INSPECTOR NOTES

SURRY ISFSI PRE-OPERATIONAL TESTING AND FIRST LOADING

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(INSPECTOR NOTES)

Category: Crane Design *Topic:* Hoist Control Brake

Reference: ASME B30.2, Sections 2-1.9.1 (b) and 2-1.9.3

Requirement: Each hoisting unit of the crane shall be equipped with a control brake to control lowering speeds. The control brake may be electrical, mechanical, or hydraulic and shall have the thermal capacity required for the frequency of operation required by the service.

Finding: This requirement was implemented. Primary braking control was provided by the hoist motor. The hoist motor was equipped with a 5-step full magnetic control via a wound rotor motor supplied with secondary resistance. Backup braking control was provided by a mechanical load brake. As lowering speed increased, the mechanical load brake engaged to limit the speed.

Documents Reviewed: Morris Material Handling/P&H e-mail to Dominion Resource Services, Inc., dated July 18,2007

Category: Crane Design *Topic:* Hoist Holding Brakes

Reference: ASME B30.2, Sections 2-1.9.1 and 2-1.9.2

Requirement: Each hoisting unit of the crane shall be equipped with at least one holding brake, applied directly to the motor shaft or some part of the gear train. The minimum holding brake torque rating shall be either 100% of the rated load hoisting torque when the hoist is equipped with a mechanical control brake; OR 125% of the rated load hoisting torque when the hoist is equipped with a non-mechanical control brake. When the hoist is equipped with two holding brakes, each holding brake shall have a torque rating of 100% of the rated load hoisting torque. Holding brakes shall be applied automatically when power to the brake is removed.

Finding: This requirement was implemented. The holding brake had a torque rating of 100% of rated load hoisting torque and was directly coupled to the hoist drive train motor. Since the hoist was equipped with a mechanical control brake, the 100% torque rating on the holding brake was adequate. The holding brake applied automatically when power was removed from the hoist motor.

Documents Reviewed: Morris Material Handling/P&H e-mail to Dominion Resource Services, Inc., dated July 18,2007

Category: Crane Design *Topic:* Remote Controls

Reference: ASME B30.2, Section 2-1.10.3(j)

Requirement: Remote operated cranes shall respond only to signals received from the operating station (transmitter). Signals received from any other source shall not result in operation of any motion of the crane.

Finding: This requirement was implemented. During the inspection, the licensee demonstrated

operation of the crane controls. When the crane controls were selected for REMOTE, the remote controls were functional but the cab controls were not. Conversely, when the crane controls were selected for LOCAL, the cab controls were functional but the remote controls were not.

Documents Reviewed: None.

Category: Crane Design *Topic:* Trolley Brakes

Reference: ASME B30.2, Section 2-1.9.4 (i)

Requirement: Each power driven trolley shall be equipped with brakes capable of stopping travel within a distance of 10% of the rated load speed in feet per minute when traveling at full speed under rated load with power off.

Finding: This requirement was implemented. The spent fuel cask crane was equipped with an operator controlled hydraulic foot brake, capable of stopping trolley travel within the required distance under the conditions specified.

Documents Reviewed: Morris Material Handling/P&H e-mail to Dominion Resource Services, Inc., dated July 18,2007

Category: Crane Design *Topic:* Trolley Bumpers

Reference: ASME B30.2, Section 2-1.8.3 (a)

Requirement: A power operated trolley shall be provided with energy absorbing bumpers capable of: a) stopping the trolley when traveling with power off in either direction at a speed of at least 50% of rated load speed; and b) stopping the trolley at a rate of deceleration not to exceed an average of 4.7 feet per second per second (ft/sec/sec) when traveling with power off in either direction at one third of rated load speed.

Finding: This requirement was implemented. The spent fuel cask crane was equipped with 4 spring bumpers, 1 at each end of the two trolley runways. These bumpers were capable of stopping the trolley within the required rate of deceleration, under the conditions specified.

Documents Reviewed: Morris Material Handling/P&H e-mail to Dominion Resource Services, Inc., dated July 18,2007

Category: Crane Design *Topic:* Wire Rope Rating

Reference: ASME B30.2, Section 2-1.11.3

Requirement: The hoisting ropes shall be of a recommended construction for crane service. The total load (rated load plus load block weight) divided by the number of parts of rope shall not exceed 20% of the nominal breaking strength of the rope.

Finding: This requirement was implemented. The spent fuel cask crane was rated for 125 tons (250,000 pounds) and the main load block weighed 4,750 pounds. The total load was 254,750 pounds.

The load block contained 6 sheaves and 12 parts of rope. The total load of 254,750 pounds divided by 12 parts of rope equaled 21,230 pounds. Since the 21,230 pounds cannot be greater than 20% of the nominal braking strength of the rope, the wire rope was required to have a nominal breaking strength of at least 106,146 pounds.

The wire rope on the main hoist of the Spent Fuel Cask Crane was 1-1/4" 6X19 IWRC with a steel core. This wire rope had a nominal strength of 69.4 tons or 138,800 pounds.

Documents Reviewed: Leschen Wire Rope Vendor Manual

Category: Crane Inspection/Maintenance *Topic:* Crane Inspection - Frequent

Reference: ASME B30.2; Sect 2-2.1.2

Requirement: Cranes in regular use shall be subjected to a frequent crane inspection monthly during normal service, weekly to monthly during heavy service, and daily to weekly during severe service. The frequent inspection points should include: a) operating mechanisms for proper operation; b) leakage in lines, tanks, valves, pumps, and other parts of the air or hydraulic systems; c) hooks for cracks, more than 15% of normal throat opening, or more than 10 degrees of twist; d) hook latches for proper operation; e) hoist ropes including end clamps; and e) the rope reeving system. All limit switches should be checked at the beginning of each work shift by inching, or running at slow speeds, each motion into its limit switch.

Finding: This requirement was implemented. The licensee had rated the Spent Fuel Cask Crane as Class A1 service (infrequent use). The ASME code does not reference an "infrequent use" service rating. Instead, ASME uses service ratings based on the periods of idle time between crane use. A crane in regular use is idle for less than one month at a time. A crane not in regular use is idle from one month to one year. A standby crane is idle for greater than one year. During dry fuel storage operations, the spent fuel cask crane can be idle for periods of time ranging from less than one month to greater than one year. As such, the licensee's crane inspection program was designed to meet the inspection requirements for all three crane service ratings used by ASME.

The frequent crane inspection criteria were contained in the Crane Operator's Checklist, provided in Attachment 3 of Procedure VPAP-0810. The Crane Operator's Checklist was required to be completed prior to crane use and the operator was required to bring any discrepancies to the attention of a qualified crane inspector immediately. The checklist contained inspection points consistent with this ASME code requirement. Performance of the Crane Operator's Checklist was observed during the first NUHOMS system loading, with no discrepancies identified.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16
Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Crane Inspection - Periodic

Reference: ASME B30.2; Sect 2-2.1.3

Requirement: Cranes in regular use shall be subjected to a periodic crane inspection annually during normal and heavy service, and quarterly during severe service. The periodic inspection includes checking for: a) deformed, cracked or corroded members; b) loose bolts or rivets; c) cracked or worn sheaves and drums; d) worn, cracked or distorted pins, bearings, shafts, gears, and rollers; e) excessive brake system wear; f) load, wind, and other indicators over their full range for any significant inaccuracies; g) gasoline, diesel, electric, or other power plants for improper performance; h) excessive drive chain sprocket wear and chain stretch; i) deterioration of controllers, master switches, contacts, limit switches and pushbutton stations.

Finding: This requirement was implemented. A periodic crane inspection was performed quarterly in accordance with Procedure VPAP-0810 and annually in accordance with Procedure 0-MCM-1304-01. The quarterly inspection requirements were specified in the Crane Pre-Critical Lift Inspection, provided in Attachment 2 of Procedure VPAP-0810. The "load, wind, and other indicators" and the "gasoline, diesel, electric, or other power plants" were features not used on the Surry Power Station Spent Fuel Cask crane. As such, they were excluded from the checklist.

The annual inspection requirements were specified in procedure 0-MCM-1304-01 and included the lubrication schedule and a more detailed inspection of the crane structure, load blocks, hooks, wire rope, drums and sheaves, brakes, and limit switch circuits. The last annual crane inspection was completed on July 26, 2007, in accordance with Procedure 0-MCM-1304-01 under Work Order #00762730.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16
Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Hook Inspections

Reference: ASME B30.10, Sections 10-1.4.2 and 10-1.4.6

Requirement: Hooks shall be inspected monthly during normal service, weekly to monthly during heavy service and daily to weekly during severe service. Hooks shall be inspected for: a) distortion such as bending, twisting or increased throat opening; b) cracks, severe nicks, or gouges; c) damaged or malfunctioning latch (if provided); and d) hook attachment and securing means. Hooks having any of the following deficiencies shall be removed from service unless a qualified person approves their continue use and initiates corrective action: a) cracks; b) wear exceeding 10% of the original sectional dimension; c) bend or twist exceeding 10 degrees from the plane of an unbent hook; and d) an increase in throat opening of 15% (for hooks without latches).

