UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BLVD
ARLINGTON, TEXAS 76011-4511

March 30, 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 INSPECTION OF THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION - INSPECTION REPORTS 05000445/2012008, 05000446/2012008, AND 07200074/2012001

Dear Mr. Flores:

A team inspection was conducted of your Independent Spent Fuel Storage Installation (ISFSI) between February 20, 2012, and February 28, 2012. The inspection was conducted to confirm compliance with the requirements specified in the license, technical specifications, and Final Safety Analysis Report (FSAR) for the Holtec cask system during the loading of your first HI-STORM 100 storage cask. The enclosed report presents the results of this inspection. The inspection found that activities were being performed in accordance with procedural and regulatory requirements. No violations of NRC regulations were identified.

On February 28, 2012, an exit briefing was conducted with your staff to review the results of this inspection. A team of three NRC inspectors observed the critical evolutions associated with the first cask loading, from first grapple of a fuel assembly to placement of the HI-STORM storage cask onto the ISFSI pad. Comanche Peak now becomes the 16th operational ISFSI in Region IV. This inspection report documents the specifics of the first cask loading activities including selection and verification of canister contents, welding and nondestructive testing of the canister lid weld, compliance with technical specifications and FSAR requirements, overview of the radiological conditions of the first canister, and a descriptions of the loading operations.

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 and Spent Fuel Safety Branch

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

Enclosure:
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ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket:	50-445, 50-446, 72-74
Licenses:	NPF-87, NPF-89
Report Nos.:	05000445/2012008, 05000446/2012008, and 07200074/2012001
Licensee:	Luminant Generation Company LLC
Facility:	Comanche Peak Nuclear Power Plant, Units 1 and 2 Independent Spent Fuel Storage Installation (ISFSI)
Location:	FM-56 Glen Rose, Texas
Dates:	February 20 – 28, 2012
Team Leader:	Vincent Everett, Senior Inspector, RIV Repository and Spent Fuel Safety Branch (RSFSB)
Inspectors:	Lee Brookhart, Health Physicist, RIV, RSFSB Clyde Morell, Storage & Transport Safety Inspector, NMSS
Approved By:	D. Blair Spitzberg, Ph.D., Branch Chief Repository and Spent Fuel Safety Branch Division of Nuclear Materials Safety

EXECUTIVE SUMMARY

Comanche Peak Nuclear Generating Station
NRC Inspection Report 50-445/2012-08, 50-446/2012-08, and 72-74/2012-01

Comanche Peak had constructed an ISFSI pad to hold 84 HI-STORM 100S Version B storage casks (overpacks) containing the MPC-32 multipurpose canister design. The ISFSI was licensed by the NRC under the general license provisions of 10 CFR Part 72. The 2012 loading campaign was scheduled to load twelve casks. During the loading of the first canister beginning February 20, 2012, the NRC provided 24-hour coverage of the loading operations for all the critical tasks. This included fuel movement, heavy lifts of the loaded canister, radiation surveys of the loaded transfer cask and storage cask, welding of the lid and port cover plates, forced helium dehydration drying, helium backfill of the canister and transportation of the HI-STORM storage cask to the ISFSI pad. Workers were knowledgeable of their assigned tasks and had been well trained. Problems and issues were quickly identified and effectively resolved. Shift supervision provided good oversight of work activities. Procedures were closely followed and good communications between the workers was exhibited. The inspection found that activities were being performed in accordance with procedural and regulatory requirements. The first cask was placed on the ISFSI pad on February 28, 2012. The licensee made their required 30 day notification to the NRC on March 6, 2012 (NRC ADAMS Accession # ML12081A006) registering the use of their first cask in accordance with 10CFR72.212(b)(2).

Operation of an ISFSI at Operating Plants (60855.1)

- The total heat load (Q_{Total}) of the first canister loaded at Comanche Peak was 17.813 kilowatts (kW) based on summing the individual spent fuel assembly heat loads. The canister was loaded using a regional loading plan. The canister heat load limit was 34 kW. Boron concentrations in the spent fuel pool during loading were maintained above the minimum limit specified in Technical Specification Appendix A, Section 3.3.1 and confirmed through periodic sampling. All fuel assemblies loaded were inspected for damage and found to be free of foreign material. The fuel assemblies loaded met the requirements for decay heat, burnup, and cooling time limits established in Technical Specification Appendix B, Section 2.4 (Section 1.2.a).

- The 130-ton fuel building overhead crane lifted and transported the HI-TRAC transfer cask containing a canister loaded with fuel and water without problems. The weight of this lift was calculated to be 127.9 tons. The smooth operation of the 130-ton crane was due in part, to the extensive effort of preventative maintenance the licensee performed on the crane. Numerous pieces of equipment had been replaced or upgraded to ensure successful completion of the upcoming ISFSI campaigns (Section 1.2.b).

