Heat was applied with no success. A drill with a Hougen bit was used to drill along the side of the port cap at four different locations 90 degrees apart to weaken the cap. This also did not work. The RVOAs were reinstalled and water recirculation of the canister established to provide continuous cooling of the spent fuel in the canister using spent fuel pool water. The supplemental cooling system to cool the annulus continued to operate providing water cooling to the annulus region between the canister and the transfer cask by circulating demineralized (clean) water through a heat exchanger and back to the annulus region. Over the next several days, the licensee evaluated the various options to remove the drain port cap, including discussions with the cask vender and with other utilities, some of which had experienced the same problem. The licensee determined that the first actions should be to remove the port cap, determine if the threads on the drain line were sufficient to engage a new port cap or could be repaired, and if so, install and test a new port cap with a new washer. If the threads on the drain line could not be sufficiently repaired, the top ½ to 1 inch of the drain line (drain port tube nipple) would be removed and a new drain line welded in the canister lid. Holtec's Supplier Manufacturing Deviation Report (SMDR) #2185, Revision 0 provided a discussion of the requirements for welding a new drain line in place. Shielding was in-place on the canister lid and around the upper portions of the transfer cask. Neutron shielding was effectively being used to reduce the neutron levels on the lid and the streaming through the transfer cask trunnions. Dose rates in the general area were less than 1 mrem/hr. Dose rates on the cask lid, with shielding in place, were 40 mR/hr contact and 5 mR/hr at one foot beta/gamma. Minimal neutron levels were being detected due to the effective neutron shielding.

On June 4, 2012, the licensee was prepared to remove the damaged drain port cap. The recirculation of the water inside the canister was stopped and the drain line RVOA removed. A hole saw and guide were used to remove the outer portion of the drain port cap with the intent of weakening the cap. A wrench was then used to remove the port cap, however, the top portion of the cap broke off leaving the threaded area of the cap still on the drain line. A chisel was then used to remove the threaded part of the port cap. Examination of the drain line threads found that they had been damaged. The activities to remove the port cap were observed by the NRC inspector who also examined the borescope pictures of the damage to the drain line threads. Examination of the surface of the drain line where the seal will occur with the port cap did not find any damage from the chisel effort that would prevent a good seal. The threads on the drain line were reconditioned using a dye set. A new port cap was placed on the drain line and tightened to 85 foot-pounds (ft-lbs). Upon removal of the port cap, an examination of the indention made on the metal washer on the port cap indicated that a seal had been made on all portions of the drain line. The licensee determined that an adequate seal could be made with the new port cap to keep the helium in the canister while the port cover plate was being welded.

The drain port RVOA was re-installed, the canister drained of water and over the next several days the canister was dried. On June 7, 2011, the technical specification required canister dryness level was achieved and the canister was backfilled with approximately 75 pounds/square inch-gauge (psig) helium. The vent port cap and the drain port cap were closed and torqued to 65 ft-lbs in accordance with Procedure DCS-204 "MPC Closure Operations (Sealing, Drying, and Backfilling)." The RVOAs were isolated from the helium supply and the pressure released in the RVOA such that the pressure reading on the pressure gauges on the two RVOAs was zero. There were two calibrated pressure gauges on each RVOA. The RVOAs were isolated such that the pressure gauges would read any leak of helium from the port cap to verify the caps were not leaking. The step in Procedure DCS-204 to verify no leakage on the port caps was extended from the normal time of 2 minutes to 5 minutes to further monitor the seal on the damaged drain line. The cask vendor, Holtec Int., had provided calculations that showed that at the temperature of the cask (around 300 degree F) and the pressure of the helium (around 75 psig), that the lowest indication that could be recognized on the pressure gauges of a 0.1 psig leak over 2 minutes would result in a leak rate that would require the port cover plate to be installed within 120 minutes. Actual time to install a port cover plate is typically less than an hour. No increase on the pressure gauge was observed during the 5 minute period, indicating that sufficient time was available to weld the port cover plate over the drain port before unacceptable levels of helium could leak out. If a helium leak had occurred, Procedure DCCS-204 allowed the port cover to be torqued to 82-85 ft-lbs. Since no leak was observed, additional torquing of the port cap was not performed at the risk of further damaging the drain line threads. The drain port RVOA was removed and welding completed on the drain port cover plate. During this process, the vent port RVOA was left in place in case problems occurred and a helium leak was discovered before welding could be completed. This provided a means to use the vent port RVOA to inject additional helium into the canister to compensate for any leaks and prevent air from entering the canister until the drain port RVOA could be re-installed or the welding completed. All welding on the canister (port covers and outer lid) was successfully completed on June 8, 2012.