Finding: This requirement was implemented. The hooks were inspected prior to operating the crane in accordance with inspection items #16 and #22 of the Crane Operator's Checklist provided in Attachment 3 of Procedure VPAP-0810. The hooks were visually inspected for excessive wear, twist, and spread prior to use. Performance of the hook inspections was observed during the first NUHOMS system loading, with no discrepancies.

The hooks were also inspected annually in accordance with Section 6.4 of Procedure 0-MCM-1304-01. The hooks were visually inspected for cracks and excessive wear, and throat opening and twist were physically measured. The acceptance criteria was no more than a 5% increase in throat opening from nominal (as provided in Attachment 1 to the procedure), and no twist.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16
Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Preventive Maintenance Program

Reference: ASME B30.2; Sect 2-2.3.1

Requirement: A preventive maintenance program should be established based on the crane manufacturer's or a qualified person's recommendations.

Finding: This requirement was implemented. The Spent Fuel Cask Crane preventive maintenance program was established under Procedure 0-MCM-1304-01. The maintenance program was based on frequent and periodic inspections of the main and auxiliary hoist operation and travel, load blocks, hooks, wire ropes, hoist drums, and hoist and hoist brakes. The inspections also included proper operation and travel of the bridge, including brakes, lights, and warning devices. Finally, the maintenance program included the lubrication schedules. The preventive maintenance program was consistent with the P&H vendor manual.

Documents Reviewed: Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Wire Rope Inspection - Frequent

Reference: ASME B30.2, Section 2-2.4.1 (a)

Requirement: All ropes should be visually inspected at the start of each shift for: a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion; b) general corrosion; c) broken or cut strands; and d) number, distribution, and type of visible broken wires. When such damage is discovered, the rope shall be removed from service or be given a periodic inspection.

Finding: This requirement was implemented. The wire ropes were inspected prior to operating the crane in accordance with inspection items #17 and #23 of the Crane Operator's Checklist provided in Attachment 3 of Procedure VPAP-0810. The wire ropes were visually inspected for distortion, corrosion, and broken strands or wires. The wire rope inspections were observed during the first NUHOMS system loading, with no discrepancies identified.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16
Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Wire Rope Inspection - Periodic

Reference: ASME B30.2, Section 2-2.4.1 (b)

Requirement: Periodic wire rope inspections shall be performed at a frequency established by a qualified person, and whenever gross damage is discovered during a frequent inspection. Periodic inspections shall be performed over the full length of the rope and shall check for: a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion; b) general corrosion; c) broken or cut strands; d) visible broken wires; e) reduction of rope diameter below nominal due to loss of core support, internal or external corrosion, or wear of outside wires; f) severely corroded or broken wires at end connections; and g) severely corroded, cracked, bent, worn, or improperly applied end connections.

Finding: This requirement was implemented. The wire ropes were inspected annually in accordance with Section 6.7 and Table 5 of Procedure 0-MCM-1304-01. The inspection points were consistent with the ASME code requirements.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16
Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Inspection/Maintenance *Topic:* Wire Rope Replacement Criteria

Reference: ASME B30.2, Section 2-2.4.2

Requirement: Conditions such as the following should be sufficient reason for questioning continued use of the rope, or increasing the frequency of inspection: a) twelve randomly distributed broken wires in one lay or 4 broken wires in one strand in one lay; b) one outer wire broken at the contact point with the core of the rope which has worked its way out of the rope structure; c) wear of one-third of the original diameter of outside individual wires; d) kinking, crushing, birdcaging or any other damage resulting in distortion of the rope structure; e) evidence of heat damage; and f) reduction in diameter in excess of nominal.

Finding: This requirement was implemented. The wire ropes were inspected annually in accordance with Section 6.7 and Table 5 of Procedure 0-MCM-1304-01. Six randomly distributed broken wires in one rope lay or three broken wires in any one strand in one lay required wire rope replacement. All other conditions required evaluation by a qualified crane inspector.

Documents Reviewed: Procedure 0-MCM-1304-01, "Turbine, Polar, and Fuel Handling Crane Maintenance", Revision 5

Category: Crane Licensing Basis *Topic:* Load Drop Analysis

Reference: NUREG 0612, Sections 5.1.2.4 and 5.1

Requirement: For non-single failure proof cask handling cranes, the effects of a cask drop in all areas where the spent fuel cask will be handled should be analyzed to ensure that the worst case drop will not result in: a) doses to the public greater than 25% of the 10 CFR 100 limits; b) a spent fuel Keff greater than 0.95; c) lowering of spent fuel pool level to the

point of uncovering fuel assemblies; or d) a loss of reactor safe shutdown functions.

Finding: This requirement was implemented. The licensee had performed evaluations for spent fuel cask drops in the spent fuel pool, and had documented the results in Chapter 9, Appendix B.1.5 of the Surry Power Station UFSAR. Based on the results of these evaluations, the licensee installed impact limiters at the bottom of the spent fuel pool in the cask loading area, and had restricted the first three rows of storage racks to storage of fuel assemblies with decay times of at least 150 days.

The impact limiters and the loading restriction on the first three rows of storage racks ensured that if a cask drop were to occur: a) the spent fuel pool would sustain minimal damage and would not drain; b) the fuel assemblies would remain subcritical if the storage racks were damaged by a cask tip-over; and c) the radiological consequences of a cask drop would be within the limits of 10 CFR 100. The evaluations further documented that there were no safe shutdown systems under the travel path.

NUREG 0612 further limited the dose to the public from a cask drop to less than 25% of the 10 CFR 100 limit. The licensee performed a worst case drop analysis specific to the NUHOMS OS187H transfer cask and 32PTH-HD canister. The analysis considered a cask drop in both the fuel building and decontamination building, and the results were documented in Dominion Calculation PA-0238. The cask drop analysis assumed: a) the 32 spent fuel assemblies in the canister were bounding in terms of enrichment, burnup and cooling times; b) all 32 spent fuel assemblies ruptured; c) the release fractions for H-3, Kr-85, I-129, and Co-60 were consistent with those used for the worst case fuel handling accident; and d) the member of the public located at the site Exclusion Area Boundary (EAB) remained at that location for two hours following the onset of fission product release. Further, the analysis did not credit fuel building ventilation system filtration or the canister shield plug barrier.

Calculation PA-0238 indicated that the resultant dose to the member of the public was 0.495 rem to the whole body and 0.0285 rem to the thyroid. Since 25% of the 10 CFR 100.11 limit was 6.25 rem to the whole body and 75 rem to the thyroid, the dose from a cask drop was within the NUREG 0612 requirement.

Documents Reviewed: Surry Power Station Updated Final Safety Analysis Report (UFSAR), Revision 38
Dominion Calculation PA-0238, "EAB Dose from Drop of a NUHOMS Transfer Cask," dated June 14, 2007

Category: Crane Licensing Basis *Topic:* NUREG 0612 Phase I & II Letters

Reference: GL 81-07, GL 85-11

Requirement: Generic Letter 81-07 required licensees to evaluate their controls of handling heavy loads and to provide these evaluations to the NRC. Generic Letter 85-11 documented that all licensees had submitted a Phase I and a Phase II report, and further stated that while not a requirement, the NRC encouraged the implementation of any actions the licensee identified in Phase II regarding the handling of heavy loads.

Finding: This requirement was implemented. Virginia Electric and Power Company (VEPCO) evaluated their controls for handling heavy loads at the Surry plant and submitted their

evaluations to the NRC on November 16, 1981, December 22, 1981, and on March 22, 1982. The NRC consultant, Franklin Research Center, reviewed the Surry evaluations and developed a Technical Evaluation Report (TER). In their TER, Franklin concluded that the Surry plant was in compliance with the guidelines in NUREG 0612. The NRC staff concurred with the Franklin TER in a letter to VEPCO on May 16, 1984.

In their response to the NRC Generic Letter 81-07, the Surry Power Station committed to the requirements of ASME B30.2 - 1976. ASME B30.2 called for certain inspections, tests, and maintenance to be performed daily or monthly. Since the Spent Fuel Cask Crane was infrequently used, Surry proposed relaxing the frequency of these inspections, tests, and maintenance to "prior to use". The NRC approved this frequency through the Franklin Research Center TER.

Documents Reviewed: Letter from Steven A. Varga of the NRC to W. L. Stewart of VEPCO dated May 16, 1984
Technical Technical Evaluation Report (TER) on Control of Heavy Loads performed by Franklin Research Center and dated April 23, 1984,
Surry Power Station Updated Final Safety Analysis Report (UFSAR), Revision 38

Category: Crane Load Testing *Topic:* Hook Proof Load Testing

Reference: ASME B30.10, Section 10-1.1.2, and Table 1

Requirement: When proof tests are used to verify manufacturing process, material, or configuration, the hook shall be able to withstand a 15 second proof loading without a permanent increase in throat opening in excess of 0.5% or 0.010 inches (0.25 mm). Table 1 provides the following minimum proof loading values:
Hook rating 75 tons - minimum proof load 137 tons
Hook rating 100 tons - minimum proof load 166 tons
Hook rating 125 tons - minimum proof load 188 tons
Hook rating 150 tons - minimum proof load 200 tons

Finding: This requirement was implemented. The Surry Power Station spent fuel cask crane was a 125 ton crane manufactured in 1971 in conformance with the 1961 Electric Overhead Crane Institute standard (EOCI-61). The EOCI-61 standard was silent on hook proof load testing and did not refer to ASME B30.10. The 1976 ASME code requirement for a 188 ton minimum proof load test was implemented after this hook was manufactured.