- The licensee was successful in completing the canister's lid-to-shell weld, the vent and drain port cover plate welds, and the canister closure ring welds. The welding personnel completed good welds with only a few indications found by either visual or liquid penetrant testing. All indications were successfully cleaned by the welders and passed the subsequent non-destructive examination. Throughout the lid-to-shell welding, the licensee monitored for hydrogen as required by Technical Specification Appendix B, Section 3.8 (Section 1.2.c).

- The canister was pressurized during the hydrostatic pressure test to 128.9 psig and held for a period of ten minutes in accordance with FSAR Section 8.1.5.4. No leakage was observed around the lid-to-shell weld area and the subsequent liquid penetrant exam passed with no indications (Section 1.2.d).

- The licensee had removed the bulk water from the canister and met the time-to-boil time limit. The canister was successfully dried though the use of the forced helium dehydration system, below the dryness criteria of Technical Specification Appendix A, Section 3.1.1.1 (Section 1.2.e).

- The canister was backfilled with 99.995% helium to the required pressure criteria specified in Technical Specification Appendix A, Section 3.1.1.2 (Section 1.2.f).

- The vent and drain port cover plate welds were leak tested to the leak tight criteria of ANSI N14.5 (1997), meeting Technical Specification Appendix A, Section 3.1.1.3 (Section 1.2.g).

- Radiological controls were effectively implemented during cask loading activities. Radiation levels in the work areas around the HI-TRAC transfer cask during welding, removal of water from the canister, drying of the canister, and helium backfill were low, with most areas less than 0.5 mR/hr. The survey results of the HI-TRAC transfer cask and HI-STORM storage cask required by Technical Specification Appendix A, Section 5.7 were all below the limits (Section 1.2.h).

- A seismic restraint was used by the licensee during the HI-TRAC/HI-STORM stack-up operations (Section 1.2.i).

- The vertical cask transporter with new and improved wheel hubs was successfully used to transport the loaded HI-STORM storage cask from the fuel building to the ISFSI pad on February 28, 2011. Analysis had concluded that the new design and fabrication changes made to the hubs would improve their performance. Comanche Peak included provisions in their procedures to address a failure of the transporter that would require the transporter to be disconnected from the cask and the cask left in a free-standing configuration (Section 1.2.j).

- The corrective action system was being used to capture issues and document corrective actions. All condition reports reviewed had been adequately resolved. No adverse trends were identified (Section 1.2.k).

Report Details

1 Operation of an ISFSI at Operating Plants (60855)

1.1 Inspection Scope

This ISFSI inspection included 24-hour coverage of the loading operations for the critical tasks associated with the licensee's first cask loading. Inspectors from both NRC Region 4 and NRC headquarters observed operations which included fuel loading, heavy lifts associated with the fuel building crane, welding and nondestructive testing of the canister lid-to-shell weld, hydrostatic pressure testing, forced helium dehydration, helium backfill, vent/drain port welding and nondestructive testing, helium leak testing, radiological surveying, and transport of the HI-STORM storage cask to the ISFSI pad. The inspectors reviewed selected procedures and records to verify ISFSI operations were in compliance with the Holtec Certificate of Compliance #1014, Amendment 7 and the Holtec Final Safety Analysis Report, Revision 9.

1.2 Observations and Findings

a. Fuel Selection and Fuel Loading

Procedure NUC-212 "Spent Fuel Limits for Dry Cask Operations" Revision 1 was used to verify that spent fuel selected for storage in the HI-STORM storage casks met the applicable technical specification requirements and to document the specific fuel characteristics of each canister planned for loading during the first loading campaign. The canisters being used at Comanche Peak held 32 zirconium clad pressurized water reactor 17 x 17 spent fuel assemblies. The first canister was loaded using the Region I (inner) and Region II (outer) loading concept allowed by Technical Specification 2.4 "Decay Heat, Burnup, and Cooling Time for Zr-Clad Fuel." The maximum total decay heat allowed per canister from Technical Specification Appendix B, Section 2.4.2 for regional loading was 34 kilowatts (kW). The sum of the heat load of all 32 assemblies loaded in the first canister was 17.813 kW (Q_{total}). For compliance with the Certificate of Compliance technical specifications, the calculated heat load was 20.324 kW (Q_{CoC}) using the regional heat load formula specified in FSAR Section 2.1.9.1.2. This Q_{CoC} value was used to determine the required helium backfill limit and to determine if supplemental cooling was required. The Q_{total} value was used to determine the time-to-boil-limit as specified per FSAR Section 4.5.2. For burnup limits for the canister, Technical Specification B.2.4.3.4 limited the calculated burnup to 68,200 megawatt days per metric ton uranium (MWD/MTU). Procedure NUC-212, Step 5.4 limited the burnup for the Comanche Peak casks to 50,000 MWD/MTU. For the first canister, the highest spent fuel assembly burnup value was 42,278 MWD/MTU. Technical Specification B.2.4.3 "Burnup Limits as a Function of Cooling Time for Zr-Clad Fuel" provided an equation to calculate the burnup limit for each individual fuel assembly. Procedure NUC-212 had incorporated this equation in its model. Form NUC-212-5 was generated by the computer model and listed the acceptable burnup value. For the first canister, a review was completed of each of the spent fuel assembly burnup values and the calculated maximum burnup value allowed for the assembly based on cooling time, decay heat, and enrichment using the equation in Technical Specification 2.4.3. All fuel assemblies selected for the first canister met the individual burnup limits.