Final Design Authorization (FDA)-2009-000859-36 documented the damaged drain line threads and the effort to repair the threads and install a new port cap. The licensee performed a 10 CFR 72.48 safety screening. This was documented in the 72.48 Screen No. EV-CR-2009-000859-00-140 (FDA-2009-000859-36-00) entitled "MPC #9 (Serial # 198) Drain Port Cap Resolution Modification and Supplier Manufacturing Deviation Report MPC Drain Port Cap," Revision 0. The options evaluated included use-as-is or replace the drain port tube nipple. Holtec performed a 72.48 safety screening and evaluation, No. 987, on May 31, 2012, that evaluated the two options and determined that either option could be performed without obtaining an amendment to the license or Certificate of Compliance.

The evaluations performed by Holtec and Comanche Peak also included the potential for stainless steel metal shavings to be introduced into the canister during the machining to remove the port cap. Holtec included an extensive evaluation of the effect of the metal shavings being introduced into the canister during the port cap removal in Holtec's Supplier Manufacturing Deviation Report (SMDR # 2185) as Appendix C "Safety Evaluation of Foreign Material (Nitronic 60 Shavings) in MPC." The evaluation determined that the shavings would present no significant or long term issue with storage. Comanche Peaks' 72.48 screening also discussed the potential impact of the shavings being introduced into the canister. The 72.48 screening stated that the metal shavings would either be flushed out of the canister during blowdown or would remain in the bottom of the canister after sealing, presenting no significant or long term issue with storage of Cask #9.

Concerning the 10 CFR Part 71 transportation requirements for the canister, the Holtec 72.48 screening and evaluation No. 987 stated that the metal fines would not adversely affect the fuel assemblies during a design basis transportation deceleration accident and had a low probability for the potential of fretting of the fuel assemblies since there would be no long term turbulence or vibration inside the canister during transportation operations that could result in the small and light shavings causing damage to a fuel rod. The 72.48 screening and evaluation also noted that the Holtec HI-STAR 100 safety evaluation report had already considered a 3% rod rupture due to transportation vibrations, which would bound any unforeseen event of rod rupture due to fretting.

Documentation related to the damaged threads on the drain line will be included in the permanent records for this cask.

b. Contamination of Annulus Area

On May 27, 2012, while corrective actions for the stuck port cap were being developed, leakage of water around the vent port RVOA was observed. Smears taken of the area around the RVOA and the top two inches around the annulus area found contamination levels as high as 6,000 disintegrations per minute (dpm)/100 square cm. No alpha contamination or hot particles were found. Condition Report CR-2010-5362 was issued to document the discovery of the contamination. A sample of water from the supplemental cooling system was analyzed on May 27, 2012 and confirmed that the leak from the RVOA had contaminated the clean water used to re-circulate and cool the annulus area. Gamma analysis of the annulus water found low levels of Mn-54, Co-58, Co-60, Sb-125, Cs-134, and Cs-137. The predominant isotope was Cobalt-60 at a concentration of 5.4 x 10(-5) microcuries/ml. Water samples of the spent fuel pool near the intake hose for the system providing cooling to the canister found similar isotopes with similar concentrations. On May 29, 2012, the drain port RVOA was observed to also be leaking. On June 3, 2012, annulus flushing was started in an attempt to clean the annulus water. Flushing was a once through process of filling the annulus with demineralized water, then draining it to the radioactive drains. Then filling again and repeating the process. This continued for several days. By June 7, 2012, the only isotope detectable in the water samples of the annulus was Co-60 at 9 x 10(-7) microcuries/ml. Later that day levels were down to 5 x 10(-8) microcuries/ml. This was at the minimum detectable limit for Co-60. The lid was successfully decontaminated to below the 1,000 dpm/100 square cm limit in Technical Specification 3.2.2.