Following the original 125% rated load test on the crane on March 31, 1971, the main hook was subjected to a Magnetic Particle examination. No cracks were identified. The main hook was again subjected to a Magnetic Particle examination on July 30, 2007, following the annual crane inspection. No cracks were identified.

Documents Reviewed: Froehling and Robertson, Inc., Magnetic Particle Inspection Report, dated April 13, 1971
Morris Material Handling/P&H e-mail to Dominion Resource Services, Inc., dated July 18,2007
Magnetic Particle Examination Report BOP-MT-07-044, dated July 30, 2007

Category: Crane Load Testing *Topic:* Rated Load Marking

Reference: ASME B30.2, Section 2-1.1.1

Requirement: The rated load shall be marked on each side of the crane and, if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or on its load block. This marking shall be legible from the ground or floor.

Finding: This requirement was not fully implemented at the time of the first NUHOMS system loading. The spent fuel cask crane main load block was properly marked at 125 tons and the auxiliary load block was properly marked at 10 tons. However, the spent fuel cask crane rated load marking on the cab was incorrect. The crane was rated for 125 tons and 156 tons was stenciled on the cab. The 156 ton marking was the load at which the 125% testing was performed in 1986. This discrepancy was entered into the Surry Power Station corrective action program under Item #7 of CA011688. The licensee planned to correct the rated load marking following completion of the dry cask loading campaign.

Documents Reviewed: None.

Category: Crane Load Testing *Topic:* Rated Load Testing

Reference: ASME B30.2, Section 2-2.2.2

Requirement: New, extensively repaired, and altered cranes should be load tested prior to initial use. The test loads shall not be more than 125% of the rated load, and the load rating should not be more than 80% of the maximum load sustained during the test. The rated load test, if made, shall consist of the following operations as a minimum: 1) Hoist the test load a distance to assure that the load is supported by the crane and held by the hoist brakes; 2) Transport the test load by means of the bridge for the full length of the runway in one direction with the trolley as close to the extreme right hand end of the crane as practical, and in the other direction with the trolley as close to the extreme left hand end of the crane as practical; and 3) Lower the test load, and stop and hold the load with the brakes.

Finding: This requirement was implemented. The Surry Power Station Spent Fuel Cask Crane had a fixed bridge and the trolley traveled north and south on the two runways. There was no crane travel in the east/west direction.

The Spent Fuel Cask Crane was initially load tested on March 30, 1971 by Harnischfeger Corporation under Purchase Order SN-23, Job No. 11448. The test load was 156.25 tons and the trolley traveled the full length of the runways. The crane was rated at 80% of 156.25 tons, or 125 tons.

The Spent Fuel Cask Crane was again subjected to a load test on December 4, 1989 following replacement of the main hoist gear box bearings. The test load was 322,652 pounds or 161.32 tons. The test load was lifted a distance less than 12" to assure that the load was supported by the crane and held by the hoist brakes. The test load was then lowered 6-8", stopped, and held with the brakes. Since the bearing replacement only affected the main hoist, trolley travel was not required.

Documents Reviewed: Procedure for Testing Vepco Power Station Cranes, dated February 20, 1970.

Category: Crane Operation *Topic:* Brake Test Prior to Lift

Reference: ASME B30.2, Section 2-3.2.3 (g)

Requirement: The operator shall check the hoist brakes at least once each shift if a load approaching the rated load is to be handled. This shall be done by lifting the load a short distance and applying the brakes.

Finding: This requirement was implemented. Procedure VPAP-0810, Step 6.3.11 required the operator to check the hoist brakes at least once each shift whenever a load approaching the rated load was handled. This was done by lifting the load a short distance, verifying the brakes engaged automatically when the hoist was stopped, and verifying slippage (if any) was minimal. Testing of the hoist brakes at rated load was observed during the first NUHOMS system loading, with no discrepancies or slippage identified.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16

Category: Crane Operation *Topic:* Hoist Limit Switch Tested Each Shift

Reference: ASME B30.2, Chap 2-3.2.4 (a)

Requirement: At the beginning of each shift, the operator shall try out the upper limit device of each hoist under no-load. Care shall be exercised; The block shall be inched into the limit or run in at a slow speed.

Finding: This requirement was implemented. The hoist upper limit switches were inspected prior to crane use in accordance with inspection items #17 and #23 of the Crane Operator's Checklist provided in Attachment 3 of Procedure VPAP-0810. The instructions were to inch, or raise the hoist in the slowest speed, until the upper limit switch stopped upward travel. Testing of the upper limit switches on both hoists was observed during the first NUHOMS system loading, with no deficiencies identified.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16

Category: Crane Operation *Topic:* Minimum of Two Wraps of Rope

Reference: ASME B30.2, Sect 2-3.2.3 (h)

Requirement: The load shall not be lowered below the point where two wraps of rope remain on the each anchorage of the hoisting drum unless a lower-limit device is provided, in which case no less than one wrap shall remain.

Finding: This requirement was implemented. Procedure VPAP-0810, Step 6.3.12 prohibited lowering the load below the point where less than two full wraps of rope remained on the drum. During the inspection, the licensee lowered the hook to the lowest point of travel during dry fuel storage operations. At that point, approximately 25 wraps of wire rope remained on the drum.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16

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Category: Crane Operation *Topic:* Qualification For Crane Operator

Reference: ASME B30.2, Sections 2-3.1.2 and 2-3.1.6

Requirement: Qualification to operate a cab operated or remote operated crane, requires the operator to pass a written or oral examination and a practical operating examination specific to the type of crane to be operated. In addition, the operator shall: a) have vision of at least 20/30 Snellon in one eye and 20/50 in the other with or without corrective lenses; b) be able to distinguish colors regardless of their position; c) have sufficient hearing capability for the specific operation with or without hearing aids; d) have sufficient strength, endurance, agility, coordination and reaction speed for the specific operation; e) not be subject to seizures, loss of control or dizziness; and f) have normal field of vision and depth perception.

Finding: This requirement was implemented. Section 6.1.2 of Procedure VPAP-0810 required a written or oral examination, and a practical operating examination, for qualification to operate the Spent Fuel Cask Crane. The practical examinations included crane operation using both the cab and the remote controls.

Section 6.1.1.e of Procedure VPAP-0810 specified the physical requirements. The physical requirements were consistent with ASME B30.2. Section 6.1.3 of Procedure VPAP-0810 specified that the Spent Fuel Cask crane qualification was valid for 3 years. Every 3 years, the operator was required to re-perform the practical examination in order to maintain crane qualification.

Completion of crane operator qualification was documented on Attachment 1 of Procedure VPAP-0810. A review of the qualified operator list indicated all crane operators assigned to the ISFSI crew had current qualifications on the Spent Fuel Cask Crane.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16

Category: Crane Operation *Topic:* Warning Signals

Reference: ASME B30.2, Section 2-3.1.7(e)

Requirement: If a warning device is furnished. It shall be activated each time before traveling, and intermittently when approaching workpersons.

Finding: This requirement was implemented. Procedure VPAP-0810, Step 6.3.7 required the crane operator to sound the warning signal before traveling and continuously during travel, when such an operation may cause a hazard to personnel. When the Spent Fuel Cask Crane was operated from the cab, a foot operated warning gong was available for use before and during crane motion. However, this warning gong was not operable from the crane's Telemotive remote control box.

In order to meet this ASME code requirement during remote operation, the licensee had mounted a flashing red light under the cab to warn personnel of crane movement. However, the light was small and was mounted high above the operating floor when using the remote control. Further, the light continuously flashed whenever the remote control box was activated, whether or not the crane was in motion. Although this light

would meet the code requirement for a warning device, the licensee generated Condition Report #016711 to evaluate its effectiveness.

Documents Reviewed: Procedure VPAP-0810, "Crane and Hoist Program", Revision 16

Category: Drying/Helium Backfill *Topic:* Drying Final Pressure

Reference: CoC 1030, Tech Spec 3.1.1

Requirement: The 32PTH canister vacuum drying pressure shall be sustained at or below 3.0 torr (3 mm Hg) absolute for a period of at least 30 minutes following evacuation.

Finding: This requirement was implemented. Procedure 0-OP-FH-072, Step 5.10.62 required a final vacuum drying pressure of less than 4 mbar (3 torr) for at least 30 minutes following evacuation. During the first NUHOMS system loading, vacuum drying pressure was 1.740 mbars (1.305 torr) at the start of the 30 minute clock and 2.685 mbars (2.014 torr) at the end.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Drying/Helium Backfill *Topic:* Drying Time Limits - Procedure A

Reference: CoC 1030, Tech Spec 3.1.1

Requirement: Procedure A vacuum drying time limits apply when the transfer cask annulus is full and the water temperature is maintained below 180 degrees F.
When the canister decay heat load is less than 23.2 kW, there is no vacuum drying time limit.
When the canister decay heat load is greater than 23.2 kW, AND canister draining is chased with helium, there is no vacuum drying time limit.
When the canister decay heat load is greater than 23.2 kW, AND canister draining is chased with nitrogen, the vacuum drying time limit is 36 hours after the canister is drained.