Computerized reports generated from the model created to implement Procedure NUC-212 listed the maximum enriched fuel assembly for the first canister as 4.5% enriched U-235 and the fuel assembly with the lowest enrichment as 3%. Technical Specification Table 2.1-1 "PWR Fuel Assembly Characteristics" listed 5% as the maximum enrichment for 17x17A fuel. The minimum enrichment limit established in the Comanche Peak procedure was 2.3%. The minimum 2.3% enrichment limit was not from the Certificate of Compliance, but was from Holtec Report HI-2104636 "Dose Versus Distance From HI-STORM 100S Version B Containing MPC-32 for Comanche Peak," Revision 4. This report calculated the dose at the owner controlled area to demonstrate compliance with the 25 mrem/yr limit specified in 10 CFR 72.104 and considered several assumed combinations of burnup and enrichment. The lowest enrichment verified to be bounded by the Holtec calculations for the Comanche Peak site was 2.3%. As such, loading of spent fuel with a lower enrichment value would require a revision of the Holtec report to analyze the dose at the owner controlled area. Lower enrichment of U-235 in spent fuel will result in a higher source term and dose rate from the fuel assembly after it has been inside the reactor due to the higher amount of U-238 that is fertile to become Pu-239.

For spent fuel enriched to a maximum of 4.5%, a minimum boron concentration of 2271 part per million (ppm) was required in the spent fuel pool during canister loading, as verified by two independent boron samples. Boron samples taken from the spent fuel pool prior to loading the canister were 2693 ppm and 2695 ppm on February 20, 2012 at 10:30 am. Pool water temperature was 81 degree F. The HI-TRAC transfer cask containing an empty canister was placed into the spent fuel pool at 7:20 pm on February 20. A new set of boron samples was collected at 8:35 pm and was found to be 2610 ppm and 2611 ppm. The first fuel assembly was placed into the canister at 10:56 pm, within the four hour time limit of sampling the spent fuel pool for boron as required by Technical Specification Appendix A, Section 3.3.1. The licensee averaged approximately 20 – 25 minutes to retrieve a spent fuel assembly from the storage rack, perform a video inspection, and insert the assembly into the canister. All fuel assemblies were inspected for damage prior to placement in the canister by use of an underwater camera. The recorded inspections for all 32 fuel assemblies were compiled onto a DVD that was required to be saved for the life of the ISFSI. No damage was observed on any of the fuel assemblies loaded into the first canister, though numerous assemblies had noticeable levels of crud. Of the fuel loaded into the first canister from the Unit 2 spent fuel pool, 21 assemblies had been used in Unit 1 and 11 fuel assemblies were from Unit 2. The last fuel assembly was loaded into the canister at 1:50 pm February 21, 2012. Fuel loading took approximately 15 hours, with this time including lunch breaks, personnel changes, and pre-shift briefings.

b. <u>Heavy Lifts</u>

The lid was placed on the canister at 8:24 am on February 22, 2012 while the canister was in the spent fuel pool and inside the HI-TRAC transfer cask. This was the time used to start the time-to-boil time clock. The time-to-boil deadline was calculated in Attachment 10.1.3 "Time-to-Boil Worksheet" in Procedure DCS-203 "MPC Handling and Fuel Loading Operations" Revision 3. The calculation was consistent with FSAR Section 4.5.2. The time-to-boil deadline was calculated as February 24, 2012 at 3:24 pm. The HI-TRAC transfer cask containing the loaded canister was lifted from the spent fuel pool and moved to the dry cask pit using the licensee's 130 ton fuel building crane. This was the heaviest lift throughout the campaign and was calculated to be approximately 255,814 lbs (127.9 tons). The crane lifted and transported the cask to the dry cask pit without any problems. The cask was placed into the dry cask pit at 10:35 am on February 22, 2012.

The smooth operation of the 130-ton overhead fuel building crane was due, in part, to the licensee's extensive preventative maintenance effort on their crane. Numerous crane components had been replaced or upgraded to ensure successful completion of the upcoming ISFSI campaigns. One of the more recent upgrades included replacement of the actuators on the main hoist pneumatic emergency braking system. During this replacement, maintenance individuals found that two brake "yoke" assemblies had developed cracks. The 130-ton crane had two braking systems for the main hoist, the holding brakes which were electrical and the emergency brake which was pneumatic. While the crane was energized, the pneumatic emergency braking system remained open and would close on a trip signal or loss of power, locking the brakes. Had the small yoke assemblies completely failed during crane use, the pneumatic emergency brake would have closed and locked the main hoist from moving the load up or down. The licensee had recently developed a procedure and procured the required equipment to manually move and safely lower a load should a crane malfunction such as this occur during a fuel loading campaign. During this inspection, the licensee provided a step-by-step description of the operations to manually operate the crane, including providing a walkdown of the crane bridge and trolley with the NRC inspectors.