After the canister welding was completed on the vent and drain port covers, the survey of the top portion of the annulus found slight contamination levels well below the 1,000 dpm/100 square cm limit. After the canister was placed in the stack-up position on the Hi-Storm storage cask in the train bay and lowered into the Hi-Storm storage cask, the bottom lid of the transfer cask was surveyed. Contamination levels as high as 7,225 dpm/100 square cm were found on the lid. The transfer cask was moved to an area and further surveyed. Highest reading on the inside of the transfer cask was 66 dpm/100 square cm. The transfer cask and lid were decontaminated. After the transfer cask and lid were cleaned, the canister was uploaded back into the transfer cask, returned to the dry cask pit, and additional flushing of the annulus performed. The inside of the Hi-Storm storage cask was surveyed. The highest reading found was 68 dpm/100 square cm beta/gamma. The Hi-Storm storage cask was decontaminated prior to returning the canister after it had completed the final flushing. No alpha radiation or hot particles were found during any of the smear surveys. On June 15, 2012, annulus flushing was completed and the upper portion of the canister smeared. The canister was found to be clean. Smears of the transfer cask lid and interior, after the canister was downloaded in the Hi-Storm storage cask, were also found to be clean. Based on the results of the contamination smears, it was determined that the canister contamination limits were now below the technical specification limits.

c. Neutron Activation of Low Profile Transporter

During the loading and handling activities associated with the fourth Hi-Storm cask on April 9, 2012, the licensee observed unusual radiation readings of two to four times background during a survey of the low profile transporter after the cask was removed. Cask #4 contained 25.1 kW of spent fuel. The cask had been removed from the low profile transporter using the vertical cask transporter in preparation for movement to the

ISFSI pad. The cask had been sitting on the low profile transporter in the train bay over the weekend. No removable contamination was found, but very low levels of radiation above background were detected at several locations on the low profile transporter using a Radeye survey instrument. Counts ranged from 60 to 115 counts/minute (cpm) gamma above background. Background was 33 cpm. The low profile transporter was constructed of stainless steel and ferric steel. At the time of the discovery of the low radiation levels on the low profile transporter, instrumentation to determine the isotopes present was not available. Condition Report CR-2012-004221 documenting the discovery of the radiation was issued. In May, after Cask #6 (25.47 kW) had been removed from the low profile transporter, instrumentation was available to perform an analysis to determine the isotopic content of the radiation. The analysis found evidence of small levels of Manganese (Mn)-56 (energy level of 0.847 Mev) with net readings of approximately 2300 counts/second above background. No other significant isotopes were found. A half-life evaluation found the gamma half life to be approximately 2.6 hrs. Mn-56 has a half-life of 2.57 hrs. Manganese exists 100% in nature as stable Mn-55 and is found in stainless steel at levels of 1-2%. Neutron activation of Mn-55 results in Mn-56. As such, the licensee concluded that the low profile transporter had become activated by the neutron flux coming out of the bottom of the cask. Readings taken of the bottom of the cask while sitting on the low profile transporter had recorded neutron exposure levels of 440 mrem/hr on contact. This apparently was a high enough flux to generate activation products in the low profile transporter. Contamination from the spent fuel pool water was ruled out because no Cobalt-58 or Cobalt-60 had been detected, which were always present in the spent fuel pool water. Discovery of the activation of the low profile transporter was the result of good radiation protection practices and a questioning attitude. This is believed to be the first recognition that this phenomena is occurring with the low profile transporter. The radiation levels are near background levels with a very short half-life and would not present any radiological concerns related to worker exposures.