Finding: This requirement was implemented. The licensee elected to maintain Procedure A conditions for the duration of the loading. The transfer cask annulus was maintained full of water and below 180 degrees F, and all canister draining was chased with helium. Under these conditions, there was no vacuum drying time limit. The licensee completed vacuum drying in approximately 57 hours and exited this technical specification.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Drying/Helium Backfill *Topic:* Helium Backfill Final Pressure

Reference: CoC 1030, Tech Spec 3.1.2

Requirement: The 32PTH helium backfill pressure shall be 1.5 to 3.5 psig and stable for 30 minutes after filling after completion of vacuum drying.

Finding: This requirement was implemented. Procedure 0-OP-FH-072, Step 5.11.22 required a

final helium backpressure of 1117 mbars (1.5 psig) to 1254 mbars (3.5 psig), stable for 30 minutes. The final helium backfill pressure for the first canister was 1184 mbars (2.47 psig).

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Drying/Helium Backfill *Topic:* Helium Pressure Test

Reference: FSAR 1030, Section 8.1.1.3.19a

Requirement: Following intial evacuation, backfill the canister with helium to 16.5 to 18.0 psig and hold for 10 minutes.

Finding: This requirement was implemented. Procedure 0-OP-FH-072, Step 5.11.13 required backfilling the canister with helium to between 2151 mbars(16.5 psig) and 2254 mbars (18.0 psig). Step 5.11.15 of Procedure 0-OP-FH-072 required holding the test pressure for 10 minutes.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Drying/Helium Backfill *Topic:* Helium Purity

Reference: FSAR 1030, Section 8.1.1.3.14

Requirement: All helium used in backfilling operations shall be at least 99.99% pure.

Finding: This requirement was implemented. Procedure 0-OP-FH-072, Step 5.1.7 required at least eight bottles of 99.99% pure helium to be available prior to starting dry cask operations. Procedure 0-OP-FH-072, Attachment 2, Step 1.2.a verified that the replacement helium bottles were 99.999% pure helium. The helium used during the first NUHOMS system loading was of the correct purity.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Emergency Planning *Topic:* Emergency Plan

Reference: 10 CFR 72.32(c)

Requirement: For an ISFSI that is located on the site of a nuclear power plant licensed for operation, the Emergency Plan required by 10 CFR 50.47 shall be deemed to satisfy the requirements of this section.

Finding: This requirement was implemented. Sections 2.0 and 2.1 of the Surry Power Station Emergency Plan had been expanded to include the ISFSI. The conditions requiring activation of the Emergency Plan included "Spent Fuel Storage Facility Accident" found on Page 10.8.3 and "Loss of Cask/Fuel Containment Barriers or Accidental Criticality" found on Page 10.8.11.

More specifically, Implementing Procedure EPIP-1.01, Attachment 1 contained the

emergency action levels (EALs) for accidents involving the ISFSI. Condition 11, "Loss of Cask/Fuel Containment Barriers or Accidental Criticality" contained the indication and classification criteria for an Alert notification. Condition 12, "Spent Fuel Storage Facility Accident" contained the indication and classification criteria for a Notification of Unusual Event.

Documents Reviewed: Surry Power Station Emergency Plan, Revision 52
Procedure EPIP-1.01, "Emergency Manager Controlling Procedure," Revision 49

Category: Emergency Planning *Topic:* Emergency Plan Changes

Reference: 10 CFR 72.44(f)

Requirement: Within six months of any changes made to the emergency plan, the licensee shall submit a report containing a description of the changes to the appropriate regional office and headquarters.

Finding: This requirement was implemented. Procedure VPAP-2802, Section 6.10.5.c.2 required that any emergency plan revisions, including the ISFSI, be submitted to the NRC within 30 days of the assigned effective date. At the time of the inspection, the licensee had not made any ISFSI related changes to the emergency plan within the last six months.

Documents Reviewed: Procedure VPAP-2802, "Notifications and Reports," Revision 25

Category: Fire Protection *Topic:* Fire Protection Plan

Reference: 10 CFR 50.48(a)(1)

Requirement: Each operating nuclear power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A to Part 50. This fire protection plan must describe the overall fire protection program for the facility.

Finding: This requirement was implemented. The Surry Power Station Fire Protection Program was expanded to include the ISFSI. Procedure VPAP- 2401, Section 6.1.2.a.10 required a monthly inspection of all fire zones, to be documented on Attachment 4 to the procedure. The licensee revised the Surry Power Station Appendix R Report to include the ISFSI pad as Fire Zone 72 and the ISFSI haul route as Zone 73.

The licensee developed and implemented Procedure NF-AA-NSF-601 to direct performance of a haul route walkdown prior to transfer operations. The new procedure ensured that all potential fire and explosion hazards along the haul route were identified and mitigated prior to transfer operations.

Documents Reviewed: Procedure VPAP-2401, "Fire Protection Program", Revision 27
Procedure NF-AA-NSF-601, "NUHOMS Transfer Haul Route Walkdown", Revision 0

Category: Fire Protection *Topic:* Offsite Emergency Support

Reference: 10 CFR 72.122(g)

Requirement: Structures systems and components important to safety must be designed for

emergencies. The design must provide accessibility to emergency equipment, facilities and services such as hospitals, fire and police departments, ambulance services, and other emergency agencies.

Finding: This requirement was implemented. The licensee had mutual aid agreements with three local volunteer fire departments; Surry, Rushmere, and Smithfield. The licensee offered training to the volunteer fire departments at least annually. This training took place on the fire deparment facilities or at the onsite Information Center. The training discussed all potential fire locations onsite, fire fighting strategies and the licensee's fire fighting capabilities. The discussions included a description of the facilities onsite, including the ISFSI. Several Surry staff members were part of the volunteer fire departments. Training was provided to 30 individuals from the Surry VFD on December 12, 2006, and to 9 individuals from the Rushmere VFD on December 21, 2006.

Documents Reviewed: Letter dated May 9, 2006, from Fire Chief Rushmere Volunteer Fire Department, Inc.
Letter dated May 8, 2006, from Fire Chief Smithfield Volunteer Fire Department, Inc.
Letter dated September 1, 2006, from Fire Chief Surry Volunteer Fire Department, Inc.
Emergency Plan Training for Offsite Support Agencies, dated December 19, 2006.

Category: Fuel Selection/Verification *Topic:* Approved Contents

Reference: CoC 1030, Tech Spec 2.1.d

Requirement: The 32PTH canister is authorized for storage of 32 intact fuel assemblies, or up to 16 damaged fuel assemblies with the balance intact assemblies.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum specified that 32 intact spent fuel assemblies had been selected for loading into the first canister. No damaged fuel assemblies had been selected.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Approved Spent Fuel Types

Reference: CoC 1030, Tech Spec 2.1.b

Requirement: Spent fuel assemblies authorized for storage in the 32PTH are limited to the fuel types specified in Table 1. Equivalent reload fuel assemblies that are enveloped by the fuel assembly design characteristics listed in Table 2 for a given fuel assembly class are also acceptable for storage.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum specified that no equivalent reload assemblies had been selected for loading into the first canister.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Classifying Damaged Fuel

Reference: Interim Staff Guidance ISG-1

Requirement: The process for classifying spent fuel as intact or damaged should be consistent with Interim Staff Guidance ISG-1. Fuel assemblies discharged from operating cycles with no chemistry indications of cladding breaches may be classified as intact without further evaluation. Fuel assemblies discharged from operating cycles with chemistry indications of cladding breaches shall be classified as damaged, pending fuel sipping or ultrasonic testing results confirming the fuel assembly has not experienced cladding failure. Fuel assemblies with visible cladding breaches shall be classified as damaged.

Finding: This requirement was implemented. In 1986, prior to the first dry fuel storage operations, all spent fuel assemblies and insert components stored in the spent fuel pool were evaluated for re-use in the reactor core. Each fuel assembly was subjected to a visual examination and ultrasonic testing. The specific fuel assemblies and insert components that were unacceptable for re-use in the core were classified as "restricted" and were documented in Technical Report NE-0728.

Causes for restricted classification included cladding breaches, stuck Burnable Poison Rod Assembly (BPRA), damaged rod control cluster (RCC), bent spider vane, lodged debris, grid damage, severe rod bow, broken spring clamp, top nozzle spring screw failure, potential or confirmed inter-granular stress corrosion cracking of the 304 stainless steel thimble tube sleeves, and visible rod failure.

Since 1986, the licensee has maintained the restricted list through visual examination of all fuel assemblies discharged from the reactor core and sipping of all fuel assemblies discharged from operating cycles with chemistry indications of cladding failure. All spent fuel assemblies with cladding failures or other mechanical anomalies have been identified. Prior to each dry fuel storage campaign, the licensee reviews the restricted list to identify fuel assemblies that are not acceptable for core reload but may be acceptable for dry storage. The licensee's process for classifying spent fuel as damaged was consistent with ISG-1.