c. Welding and Non-Destructive Examinations

Welding of the canister lid-to-shell began at 10:43 pm on February 22, 2012. The licensee utilized both an in-line and hand-held hydrogen monitor throughout the root pass weld to ensure hydrogen levels were below the lower explosive limit. Monitoring of hydrogen was required by Technical Specification Appendix B, Section 3.8. The hand held hydrogen monitor was a H_2 Scan 500 Model, serial number A000396. The annual calibration of the monitor had been performed on January 1, 2012. The in-line hydrogen monitor was a Hy-Optima 1700 Model, serial number A000179. The in-line monitor was calibrated on January 19, 2012. Hydrogen levels rose from 0% up to 1.03% just before completing the root pass weld. The hydrogen limit was 2%. The root pass weld took approximately 1 hour. The following fill welds, the final weld, and the required nondestructive testing (visual and dye penetrant testing) took approximately 10 hours to complete. The welding personnel completed good welds with only a few indications found by either visual or liquid penetrant testing. All indications were successfully cleaned by the welders and passed the subsequent non-destructive examination.

Welding on the vent and drain port cover plates was completed after hydrostatic pressure testing, blowdown, forced helium dehydration, and helium backfilling. The welds on the vent and drain port cover plates successfully passed all nondestructive examinations. After the vent/drain ports were helium leak tested, the closure ring was placed on the canister and properly welded.

d. Hydrostatic Pressure Testing

A new set of boron samples were required prior to filling the canister with water to perform the hydrostatic test. The new boron sample values were 2582 ppm and 2581 ppm and met the minimum concentration limit of 2271 ppm. The two pressure gages, P-3 and P-5, used in the hydrostatic pressure test were both calibrated on February 20, 2012, three days prior to use. Post calibration was March 5, 2012, 12 days after use on the first canister. This met the calibration requirement of ASME Section III Article NB-6413 for calibrating pressure gages. The hydrostatic test started at 10:08 pm and was completed by 10:18 pm on February 23, 2012. The canister was pressurized to 128.9 psig and held for ten minutes in accordance with FSAR Section 8.1.5.4. Section 8.1.5.4 required the canister to be hydrostatically pressure tested to 125 psig + 5, - 0 psig and held for a ten minute period. No leakage was observed around the lid-to-shell weld area and the subsequent liquid penetrant exam passed with no indications.

e. Blowdown and Forced Helium Dehydration (FHD)

All water was removed from the canister using the forced helium dehydration (FHD) blowdown process and FHD drying process. The blowdown started at 2:30 am on February 24, 2012 and was completed at 4:59 am on February 24, 2012. The licensee met the time-to-boil time clock and had removed the bulk water from the canister prior to the time-to-boil deadline of 3:24 pm on February 24, 2012. The FHD drying valve line-up was completed to initiate drying operations by 8:01 am on February 24, 2012. The drying operations were completed approximately 27 hrs later at 11:00 am, February 25, 2012. The helium gas temperature exiting the freezer section of the dryer was less than 16 °F for over 30 minutes. This met Technical Specification Appendix A, Section 3.1.1.1 which required the gas temperature exiting the demoisturizer to be 21 degrees F or less for 30 minutes or more.

f. Helium Backfill

Helium backfill of the canister was completed by 12:28 pm on February 25, 2012. The canister was successfully backfilled with 72.7 pounds/square inch-gauge (psig) of helium at a temperature of 289.3 °F, as shown on the inlet temperature gauge of the canister, and a temperature of 296.8 °F, as shown on the exit temperature gauge to the canister. Using the ideal gas law, this equated to a pressure of 46.5 to 47.1 psig at 70 °F. Technical Specification Appendix A, Section 3.1.1.2 required casks with calculated heat loads (Q_{CoC}) less than or equal to 28.74 kW to backfill the canister with helium equal to or greater than 29.3 psig up to 48.5 psig when the pressure range is at a reference temperature of 70 °F. The licensee was within that pressure band for their first canister which had a Q_{CoC} heat load of 20.324 kW. The value for Q_{CoC} was calculated in accordance with FSAR Section 2.1.9.1.2. The purity of helium used to backfill the canister was 99.995% per Air Liquide Specification Sheet no. ZB-ALPCYL-OPS-0035-F, Revision 0. Technical Specification Table 3-2 required the helium used for backfilling the canister to have a purity of 99.995% or higher.