d. Lift Yoke Load Rating Down-Graded Due to New Analytical Model Results

The lift yoke and lift yoke extension used to lift the Hi-Trac transfer cask at Comanche Peak was rated for 125 tons (250,000 pounds). The lift yoke is connected to the crane using three large round engagement pins (two main pins and one block pin). The transfer cask is lifted by connecting the two arms of the lift yoke to the transfer cask trunnions. Each arm has an actuator pin that connects the arm to the yoke. When the lift yoke extension is used, it is connected to the hook using three engagement pins that are the same dimensions as the pins used with the yoke. On the bottom of the yoke extension is a plate that is connected with two pins (extension main pins). The other side of the plate connects to the three engagement pins of the yoke. All eight pins are six inches in diameter and the same size. The Hi-Trac lift yoke (which would include the yoke extension) was identified in the Holtec Final Safety Analysis Report, Table 8.1.6 “Hi-Storm 100 System Ancillary Equipment Operational Description” as being designed to the requirements of American National Standard Institutes (ANSI) N14.6 “Special Lifting Devices for Shipping Containers Weighting 10,000 Pounds or More.” The pins for the lift yoke, yoke extension, and yoke arms had originally been analyzed by Holtec Int. using classical strength-of-material principles. However, because the pins were short in comparison to their diameter, the model used may not have correctly captured the contact stress distribution that occurred on the pins and the yoke interface with the pins. This issue was identified during an NRC inspection of the Braidwood Station and documented in Inspection Report 05000456/2011005 (NRC Adams Document

ML12041A339) in Section 4OA5 "Other Activities." The pins were required to meet ANSI N14.6 (1978), Section 6 "Special Lifting Devices for Critical Loads." As such, the load bearing members, such as the pins, were required to be designed to lift six times the combined weight of the transfer cask, plus the weight of the intervening components. This is referred to as the material yield strength. The pins were also required to be designed to lift ten times the weight without exceeding the ultimate strength of the material.

Recent questions concerning the model used for the original calculations indicated that the strength-of-materials analysis may have understated the flexural stress fields in the calculations. Holtec Int. initiated a re-analysis of the pins and notified users of the issue. Comanche Peak was notified by letter on May 24, 2012, that the pins used for the lift yoke and yoke extension were being re-analyzed. An initial evaluation by Holtec, Int. of the Comanche Peak calculations at the time of the notification showed that the analysis completed so far demonstrated acceptable interation ratios at a load capacity of 220,000 pounds (110 tons). The activities at Comanche Peak for the remaining Cask #9 movements would require lifts of 108.2 tons in order to complete the stack-up. As such, Holtec Int. informed Comanche Peak that the heavy lifts could continue with Cask #9. The 220,000 pounds (110 tons) limit in the Holtec letter, in effect, presented a restriction on further cask loading because the maximum cask weight, which included the canister filled with water, would exceed the 110 tons when a loaded cask is being removed from the spent fuel pool.

Comanche Peak had issued Condition Report CR-2012-005267 on May 23, 2012, based on an e-mail from Holtec Int. notifying users of the problem. On June 7, 2012, Holtec Int. issued Holtec Report No. HI-2104602 "Structural Analysis of the HI-TRAC 125 Ton Lift Yoke for Comanche Peak," Revision 3 and Holtec Report HI-2104603 "Structural Analysis of HI-TRAC 125 Ton Lift Yoke Extension for Comanche Peak," Revision 2 which included the new analysis results that showed the six inch pins in the lift yoke and in the lift yoke extension and the actuator pins in the yoke arms in use at Comanche Peak were qualified for a maximum loads of 245,000 pounds (122.5 tons). This included the three hook engagement pins used with the yoke and the three used with the yoke extension plus the two extension main pins in the yoke extension. At 245,000 pounds, the calculations showed a safety factor for the engagement pins of 1.28 for the material yield strength and 1.48 for the ultimate strength. For the actuator pins on the yoke arms, the safety factor for the material yield strength was 1.045 and for the ultimate strength was 1.21. A safety factor of one indicated the six times material yield strength and ten times ultimate strength criteria were met. A dynamic load factor of 15% was applied to the calculations. Currently, the yoke at Comanche Peak is rated at 250,000 pounds. This rating will be reduced to 245,000 pounds based on the Holtec calculations.