Documents Reviewed: Technical Report NE-0728, "Restricted Fuel Assembly and Insert Component List for Design Initialization - Surry Units 1 and 2", Revision 23

Category: Fuel Selection/Verification *Topic:* Decay Heat Load

Reference: CoC 1030, Tech Spec 2.1.c

Requirement: The maximum heat load for a single fuel assembly, including insert components, is 1.5 kW. The maximum heat load for a 32PTH canister is 34.8 kW for Westinghouse and Babcock and Wilcox (B&W) fuel assemblies, and 33.8 kW for CE 14X14 fuel assemblies.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum specified that, for the first canister to be loaded, the highest decay heat load for a single fuel assembly, including its integral BPRA, was 1.155 kW. The total decay heat load for the first canister was 27.993 kW. Both the highest individual fuel assembly decay heat load and the total canister decay heat load were

within the Technical Specification limits.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Fuel Design Characteristics

Reference: CoC 1030, Tech Spec 2.1.e

Requirement: Spent fuel assemblies authorized for storage in the 32PTH are limited to the design characteristics (dimensions and weights) specified in Table 2.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum specified that the dimensions and weights of the fuel assemblies selected for loading into the first canister were within the design limits of Technical Specification 2.1.e and Table 2.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Loading Configurations

Reference: CoC 1030, Tech Spec 2.1.b and c

Requirement: Fuel assemblies may be qualified for four (4) heat load zones designated as Zones 1a, 1b, 2, and 3. Figure 2 shows the heat load zone locations. Table 4 identifies the acceptable combinations of enrichment, burnup and cooling times for each heat load zone.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum specified the following decay heat loading configurations for the first canister to be loaded:

Zone 1a
The maximum allowable decay heat load per fuel assembly was 1,050 watts. The highest fuel assembly decay heat load selected for Zone 1a was 804 watts. The fuel assembly requiring the longest cooling time had a maximum assembly average initial enrichment of 3.96 wt. % and a burnup of 46.486 GWD/MTU. For this combination of initial enrichment and burnup, the minimum cooling time was 7 years. The actual cooling time was 12.5 years.

Zone 1b
The maximum allowable decay heat load per fuel assembly was 800 watts. The highest fuel assembly decay heat load selected for Zone 1b was 758 watts. The fuel assembly requiring the longest cooling time had a maximum assembly average initial enrichment of 3.93 wt. % and a burnup of 46.293 GWD/MTU. For this combination of initial enrichment and burnup, the minimum cooling time was 10 years. The actual cooling time was 13.5 years.

Zone 2
The maximum allowable decay heat load per fuel assembly was 1,100 watts. The highest fuel assembly decay heat load selected for Zone 2 was 978 watts. The fuel

assembly requiring the longest cooling time had a maximum assembly average initial enrichment of 3.94 wt. % and a burnup of 48.302 GWD/MTU. For this combination of initial enrichment and burnup, the minimum cooling time was 7 years. The actual cooling time was 8.8 years.

Zone 3
The maximum allowable decay heat load per fuel assembly was 1,500 watts. The highest fuel assembly decay heat load selected for Zone 1b was 1,155 watts. The fuel assembly requiring the longest cooling time had a maximum assembly average initial enrichment of 3.95 wt. % and a burnup of 48.702 GWD/MTU. For this combination of initial enrichment and burnup, the minimum cooling time was 5 years. The actual cooling time was 6.8 years.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Non-Fuel Assembly Hardware

Reference: CoC 1030, Tech Spec 2.1.b

Requirement: Non-Fuel Assembly Hardware (NFAH) stored integral to the assemblies shall be limited to Burnable Poison Rod Assemblies (BPRAs), Thimble Plug Assemblies (TPAs), and Vibration Suppressor Inserts (VPIs). The NFAH stored shall have acceptable combinations of burnup and cooling time described in Table 5. CE 14X14 fuel assemblies are stored without NFAH.

Finding: This requirement was implemented. The ISFSI Fuel Assembly and Insert Component Certification memorandum identified a maximum BPRA burnup value of 26.120 GWD/MTU. For all NFAH burnup values of less than 30.0 GWD/MTU, Table 5 required a minimum cooling time of 5 years. The minimum cooling time for BPRAs in the first loading was 5.35 years.

The ISFSI Fuel Assembly and Insert Component Certification memorandum specified that no Thimble Plug Assemblies (TPAs) or Vibration Suppressor Inserts (VPIs) had been selected for loading into the first canister.

Documents Reviewed: Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Fuel Selection/Verification *Topic:* Spent Fuel Assembly Mis-Loading

Reference: FSAR 1030, Sect 8.1.1.2.7; CoC 1030, TS Spec 2.2

Requirement: After all assemblies have been placed in the canister, verify their identities. If any functional or operating limit of Technical Specification 2.1, "Fuel To Be Stored In The 32PTH Canister", is violated, the following actions shall be completed:
The affected fuel assemblies shall be placed in a safe condition.
Within 24 hours, notify the NRC Operations Center.
Within 30 days, submit a special report which describes the cause of the violation and the actions taken to restore compliance and prevent recurrence.

Finding: This requirement was implemented. Procedure 0-OP-FH-072, Step 5.4.6 required entering Technical Specification 2.2 if the post loading verification determined that the canister had not been loaded in accordance with the cask loading map.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: General License *Topic:* Cask Design Compatible With Part 50

Reference: 10 CFR 72.212(b)(4)

Requirement: Prior to use of the general license, determine whether activities related to storage of spent fuel involve a change in the facility technical specifications or require a license amendment for the facility pursuant to Part 50.59(c)(2). Results of this determination must be documented in the 10 CFR 72.212 Evaluation Report.

Finding: This requirement was implemented. Technical Report NE-1506, Section 3.9 stated that Surry had operated a site specific ISFSI since 1986 and the plant systems and programs were already in-place to support operations of the NUHOMS-HD system under a general license. Section 3.9 further discussed the modifications that were made for the ISFSI pad and its associated security and electrical requirements. Additionally, an in-pool drop of the OS187H transfer cask was evaluated and the Surry Power Station UFSAR was updated.

The conclusion at the end of Section 3.9 was that there were no items resulting from implementation of the NUHOMS-HD system that required NRC approval or review.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Dose to the Public - Accident Conditions

Reference: 10 CFR 72.106(a)/(b)/(c)

Requirement: For each ISFSI, a controlled area must be established. Any individual located on or beyond the nearest boundary of the controlled area may not receive from any design basis accident 5 rem Total Effective Dose Equivalent (TEDE) for accident conditions. The minimum distance from the ISFSI to the nearest boundary of the controlled area must be 100 meters. The controlled area may include roads, railroads or waterways as long as arrangements are made to control traffic to protect the public.

Finding: This requirement was implemented. The licensee performed a worst case drop analysis specific to the NUHOMS OS187H transfer cask and 32PTH-HD canister. The analysis considered a cask drop in both the fuel building and decontamination building, and the results were documented in Dominion Calculation PA-0238. Calculation PA-0238 indicated that the resultant dose to the member of the public was 0.495 rem to the whole body and 0.0285 rem to the thyroid. This was within the 5 rem Total Effective Dose Equivalent (TEDE) limit for accident conditions.

The distance from the ISFSI perimeter fence to the nearest site boundary was 460 meters. The controlled area was not traversed by public roads, railroads or waterways.

Documents Reviewed:	Dominion Calculation PA-0238, "EAB Dose from Drop of a NUHOMS Transfer Cask," dated June 14, 2007

Category:	General License *Topic:* Dose to the Public - Normal Operations
Reference:	10 CFR 72.212(b)(2)(i)(C); 10 CFR 72.104(a)
Requirement:	The general licensee shall perform a written evaluation that establishes that the requirements of 10 CFR 72.104, "Criteria for Radioactive Materials in Effluents and Direct Radiation from an ISFSI", have been met. 10 CFR 72.104 requires the annual dose equivalent to any real individual located beyond the controlled area must not exceed 25 mrem to the whole body during normal operations and anticipated occurrences.
Finding:	This requirement was implemented, as presented in Technical Report NE-1506, Section 3.7.c. Calculation PA-0235 was performed to determine the expected maximum annual dose from radiation as a result of normal ISFSI storage operations. The calculation yielded dose rates at the site boundary of 3.3 X 10(-3) mrem per hour from the ISFSI and 3.5 X 10(-3) mrem per hour from the Low Level Waste Storage Facility (LLWSF). Using an occupancy rate of 260 hours per year, based on non-employee visits to the wildlife sanctuary for recreational purposes, the total dose to a real individual from the ISFSI and the LLWSF was 1.8 mrem/year. This was within the 25 mrem per year limit.
Documents Reviewed:	Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0 Calculation PA-0235, "Dose Rate Evaluation of the Surry ISFSI Based on TN-32 and NUHOMS-HD Storage Systems"

Category:	General License *Topic:* Evaluation Report Changes
Reference:	10 CFR 72.212(b)(2)(ii)
Requirement:	Changes to the approved 72.212 evaluation report shall be made using the requirements of 72.48(c). A copy of the completed 72.48 evaluation shall be retained until spent fuel is no longer stored under the general license issued.
Finding:	This requirement was implemented. Technical Report NE-1506, Section 3.1 specified that future revisions of the 72.212 report will be issued via the 10 CFR 72.48 regulatory review process using Procedure VPAP-3001 or Procedure DNAP-3004, as required. Procedure DNAP-3004, Sections 4.0 and 4.3 required completed 72.48 screens and evaluations to be attached to, and retained with, the document they supported. Procedure DNAP-3004, Section 4.3 required a report to be submitted to the NRC every 24 months describing all changes made to the ISFSI for which a 72.48 evaluation had been documented.
Documents Reviewed:	Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0 Procedure DNAP-3004, "Dominion Program for 10 CFR 50.59 and 10 CFR 72.48 - Changes, Tests, and Experiments", Revision 1

Category: General License *Topic:* HSM - Storage Pad Soil Liquefaction

Reference: CoC 1030, Tech Spec 4.2.2

Requirement: For sites for which soil-structure interaction is considered important, the license is to perform site-specific analysis considering the effects of soil structure interaction (SSI). Amplified seismic spectra at the location of the HSM-H center of gravity (CG) is to be developed based on the SSI responses. The storage pad location shall have no potential for liquefaction at the site-specific level earthquake.