g. Helium Leak Testing

Technical Specification Appendix A, Section 3.1.1.3 required the helium leak rate through the canister vent and drain port confinement welds to meet the leak tight criteria of American National Standards Institute (ANSI) N14.5 (1997) "Leakage Tests on Packages for Shipment." The ANSI standard required a leakage rate less than or equal to 2 x 10(-7) atm·cc/sec of helium at an upstream pressure of 1 atmosphere (atm) absolute (abs) and a downstream pressure of 0.01 atm abs or less. For the first canister loaded, this required leak rate was verified using Procedure MSLT-MPC-Holtec "Helium Mass Spectrometer Leak Test Procedure". A Varian Model 959M helium leak detector (Serial Number: LL1001L003) was used to measure the leak rate on the vent and drain port welds. The sensitivity of the helium leak rate detector was calculated to be 2.0 x 10(-9) atm cc/sec. The sensitivity was calculated using a helium calibration source (Serial Number: 5227) that had an expiration date of February 14, 2014. During the leak tests, the upstream pressure was 1 atm and downstream pressure was about 10 millitorr (1.3 x 10(-6) atm cc/sec). The drain port leak test result was 1.4 x 10(-8) atm cc/sec and the result of the vent port was 1.6 x 10(-8) atm cc/sec. The total leak rate was 3.0 x 10(-8) atm cc/sec, which was less than the required ANSI N14.6 limit of 2 X 10(-7) atm·cc/sec. The helium leak rate testing on the vent and drain port welds was completed on February 25, 2012 at 6:00 pm.

h. Radiation Protection

Radiological coverage was provided throughout the loading campaign to ensure worker safety. The first cask had a heat load of 17.813 kW and was not expected to have high radiation levels or require restrictive work limitations to prevent workers from receiving high doses for most of the work activities. The radiation protection staff implemented ALARA controls to minimize the overall collective dose during cask loading by providing a significant amount of radiation protection technician coverage during work activities, routinely observing work activities by radiation protection management personnel, providing detail and comprehensive pre-job briefings on radiological conditions, effectively using portable radiation shielding, directing personnel to remain away from the cask unless performing work, and by using the video system where personnel could watch cask loading activities from the radiation protection control point and the outage control center. The HI-TRAC transfer cask was cleaned as it was removed from the spent fuel pool and kept free of contamination, allowing workers to perform welding and other work around the cask without restrictive contamination controls. Dose rates varied depending on whether water was in the canister and in the annulus gap and were maintained at reasonable levels in the work area through the use of portable shielding such as lead blankets. The following table provides examples of the dose rates measured around the cask during the work activities in the fuel building. Note that the highest radiation levels were from streaming up the annulus gap and at the vent and drain ports.

Table 1 – Dose Rate Surveys During Cask Work Activities
(Note: Values Represent Highest Contact Reading)

LOCATION	GAMMA (mR/hr)	NEUTRON (mrem/hr)
HI-TRAC – center of lid - cask being removed from pool - water in canister and in annulus gap	12	-
HI-TRAC – annulus gap (unshielded) – cask being removed from pool – water in canister and in annulus gap	66	-

LOCATION	GAMMA (mR/hr)	NEUTRON (mrem/hr)
HI-TRAC – general work area around top portion of cask prior to lid welding - water in canister and in annulus gap	<0.5	0.6
HI-TRAC – along sides at lower levels - water in canister and in annulus gap	10	0.8
HI-TRAC – annulus gap after root pass weld installed - water in the canister and in annulus gap	8	<0.5
HI-TRAC – various locations on lid – water drained from canister – annulus being drained – neutron shielding on lid	3-4	8-9
HI-TRAC – vent & drain ports - water drained from canister – annulus drained – no shielding on ports	148	12
HI-TRAC – annulus gap – water drained from canister and annulus gap - shielding removed prior to welding of closure ring	305	28

Note: Neutron readings were taken with the ASP-1 remball unless noted otherwise. Gamma readings were taken with a teletector

Comanche Peak performed the various neutron surveys using the ASP-1 remball. A number of side-by-side surveys were also performed using the Rem-500 as a comparison. Table 2 provides some of the comparison data collected. The values were contact readings. The canister and annulus were drained. The neutron shield consisted of tungsten impregnated blocks.

Table 2 – Comparison of Remball to Rem-500 Neutron Readings
(Note: Values Represent Contact Reading)

LOCATION	GAMMA (mR/hr)	REMBALL (mrem/hr)	REM-500 (mrem/hr)
HI-TRAC – center of lid – no shielding	17	34	12
HI-TRAC – edge of lid – no shielding	12	40	20
HI-TRAC – edge of lid – neutron shield installed	2	8	3
HI-TRAC – annulus gap – no shielding	225	28	17
HI-TRAC – annulus gap – neutron shield installed	20	10	2
HI-TRAC – midway along side of cask	22	12	20

As can be seen from the data on the lid, the remball consistently read 2 – 3 times higher than the Rem-500, except along the side of the cask. The licensee placed special neutron dosimeters at several locations on the cask to further analyze the neutron contribution to the overall dose. Personnel neutron dosimetry was required around the cask once the water had been drained.