Holtec has initiated the design and construction of new pins that will be available in the near future that provide additional safety margins. Comanche Peak will complete the current loading campaign after Cask #9 is placed on the ISFSI pad. New pins should be available before the next loading campaign to re-establish the 250,000 pound rating of the yoke. The maximum load on the yoke during a cask loading activity is when the cask is loaded with spent fuel, filled with water, and being lifted from the spent fuel pool and moved to the dry cask pit. At that time, the canister is calculated to weigh 244,646 pounds based on weight values in Holtec Report HI-2104639 "Cask Handling Weight and Cask Handling Dimensions for Comanche Peak," Revision 0 for Case #4 when subtracting the weight of the lift yoke (5,895 pounds) and the lift yoke extension (5,273 pounds). The new load rating of the yoke of 245,000 pounds would not preclude future loading of casks.

On June 9, 2012, Holtec Int. issued Holtec Information Bulletin No. 56 to the Holtec cask users discussing the re-analysis effort for the round bars in the lifting apparatus using state-of-the-art finite element methods. The bulletin identified that the previous analysis method had been used over 20 years ago and that the availability of the new finite element code with elastic/plastic elements and non-linear geometries warranted that the original analysis be upgraded using the current day analytical models.

1.3 Conclusions

A stuck drain port cap on Cask #9 prevented the licensee from completing the helium backfill of the canister. The stuck drain port cap was successfully removed, but in the process the threads on the drain line were damaged, requiring them to be reconditioned. A new port cap was placed on the drain line and tightened to 85 foot-pounds (ft-lbs) as a test to demonstrate that the reconditioned drain line threads were adequate to achieve a seal. The canister was backfilled with helium and a pressure test performed to demonstrate the seal was not leaking.

A water leak of the canister cooling system for Cask #9 resulted in contaminated water being introduced to the annulus region between the canister and the transfer cask. This resulted in contamination of the canister. Flushing of the annulus area with clean water was performed over several days before the canister was down-loaded into the Hi-Storm storage cask. However, surveys of the bottom lid of the transfer cask after the download was completed found contamination levels above the Technical Specification 3.2.2 limits. The transfer cask and bottom lid were cleaned and the canister returned to the transfer cask and flushing continued. Upon completion of the second round of flushing, contamination smears of the top of the canister, the inside of the transfer cask after the canister was downloaded into the Hi-Storm storage cask, and of the bottom lid on the transfer cask confirmed that the contamination had been successfully removed.

Very low radiation levels that could not be contributed to contamination or background radiation were found during the survey of the low profile transporter after the fourth cask had been removed. Arrangements were made to conduct a gamma analysis of the low profile transporter after a subsequent cask was removed. The gamma analysis found radiation from Manganese-56, which was an activation product of natural manganese in the stainless steel in the transporter. The half life was 2.6 hours. The low levels and short half-life did not present a radiological concern. The discovery was noteworthy of the level of attention and inquiring attitude displayed by the radiological safety staff in making the discovery.

Comanche Peak was notified by the cask vendor, Holtec Int., that the pins used with the lift yoke and lift yoke extension that provided the connection between the crane hook and the transfer cask had been identified as requiring additional analysis to confirm their load rating. Until the analysis was completed, the lift yoke and yoke extension were limited to a reduced load rating. This reduced load rating prevented lifting any newly loaded casks from the spent fuel pool at the maximum weight that would be experienced with water in the canister. Cask #9 was below the reduced load rating and could still be moved, since no water was inside the canister. On June 7, 2012, Holtec Int. completed the additional analysis using the newer computer model which verified that the lifts that had occurred at Comanche Peak for the first nine casks were within the rated capacity of the yoke and yoke extension. However, the analysis showed that the lift yoke rated load needed to be reduced from 250,000 pounds to 245,000 pounds.