Finding: This requirement was implemented. Technical Report NE-1506, Attachment 1, Technical Specification 4.2.2 stated that the storage pad soil structure had been analyzed in Dominion Calculation CE-1691. The analysis determined that the soil would not liquefy during the Surry Power Station Safe Shutdown Earthquake (SSE) under a maximum horizontal acceleration at the base mat of 0.30g. Geotechnical Report RF-NP-3303, Section 8 documented the soil structure interaction analysis and concurred that liquefaction was not expected at the Surry Power Station ISFSI.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0
Report RF-NP-3303, "Independent Spent Fuels Installation (ISFSI) Pad #3 Geotechnical Engineering Report, Surry Power Station", dated January 16, 2004

Category: General License *Topic:* HSM Storage Arrays

Reference: CoC 1030, Tech Spec 4.6.1

Requirement: HSM-Hs are placed together in single rows or in back-to-back arrays. An end shield wall is placed on the outside of any loaded outside HSM-H. A rear shield wall is placed on the rear of any single row loaded HSM-H.

Finding: This requirement was implemented. Technical Report NE-1506, Attachment 1, Technical Specification 4.6.1 stated that the HSM-Hs were arranged in one back-to-back, 20 X 2 array with an end shield wall at each end of each row. On a back-to-back array, the rear shield walls were not required. A physical walkdown of the ISFSI pad verified that a 19 X 2 array was in place with the end shield walls installed. At the time of the inspection, the last two modules had not been installed.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Fire and Explosion

Reference: CoC 1030, TS 4.6.3.6; FSAR 1030, Sect 4.1.1.1

Requirement: The potential for fires and explosions shall be addressed, based on site-specific considerations. The bounding condition assumed in the fire accident analysis is a 300 gallon diesel fuel fire engulfing the transfer cask for 15 minutes at a temperature of 1,475 degrees F. The bounding condition assumed in the explosion analysis is a blast force of less than 1.0 psi. The general license shall determine whether the site fire and explosion hazards are enveloped by the cask design basis. This determination must be documented in the 72.212 evaluation report.

Finding: This requirement was implemented. The potential for fires and explosions was evaluated by ACI Nuclear Energy Solutions, as documented in ACI-NES Report No. R0726001. This report was included as Attachment 2 to Technical Report NE-1506. The evaluation identified and analyzed all on-site and off-site fire and explosion sources that could potentially affect the ISFSI or the haul route. This included gasoline, chemicals, paints, compressed gases, hydrogen farms, etc. The permanently installed explosion sources were determined to be shielded, or at an adequate distance, to prevent blast forces from exceeding 1 psi. Transient explosion sources were administratively controlled. A few of the measures taken were: a) prohibiting gasoline powered vehicles within the ISFSI facility; b) prohibiting propane and natural gas powered vehicles within line of sight to transporter; c) limiting diesel driven vehicles to less than 300 gallons of fuel each; d) separating diesel driven vehicles such that a fire in one vehicle would not affect other vehicles; and e) maintaining all diesel driven vehicles greater than 10 feet from the transporter. Further, the haul path was walked down immediately prior to transfer operations in accordance with Procedure NF-AA-NSF-601, to identify and mitigate any potential fire and explosion hazards that may have migrated into the area.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0
ACI-NES Report No. R0726001 dated July, 2007 (Attachment 2 of the 10 CFR 72.212 Evaluation Report)
Procedure NF-AA-NSF-601, "NUHOMS Transfer Haul Route Walkdown", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Flood Conditions

Reference: CoC 1030, Tech Spec 4.6.3.2; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites with maximum flood levels of 50 feet, and maximum water velocities of 15 feet per second. The user shall verify the site-specific maximum flood levels and water velocities are within the limits of the certification, and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. Section 2.4.2.2 of the Surry ISFSI SAR stated that the ISFSI was located at 35 feet above mean sea level (msl), and the site-specific maximum flood level was 28.2 feet above msl. Flooding was not postulated to reach the ISFSI and flooding velocities were not calculated. Tsunamis and seiches were not considered credible and were not evaluated.

Technical Report NE-1506, Section 3.8.B and Attachment 1, Technical Specification 4.6.3 (2) repeated the Surry site specific maximum flood heights and stated that the maximum flood levels were within the limits of the NUHOMS-HD certification.

Documents Reviewed: Surry ISFSI SAR, Revision 17
Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Normal Temperatures

Reference: CoC 1030, Tech Spec 4.6.3.4; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites with normal ambient temperature ranges of 0 degrees F to 100 degrees F. The user shall verify the site-specific normal temperatures are within the range of the certification and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. From the Surry Power Station UFSAR, the range of monthly mean temperatures at the site was from 39.9 degrees F to 78.4 degrees F. This data was included in Technical Report NE-1506, Attachment 1, Technical Specification 4.6.3.4.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Roof Snow Loading

Reference: CoC 1030, Tech Spec 4.6.3.3; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites where the roof snow loading will not exceed 110 pounds per square foot. The user shall verify the site-specific 100 year roof snow loading is within the limits of the certification, and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. Technical Report NE-1506, Attachment 1, Technical Specification 4.6.3.3 stated that, based on the Surry ISFSI environmental report, the expected annual site snowfall was 10 inches or less with a snow loading of less than 5.2 pounds per square foot (psf). Based on Richmond Weather Service Station Data, the maximum recorded monthly snowfall was 28.5 inches which occurred in January 1940.

The Technical Specification limit of 110 psf is equivalent to 15 feet of snow, which bounds the Surry average of 10 inches or maximum of 28.5 inches.

Documents Reviewed: Surry ISFSI SAR, Revision 17
Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Seismic Loads

Reference: CoC 1030, Tech Spec 4.6.3.8; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites with peak horizontal seismic acceleration loads of 0.30g's and peak vertical seismic acceleration loads of 0.20g's. The user shall verify the site-specific seismic acceleration loads are within the limits of the certification, and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. Technical Report NE-1506, Section 3.8.C stated that, from the Surry Power Station UFSAR, the peak ground acceleration at the reactor during a design basis earthquake (DBE) was 0.15g. Technical Report NE-1506,

Attachment 1, Technical Specification 4.6.3.8 stated that, from the Surry ISFSI SAR, the peak ground acceleration at the ISFSI during a design basis earthquake was 0.07g.

Technical Report NE-1506, Section 3.8.C stated that the peak ground acceleration during both design basis earthquakes at Surry were bounded by the NUHOMS-HD design basis earthquake of 0.30g..

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Temperature Extremes

Reference: CoC 1030, Tech Spec 4.6.3.5; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites with off-normal ambient temperature extremes of minus 20 degrees F without solar insolation and plus 115 degrees F with full solar insolation. The user shall verify the site-specific off-normal ambient temperature extremes are within the limits of the certification, and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. From the Surry Power Station UFSAR, the extreme temperature range at the site was 6.0 degrees F to 99 degrees F. Full solar insolation was stated at 800 langleys over 10 hours. This data was included in Technical Report NE-1506, Attachment 1, Technical Specification 4.6.3.5.

Documents Reviewed: Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: General License *Topic:* Reactor Site Parameters - Tornado Wind Speeds

Reference: CoC 1030, Tech Spec 4.6.3.1; 10 CFR 72.212(b)(2)

Requirement: The NUHOMS HD System is certified for use at reactor sites with maximum tornado wind speeds of 290 mph rotational and 70 mph translational. The user shall verify the site-specific maximum tornado wind speeds are within the limits of the certification, and shall document that verification in the 72.212 evaluation report.

Finding: This requirement was implemented. Section 2.2.1.1 of the NUHOMS-HD FSAR stated that the design basis tornado intensity used for the HSM-H was a wind speed of 360 mph. This was the sum of a rotational speed of 290 mph and a translational speed of 70 mph. The maximum pressure drop was 3.0 psi and the maximum rate of decrease was 2.0 psi per second.

Section 3.2.1.1 of the Surry ISFSI SAR stated that the design basis tornado wind intensity used for the ISFSI was a wind speed of 360 mph. This was the sum of a rotational speed of 300 mph and a translational speed of 60 mph. The maximum pressure drop was 3.0 psi in 3 seconds (1.0 psi per second).