Technical Specification A.5.7 required surveys of the HI-TRAC transfer cask which was performed after the outer lid welding was completed. Once the canister had been transferred to the HI-STORM storage cask, the same Technical Specification required surveys of the storage cask. The neutron surveys were performed using a remball. The gamma surveys were performed using a teletector. The radiological limits for the dose on the HI-TRAC transfer cask and the HI-STORM storage cask to comply with the technical specifications was calculated in Holtec Report HI-2104635 "HI-STORM Certificate of Compliance Radiation Protection Program Dose Rate Limits for Comanche Peak," Revision 4. For the HI-TRAC transfer cask, four readings were required on the side of the cask at the midline, 90 degree apart. Four readings were required on the lid at 90 degree from each other and half way between the outer edge of the top lid and the inner holes. For the HI-STORM storage cask, four readings 90 degree apart were required on the side of the storage cask, one set on the lower plane, one set at midheight and one set on the upper plane. On the lid of the storage cask, one reading was required at the center and four at 90 degree apart on the lid halfway between the center and the edge. Surveys of all four upper vents and all four lower vents were required. The survey results with the highest total value (neutron plus gamma) are provided in the following table. All surveys demonstrated that the first cask met the Technical Specification A.5.7 radiation limits.

Table 3 – Tech Spec A.5.7 Survey of HI-TRAC and HI-STORM
(Note: Values Represent Highest Contact Reading)

LOCATION	GAMMA (mR/hr)	NEUTRON (mrem/hr)	TOTAL (mrem/hr)	TS LIMIT (mrem/hr)
HI-TRAC - side midplane	19	16	35	458.7
HI-TRAC - lid	1	6	7	66.1
HI-STORM – side – upper plane	0.5	0.8	1.3	24.5
HI-STORM – side – midheight	1.1	1.2	2.3	40
HI-STORM – side – lower plane	0.7	0.8	1.5	8.2
HI-STORM – lid - center	0.4	0.8	1.2	14.6
HI-STORM – lid – midway to edge	0.5	0.8	1.3	20.5
HI-STORM – lower vent ducts	1.6	1.6	3.2	71.9
HI-STORM – upper vent duct	0.5	1.4	1.9	32.5

The seismic restraint system was in place during the stack-up activities to transfer the canister from the HI-TRAC transfer cask into the HI-STORM storage cask. As the canister was lowered into the HI-STORM storage cask, readings were taken of the gap between the two casks where the matting device was located. Radiation streaming occurred from the gap as the canister was being lowered. The radiation levels were measured at 1,150 mR/hr at 5 feet on one side and 1,000 mR/hr at 15 feet from the other side. The radiation protection staff had restricted personnel from the area where the streaming occurred and had posted the area as a high radiation area. After the canister was fully inserted into the HI-STORM storage cask, the HI-TRAC transfer cask and mating device were removed and the HI-STORM storage cask moved to outside the fuel building on the low profile transporter. The gamma dose rate under the center of the transporter approached 1,000 mR/hr, reflecting the doses on the bottom of the HI-STORM storage cask due to the reduction in shielding. Dose rates around the perimeter of the HI-STORM storage cask were less than 2 mR/hr gamma.

Beta/gamma contamination levels found during surveys of the HI-TRAC transfer cask, the HI-STORM storage cask, and the work areas in the fuel building were less than 1,000 disintegrations per minute (dpm) per 100 square cm, except for the initial survey of the cask coming out of the spent fuel pool, which found one spot reading 26,000 dpm. The contamination was easily removed. Additional contamination surveys were performed of the lid and weld area after the root pass weld had been completed. No contamination was found. The contamination survey of the top 6 inches of the canister shell required by Technical Specification Appendix A, Section 3.2.2, after water was lowered in the annulus gap, found no contamination, indicating the canister was free of contamination. No alpha contamination was found during the surveys with all readings below 20 dpm.

i. Stack-up and Transportation of HI-STORM to the ISFSI Pad

The licensee began stack-up operations on the morning of February 27, 2011. A seismic restraint was used to restrain the HI-TRAC transfer cask while positioned on top of the HI-STORM storage cask. A mating device was located between the two casks and both casks were securely bolted to the mating device. The canister was successfully lowered into the storage cask at 3:05 pm on February 27, 2011. The night shift removed the transfer cask and the mating device and placed the lid onto the HI-STORM storage cask.

The HI-STORM storage cask containing the loaded canister was removed from the fuel building the next morning by 7:30 am on February 28, 2012. By 11:00 am the cask was connected to the vertical cask transporter and was in route to the ISFSI pad. The storage cask was placed on the ISFSI pad, in the far north east corner, by 1:35 pm on February 28, 2012.