## 2 Exit Meeting

The inspector reviewed the scope and findings of the inspection during a telephonic exit conducted on June 19, 2012.

## ATTACHMENT 1:

## SUPPLEMENTAL INSPECTION INFORMATION

### PARTIAL LIST OF PERSONES CONTACTED

Licensee Personnel

C. Davis, Radiation Protection
B. Henley, Project Manger
K. Kilgarif, Radiation Protection
C. Montgomery, Project Engineering Manager
L. Neuburger, Engineer
J. Seawright, Regulatory Affairs

Holtec International

J. Ciesielski, Welder
J. Fosdick, Construction Manager
M. Ragan, Cask Loading Supervisor

### INSPECTION PROCEDURES USED

IP 60855.1 Operations of an ISFSIs at Operating Plants

### LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Discussed

None

Closed

None

### LIST OF ACRONYMS

| | |
|---|---|
| ANSI | American National Standards Institute |
| CFR | Code of Federal Regulations |
| cm | centimeter |
| CoC | Certificate of Compliance |
| DCS | dry cask storage |
| dpm | disintegrations per minute |
| F | Fahrenheit |
| FSAR | Final Safety Analysis Report |
| ISFSI | Independent Spent Fuel Storage Installation |

| | |
|---|---|
| kW | killo-watt |
| MPC | multi-purpose canister |
| mrem | MilliRoentgen Equivalent Man |
| NRC | Nuclear Regulatory Commission |
| OSL | optically stimulated luminescence |
| psig | pounds per square inch gauge |
| RVOA | removable valve operator assembly |

## ATTACHMENT 2:

## LOADED CASKS AT THE COMANCHE PEAK ISFSI

| LOADING ORDER | MPC SERIAL No. | HI-STORM No. | DATE ON PAD | HEAT LOAD (Kw) | BURNUP MWd/MTU (max) | MAXIMUM FUEL ENRICHMENT % | PERSON-REM DOSE |
|---|---|---|---|---|---|---|---|
| 1 | MPC-156 | Serial No. 465 | 02/28/12 | 17.813 | 42,278 | 4.50 | 0.332 |
| 2 | MPC-158 | Serial No. 467 | 03/12/12 | 24.842 | 49,268 | 4.82 | 0.359 |
| 3 | MPC-157 | Serial No. 553 | 04/02/12 | 25.031 | 49,518 | 4.82 | 0.315 |
| 4 | MPC-202 | Serial No. 550 | 04/09/12 | 25.133 | 49,561 | 4.82 | 0.195 |
| 5 | MPC-199 | Serial No. 549 | 04/14/12 | 25.216 | 49,509 | 4.82 | 0.223 |
| 6 | MPC-196 | Serial No. 557 | 05/07/12 | 25.470 | 49,750 | 4.82 | 0.116 |
| 7 | MPC-195 | Serial No. 556 | 05/14/12 | 25.377 | 49,961 | 4.82 | 0.120 |
| 8 | MPC-200 | Serial No. 551 | 05/21/12 | 27.203 | 49,584 | 4.82 | 0.098 |
| 9 | MPC-198 | Serial No. 552 | 06/18/12 | 27.657 | 49,888 | 4.80 | 0.545 (estimate) |

NOTES:

- Heat load (Kw) is the sum of the heat load values for all spent fuel assemblies in the cask
- Burn-up is the value for the spent fuel assembly with the highest individual discharge burn-up
- Fuel enrichment is the spent fuel assembly with the highest individual "initial" enrichment per cent of U-235

Special Note: The ninth cask experienced the drain port cap problem and the contamination of the annulus.