Although the rotational and translational wind speeds differed, the total wind speed of 360 mph and the 3.0 psi pressure drop at the rate of 2.0 psi per second were bounding. Technical Report NE-1506, Attachment 1, Technical Specification 4.6.3.1 repeated the

Surry ISFSI SAR wind speed values.

Documents Reviewed: Surry ISFSI SAR, Revision 17
Technical Report NE-1506, "Surry Independent Spent Fuel Storage Installation NUHOMS-HD 10 CFR 72.212 Evaluation Report", Revision 0

Category: Heavy Loads and Rigging *Topic:* Heavy Loads Safety Review

Reference: CoC 1030, Condtion 5

Requirement: Each lift of the canister and transfer cask must be made within the existing heavy loads requirements and procedures of the licensed faciliity at which the lift is made. A plant-specific safety review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing plant-specific heavy loads requirements.

Finding: This requirement was implemented. The analysis of the design functions of the Surry Power Station spent fuel pool and spent fuel storage racks were documented in Technical Report NE-0746, and were approved by the NRC. Handling of the NUHOMS OS187H transfer cask was evaluated against the NRC approved analysis and shown to be bounded. The licensee incorporated movement of the transfer cask and canister into their existing heavy loads program and updated the UFSAR. The 10 CFR 50.59 screening approved by the licensee was reviewed and found to be adequate.

Documents Reviewed: Technical Report NE-0746, "Use of New Dry Storage Cask Designs at the Surry Power Station," Revision 4
50.59/72.48 Screen, "UFSAR Change Request FS 2007-003", dated May 15, 2007
Procedure VPAP-0809, "NUREG-0612 Heavy Load Program," Revision 8

Category: Heavy Loads and Rigging *Topic:* Safe Load Paths

Reference: NUREG 0612, Sect 5.1.1 (1)

Requirement: Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical, structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact.

Finding: This requirement was implemented. The spent fuel cask crane used a movable trolley and a fixed bridge. The crane moved in the north/south direction only and as such, could not travel over any spent fuel in the spent fuel pool. An impact limiter (crush pad) was installed at the bottom of the spent fuel pool in the cask loading area. This pad was designed to protect the bottom and sides of the spent fuel pool from a drop of a fully loaded transfer cask.

While the crane was in the spent fuel pool area, Step 4.18 of Procedure 0-OP-FH-072 required the transfer cask trunnions and lift beam to be oriented in the north-south direction to preclude striking the edge of the spent fuel on a load drop.

The safe load path from the spent fuel pool to the transfer trailer in the crane enclosure building was a straight line over the three bays in the decontamination building. The

load path followed structural floor members and did not traverse any safe shutdown equipment. Maximum lifting heights were established to minimize damage to the decontamination building in the event of a transfer cask drop.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling," Revision 5
Calculation 14247.01-NM(B)-194-FB, "Fuel Cask Drop Analysis for the NUHOMS-32 Cask System," Revision 0

Category: Heavy Loads and Rigging *Topic:* Transfer Cask Drop

Reference: CoC 1030, Tech Spec 5.3.2

Requirement: The 32PTH canister will be inspected for damage after any transfer cask drop of 15 inches or more. This will ensure that the canister will continue to provide confinement and the transfer cask will continue to provide its design function regarding canister transfer and shielding.

Finding: This requirement was implemented. Section 4.1 of Procedures O-OP-FH-073 and O-OP-FH-074 required an engineering analysis of the transfer cask and canister following any cask drop greater than 15 inches. The analysis was required in order to determine continued confinement capability of the canister and to determine the transfer and shielding capability of the transfer cask.

Documents Reviewed: Procedure O-OP-FH-073, "TC/DSC Transfer to ISFSI and DSC Transfer from TC to HSM," Revision 1
Procedure O-OP-FH-074, "TC/DSC Transfer from ISFSI to Crane Enclosure and DSC Transfer from HSM to TC," Revision 1

Category: Heavy Loads and Rigging *Topic:* Transfer Cask Lifting Heights

Reference: CoC 1030, Tech Spec 5.3.1

Requirement: To ensure that any loaded canister drop is bounded by the station's accident analysis: a) the maximum lift height and handling height of all transfer operations where the loaded transfer cask is in the horizontal position on the trailer shall be 80 inches; and b) for all other configurations, the maximum lift height shall be restricted by the site 10 CFR 50 limits, as determined by an evaluation of the fuel cladding structural integrity for all credible drops.

Finding: This requirement was implemented. Section 4.4 of Procedures 0-OP-FH-073 and 0-OP-FH-074 established a transfer cask maximum lift height of 80" when the transfer cask was in the horizontal position on the trailer.

Procedure 0-OP-FH-072, Steps 4.15, 5.3.15, and 5.6.19 established a transfer cask maximum lift height over the spent fuel pool of 18" above the spent fuel pool handrail. This lift height ensured the transfer cask was within 7' of the spent fuel pool surface, which was assumed in the licensee's cask drop evaluations as described in Chapter 9, Appendix B.1.5 of the Surry Power Station UFSAR.

To determine transfer cask maximum lift heights for all other areas traversed during dry

cask storage operations, the licensee did not attempt to quantify fuel cladding structural integrity for all credible drops. Instead the licensee assumed that all drops would result in total cladding failure of all 32 spent fuel assemblies in the cask.

The licensee performed a worst case drop analysis specific to the NUHOMS OS187H transfer cask and 32PTH-HD canister. The analysis considered a cask drop in both the fuel building and decontamination building, and the results were documented in Dominion Calculation PA-0238. Calculation PA-0238 indicated that the resultant dose to the member of the public was 0.495 rem to the whole body and 0.0285 rem to the thyroid. These doses were below the limit of 75 rem to the whole body and 300 rem to the thyroid specified in 10 CFR 100.11 for a fuel handling accident.

Documents Reviewed:
Surry Power Station Updated Final Safety Analysis Report (UFSAR), Revision 18
Dominion Calculation PA-0238, "EAB Dose from Drop of a NUHOMS Transfer Cask," dated June 14, 2007
Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5
Procedure 0-OP-FH-073, "TC/DSC Transfer to ISFSI and DSC Transfer from TC to HSM," Revision 1
Procedure 0-OP-FH-074, "TC/DSC Transfer from ISFSI to Crane Enclosure and DSC Transfer from HSM to TC," Revision 1

Category: Procedures & Tech Specs *Topic:* Cask Maintenance - Annual Inspections

Reference: CoC 1030, Condition 2; FSAR 1030, Section 9.2

Requirement: Written procedures shall be prepared for cask maintenance. The procedures shall require performance of the following transfer cask inspections within one year of each loading or unloading campaign: a) dye penetrant examination of the top trunnion bearing surfaces and accessible welds; b) leak testing of the transfer cask lid, ram access cover, vent and drain cover o-rings, vent and drain quick-connect fittings and neutron shield fittings. If bubble leak testing is performed, no leak indication is allowed. If pressure drop or helium leak testing is used, the maximum allowable leak rate for each component is 1.0 X 10(-3) ref-cc/sec.

Finding: This requirement was implemented. Procedure 0-OP-FH-002, Section 5.9 performed an annual liquid penetrant (PT) examination of the upper trunnion bearing surfaces and trunnion-to-shell/pad welds.

Procedure 0-OP-FH-002, Section 5.7 performed an annual leak test of the transfer cask lid, ram access cover, vent and drain cover o-rings, and vent and drain quick-connect fittings. Procedure 0-OP-FH-002, Section 5.8 performed an annual leak test of the neutron shield tank quick-connect fittings. A bubble test was used for all leak tests and the acceptance criteria was no bubbles.

Documents Reviewed:
Procedure 0-OP-FH-002, "NUHOMS HD OS187H Transfer Cask Inspection", Revision 0

Category: Procedures & Tech Specs *Topic:* Cask Maintenance - Periodic Inspections

Reference: CoC 1030, Condition 2; FSAR 1030, Section 9.2

Requirement: Written procedures shall be prepared for cask maintenance. The procedures shall require performance of the following transfer cask inspections prior to each canister loading or unloading: a) visual inspection of the transfer cask trunnion bearing surfaces; b) visual inspection of all taps, threaded inserts and bolts; c) functional inspection of all quick-connect fittings; d) visual inspection of the interior surface of the cask for excessive wear; e) visual inspection of the neutron shield jacket; and f) visual inspection of all transfer cask o-rings.

Finding: This requirement was implemented. Transfer cask inspections were performed in accordance with Procedures 0-OP-FH-002 and 0-OP-FH-072.

Procedure 0-OP-FH-072 required the following maintenance actions prior to each use of the transfer cask: a) Clean and lubricate the transfer cask trunnion bearing surfaces; b) Inspect and clean the transfer cask lid and ram access cover bolts and holes; c) Inspect the interior surface of the transfer cask for scratches, gouges, or excessive wear; and d) Inspect and lubricate the ram access cover o-ring.

Procedure 0-OP-FH-002 required the following actions prior to each use of the transfer cask: a) Inspect and lubricate the transfer cask lid o-ring; and b) Inspect and lubricate the ram access cover o-ring.