j. Vertical Cask Transporter Wheel Failure Independent Report

Prior to the originally scheduled July 2011 loading of the first canister at Comanche Peak, a failure of a wheel hub on the vertical cask transporter occurred delaying the loading campaign. This issue was documented in the Comanche Peak pre-operational inspection report dated October 21, 2011 (NRC Adams Accession # ML11297A030). A preliminary root cause analysis of the wheel hub failure was performed by the original equipment manufacturer. The preliminary analysis concluded that the slopes associated with the Comanche Peak haul path placed high stresses on the vertical cask transporter wheels and were a significant contributor to the failure of the hub assembly. As such, a new replacement wheel hub was designed and manufactured. On February 9, 2012, Holtec, Inc. informed Comanche Peak that they had performed an assessment of the design improvements implemented by the vertical cask transporter manufacturer during trial runs in October 2011. The improvements had included both design and material changes to enhance the machine's reliability and included: a) improving the hub material with respect to mechanical properties that were important to preventing structural failure under impact and impulsive loads, b) replacing all hubs with an improved design that provided additional structural strength in high stress areas and eliminated stress increases from corners, c) increased the stiffness of the tires to reduce the contact area with the ground under the carried load which would reduced total friction forces that could arise during steering operations, and d) strengthened the inspection of the hubs using ultrasonic testing to prevent unexpected crack propagation. Holtec stated that the improvements, in conjunction with past experience of identical vertical cask transporters at other facilities, provided assurance that the vertical cask transporter would fulfill its required function for the first loading campaign at Comanche Peaks to load twelve casks. Holtec noted that additional review of the manufacturer's root cause analysis was still being performed to determine if any limitations would be appropriate after the first twelve casks were loaded. Comanche Peak initiated a review of the manufacturer's conclusions on the failure of the wheel hub and contracted with KnightHawk Engineering to review the manufacturer's report on the incident, the metallurgical analysis that had been performed, and the design of the new hub. A report was provided to Comanche Peak dated February 9, 2012 which questioned several of the original conclusions reached in the manufacturer's report related to the predicted life of the hub and the forces and applied loads that caused the hub failure. KnightHawk Engineering questioned whether the slope of the haul path was the real cause of the failure versus the stresses placed on the hubs during turning operations. A finite element analysis was performed on both the old hub and the new hub to determine the suitability of the new hub design. The analysis completed by KnightHawk Engineering concluded that the stresses that would occur on the new hub design were well below the endurance limits of the material, and as such, the redesigned hub should provide a long service life.

Comanche Peak had included contingency plans in Procedure DCS-301 "Dry Cask Storage Equipment Malfunction, Loop, and Contingency Guidance," Section 8.6 "Cask Transporter Failure," should a failure of the vertical cask transporter occur while moving a loaded cask to the ISFSI pad. If a wheel failed, the licensee intended to repair or replace the wheel while the vertical cask transporter was still connected to the cask. However, should the repair activity require the vertical cask transporter to be disconnected from the cask, provisions were made in Steps 8.6.9 and 8.6.11 to place a minimum of 1 ½ inches of non-flammable dunnage on the set down area and place sand bags around the cask. The sand bags were used in case of a cask tip-over and to prevent the cask from rolling down the slope of the haul path. Holtec performed a tip-over analysis to determine the acceptability of using sand bags to reduce the peak deceleration on the spent fuel inside the canister. For a haul path not designed to the Set A or Set B parameters of the Holtec FSAR, Table 2.2.9 "Examples of Acceptable ISFSI Pad Design Parameters," a free-standing overpack (HI-STORM storage cask loaded with a canister of spent fuel) was limited to an impact loading during a drop of 45 g's at the top of the canister fuel basket. This limit would be applicable to a tip over event on the haul path. Holtec Report HI-2114969 "Analysis of a Postulated HI-STORM Tip-Over Event on the Comanche Peak Nuclear Power Plant Haul Path," Revision 0 considered a situation where a loaded cask had started the journey to the ISFSI pad, but was temporarily stranded somewhere on the haul path and the vertical cask transporter had to be disconnected for repair, leaving the HI-STORM storage cask free standing. The report examined the acceptability of using sand bags placed around the cask to limit the impact on the spent fuel during a tip-over to less than the 45 g design limit. The analysis was performed using the finite element code LS-DYNA. The same methodology used in the Holtec Final Safety Analysis Report for generic tip-over analysis and for the Comanche Peak ISFSI pad tip-over analysis was incorporated into the Holtec report. The haul path was conservatively represented by one foot thick concrete with underlying limestone bed rock, which bounded the Comanche Peak haul path in terms of stiffness. The analysis showed that the maximum deceleration at the top center of the cask was less than 20 g's when the top of the cask impacted the sand bags. This assumed that the sand bags were placed around the cask at a distance no greater than 80 inches and were 188 inches in width and 36 inches high. The analysis concluded that the use of the sand bags was an acceptable method to prevent the tip-over design limits from being exceeded.

k. Condition Reports

The licensee provided a list of the condition reports initiated in the corrective action system since the pre-operational inspection in July 2011. The licensee had initiated over 150 new condition reports since the last inspection. Eleven condition reports were selected for additional review that related to ISFSI issues or to the 130-ton overhead fuel building crane. These condition reports included a variety of issues such as the vertical cask transporter hub failure remedial actions, fuel building crane tripped during movement of equipment, lessoned learned from other Holtec users, ISFSI procedural errors, pressure relief valve for hydrostatic skid had the wrong set point, preventative maintenance issues identified on the 130-ton overhead fuel building crane, and procurement issues associated with replacement parts for the 130-ton overhead fuel building crane. All condition reports reviewed were determined to be adequately resolved. No adversely developing trends were identified in the condition reports reviewed.

1.3 Conclusions

The total heat load (Q_{Total}) of the first canister loaded at Comanche Peak was 17.813 kilowatts (kW) based on summing the individual spent fuel assembly heat loads. The canister was loaded using a regional loading plan. The canister heat load limit was 34 kW. Boron concentrations in the spent fuel pool during loading were maintained above the minimum limit specified in Technical Specification Appendix A, Section 3.3.1 and confirmed through periodic sampling. All fuel assemblies loaded were inspected for damage and found to be free of foreign material. The fuel assemblies loaded met the requirements for decay heat, burnup, and cooling time limits established in Technical Specification Appendix B, Section 2.4.

The 130-ton fuel building overhead crane lifted and transported the HI-TRAC transfer cask containing a canister loaded with fuel and water without problems. The weight of this lift was calculated to be 127.9 tons. The smooth operation of the 130-ton crane was due in part, to the extensive effort of preventative maintenance the licensee performed on the crane. Numerous pieces of equipment had been replaced or upgraded to ensure successful completion of the upcoming ISFSI campaigns.

The licensee was successful in completing the canister's lid-to-shell weld, the vent and drain port cover plate welds, and the canister closure ring welds. The welding personnel completed good welds with only a few indications found by either visual or liquid penetrant testing. All indications were successfully cleaned by the welders and passed the subsequent non-destructive examination. Throughout the lid-to-shell welding, the licensee monitored for hydrogen as required by Technical Specification Appendix B, Section 3.8.

The canister was pressurized during the hydrostatic pressure test to 128.9 psig and held for a period of ten minutes in accordance with FSAR Section 8.1.5.4. No leakage was observed around the lid-to-shell weld area and the subsequent liquid penetrant exam passed with no indications.

The licensee had removed the bulk water from the canister and met the time-to-boil time limit. The canister was successfully dried though the use of the forced helium dehydration system, below the dryness criteria of Technical Specification Appendix A, Section 3.1.1.1.

The canister was backfilled with 99.995% helium to the required pressure criteria specified in Technical Specification Appendix A, Section 3.1.1.2.

The vent and drain port cover plate welds were leak tested to the leak tight criteria of ANSI N14.5 (1997), meeting Technical Specification Appendix A, Section 3.1.1.3.

Radiological controls were effectively implemented during cask loading activities. Radiation levels in the work areas around the HI-TRAC transfer cask during welding, removal of water from the canister, drying of the canister, and helium backfill were low, with most areas less than 0.5 mR/hr. The survey results of the HI-TRAC transfer cask and HI-STORM storage cask required by Technical Specification Appendix A, Section 5.7 were all below the limits

A seismic restraint was used by the licensee during the HI-TRAC/HI-STORM stack-up operations.

The vertical cask transporter with new and improved wheel hubs was successfully used to transport the loaded HI-STORM storage cask from the fuel building to the ISFSI pad on February 28, 2011. Analysis had concluded that the new design and fabrication changes made to the hubs would improve their performance. Comanche Peak included provisions in their procedures to address a failure of the transporter that would require the transporter to be disconnected from the cask and the cask left in a free-standing configuration.

The corrective action system was being used to capture issues and document corrective actions. All condition reports reviewed had been adequately resolved. No adverse trends were identified.

2 Exit Meeting

The inspectors reviewed the scope and findings of the inspection during an exit meeting conducted at the conclusion of the onsite inspection on February 28, 2012.

ATTACHMENT 1:

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONES CONTACTED

Licensee Personnel

J. Alldredge, Radiation Protection
T. Cornwell, Security
C. Davis, Radiation Protection
R. Garcia, Radiation Protection Supervisor
B. Henley, Project Manger
J. Hull, Fuel Handling Supervisor
K. Kilgariff, Radiation Protection
C. Lemons, Core Performance Engineer
C. Montgomery, Project Engineering Manager
L. Neuburger, Project Engineer
J. Seawright, Regulatory Affairs
T. Smith, Maintenance Supervisor
J. Simmons, Senior Quality Assurance Auditor

Holtec International

J. Fosdick, Construction Manager
J. McMahon, Welding Supervisor
M. Ragan, Cask Loading Supervisor

INSPECTION PROCEDURES USED

IP 60855.1 Operations of an ISFSI at Operating Plants

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Discussed

None

Closed

None

LIST OF ACRONYMS

abs	absolute
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
atm	atmosphere
cc/sec	cubic centimeters per sec
CFR	Code of Federal Regulations
cm	centimeter
CoC	Certificate of Compliance
DCS	dry cask storage
dpm	disintegrations per minute
F	Fahrenheit
FHD	forced helium dehydration
FSAR	Final Safety Analysis Report
ISFSI	Independent Spent Fuel Storage Installation
kW	killo-watt
MPC	multi-purpose canister
mR	MilliRoentgen
mrem	MilliRoentgen Equivalent Man
MWD/MTU	Mega Watt Day per Metric Ton Uranium
NRC	Nuclear Regulatory Commission
psig	pounds per square inch gauge
U-235	Uranium 235

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	4.5	Not Available
2	MPC-158	Serial No. 467	03/12/12	24.823	49,268	4.82	Not Available

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