Procedure 0-OP-FH-002 required the following actions prior to each loading campaign, and every 6 months or 12 canisters during the campaign: a) Inspect the trunnion bearing surfaces; b) Inspect the neutron shield quick-connect fittings; c) Inspect the neutron shield coating; d) Inspect and functionally check the transfer cask vent and drain quick-connect fittings; and e) Inspect and clean the transfer cask lid and ram access cover bolts and bolt holes.

Documents Reviewed: Procedure 0-OP-FH-002, "NUHOMS HD OS187H Transfer Cask Inspection", Revision 0
Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5

Category: Procedures & Tech Specs *Topic:* Cask Operation

Reference: CoC 1030, Condition 2; Tech Spec 5.2.2

Requirement: Written procedures shall be prepared for cask handling, loading, and movement. The procedures shall control: a) fuel qualification and loading; b) rigging and handling; c) loading operations; d) unloading operations; e) auxiliary equipment operation; f) transfer operations; g) radiation protection; and h) off-normal and accident conditions, responses and corrective actions.

Finding: This requirement was implemented. Fuel qualification and loading was performed in accordance with Dominion Memorandum DOM-32PTH-001-C. Rigging and handling was performed in accordance with Procedures 0-OP-FH-071, 072, 073, 074, and 076. Loading operations were performed in accordance with Procedure 0-OP-FH-072 and Dominion Memorandum DOM-32PTH-001-C. Unloading operations were performed in

accordance with Procedure 0-OP-FH-076. Auxiliary equipment operation was performed in accordance with Procedures 0-OP-FH-070 and 072. Transfer operations were performed in accordance with Procedure 0-OP-FH-073. Radiation protection was performed in accordance with Procedure HP-1061.500. Off-normal and accident conditions, responses and corrective actions were performed in accordance with Procedure 0-AP-22.

Documents Reviewed:

Procedure 0-OP-FH-002, "NUHOMS HD OS187H Transfer Cask Inspection", Revision 0
Procedure 0-OP-FH-070, "Transfer Trailer Inspections and Operations", Revision 1
Procedure 0-OP-FH-071, "NUHOMS 32PTH Dry Shielded Canister Receipt and Upending Procedure", Revision 3
Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5
Procedure 0-OP-FH-073, "TC/DSC/ Transfer to ISFSI and DSC Transfer From TC to HSM", Revision 1
Procedure 0-OP-FH-074, "TC/DSC/ Transfer From ISFSI to Crane Enclosure and DSC Transfer From HSM to TC", Revision 1
Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1
Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map", dated June 15, 2007
Procedure HP-1061.500, "NUHOMS Spent Fuel cask Preparation, Loading and Transport to ISFSI, Revision 0
Procedure 0-AP-22, "Fuel Handling Abnormal Conditions", Revision 1

Category: Procedures & Tech Specs *Topic:* Cask Surveillance - HSM Air Vent Inspections

Reference: CoC 1030 Condition 6; TS 5.2.5.b; FSAR, Sect 4.4.2

Requirement: Written procedures shall be prepared for cask surveillance. Site personnel shall conduct a daily visual inspection of the air vents to ensure that the HSM air vents are not blocked for more than 34 hours, and that blockage will not exist for longer than the 36 hours assumed in the safety analysis.

Finding: This requirement was implemented. A visual inspection of the HSM-H air vents for blockage was added to Procedure 0-LOG-OS-001. The check was to be performed at 8:00 am and 8:00 pm and required notifying fuel handling if blockage was discovered. Further, the procedure established a limit of 34 hours for removing the blockage.

Documents Reviewed: Procedure 0-LOG-OS-001, "Outside Logs", Revision 89

Category: Procedures & Tech Specs *Topic:* Cask Surveillance - HSM Thermal Monitoring

Reference: CoC 1030, Condition 2; Tech Spec 5.2.5.a

Requirement: Written procedures shall be prepared for cask surveillance. The air temperature difference between the ambient temperature and the roof vent temperature will be measured 24 hours after canister insertion into the HSM, and again 7 days later. If the air temperature differential is greater than 70 degrees F, the air inlets and exits should be checked for blockage. If after removing any blockage found, the temperature is still 100

degrees F or greater, corrective actions and analysis of existing conditions will be performed in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or cladding do not exist. If the temperature rise is 100 degrees F or less, the HSM-H and 32PTH canister are performing as designed and no further temperature measurements are required.

Finding: This requirement was implemented. Procedure OPT-FH-002 was used to perform this cask surveillance. The ambient temperature at the inlet and the outlet temperature at the roof vent were measured to develop a differential temperature across the loaded HSM.

Procedure OPT-FH-002, Section 6.2 performed the first differential temperature measurement at 24-30 hours of installing the door on the HSM. Section 6.3 performed the second measurement at 7-8 days of installing the door on the HSM. The temperature limits and corrective actions were consistent with the Technical Specification. For the first canister loaded, the actual differential temperatures were 18 degrees F at 24 hours and 17 degrees F at 7 days.

Documents Reviewed: Procedure OPT-FH-002, "Horizontal Storage Module Thermal Performance Verification", Revision 0

Category: Quality Assurance *Topic:* Approved QA Program

Reference: 10 CFR 72.140(d)

Requirement: A Quality Assurance program previously approved by the Commission as satisfying the requirements of Appendix B to Part 50 will be accepted as satisfying the requirements of Part 72. In filing the description of the QA program required by Part 72.140(c), each licensee shall notify the NRC of it's intent to apply it's previously approved QA program to ISFSI activities. The notification shall identify the previously approved QA program by date of submittal, docket number and date of Commission approval.

Finding: This requirement was implemented. Virginia Electric and Power Company notified the NRC on May 16, 2007 of its intent to apply the previously approved Surry Power Station Quality Assurance program to the ISFSI. The Letter from Eugene Grecheck of Virginia Electric and Power Company to the Director NRC/SFPO contained the information specified. Dominion Resources Services, Inc., holds an NRC Form 311 Quality Assurance Program Approval Number 0194 which provides for use of the previously used Appendix B to 10 CFR Part 50 QA Program. The Surry QA program was included in this program approval.

Documents Reviewed: NRC Form 311 Quality Assurance Program Approval Number 0194, Revision 10, July 30, 2015
Letter from Eugene Grecheck of Virginia Electric and Power Company to the Director NRC/SFPO, "Notification Of Intent To Apply Previously Approved 10 CFR Part 50 Quality Assurance Program to Independent Spent Fuel Storage Installation (ISFSI) Activities", dated May 16, 2007

Category: Quality Assurance *Topic:* Control of Measuring and Test Equipment

Reference: 10 CFR 72.164

Requirement: The licensee shall establish measures to ensure that tools, gauges, instruments and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specific periods to maintain accuracy within necessary limits.

Finding: This requirement was implemented. Calibration folders for Measuring and Test Equipment (M&TE) used during ISFSI operations were randomly selected for review. The M&TE equipment calibrations were current and the equipment used for the calibrations was traceable to a primary standard. The control of M&TE was found to be adequately implemented, at the frequency specified.

Documents Reviewed: Procedure DNAP-1802, "Quality Assurance Program Elements for Supply Chain Management (Generation)", Revision 2

Category: Quality Assurance *Topic:* Corrective Actions

Reference: 10 CFR 72.172

Requirement: The licensee shall establish measures to ensure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures must ensure that the cause of the condition is determined and corrective action taken to preclude repetition. This must be documented and reported to appropriate levels of management.

Finding: This requirement was implemented. The following Surry Power Station programs were reviewed during the inspection: a) 10 CFR Part 50 corrective action program, including randomly selected corrective action reports; b) the process for identifying root causes, assigning corrective actions and closing out corrective action reports; and c) metric reports on trending and tracking of root causes and trends. The programs were found to be adequately implemented in support of ISFSI operations, and the programs provided reports to upper level management.

Documents Reviewed: Procedure PI-AA-2000, "Corrective Action", Revision 0
Procedure DNAP-1802, "Quality Assurance Program Elements for Supply Chain Management (Generation)", Revision 2
Surry Power Station Corrective Action Metric Charts, dated May, 2007

Category: Quality Assurance *Topic:* Handling and Storage Controls

Reference: 10 CFR 72.166

Requirement: The licensee shall establish measures to control, in accordance with work and inspection instructions, the handling, storage, and preservation of material and equipment to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere and specific moisture content and temperature levels must be specified and provided.

Finding: This requirement was implemented. Procedure VPAP 0703 established the station processes for controlling the storage, handling, and shipping of plant materials. Three

storage levels were used; level A, B and C, with level A being the most sensitive to environmental conditions. The licensee had developed the storage requirements for ISFSI equipment to assure the equipment was maintained without damage or degradation prior to use. This information was available in the warehouse management software system for use during the receiving, inspection and storage/distribution processes. Warehouse personnel interviewed were knowledgeable of the program. The storage locations for ISFSI equipment were inspected and found to be adequate. The entire building was access controlled. The only two canisters on site were those being used for dry runs. They were found to be in good condition without any evidence of rust of weathering.

Documents Reviewed: Procedure VPAP 0703, "Storage, Handling, and Shipping Requirements for Plant Materials", Revision 15

Category: Quality Assurance *Topic:* Nonconforming Material and Parts

Reference: 10 CFR 72.170

Requirement: The licensee shall establish measures to control materials, parts or components that do not conform to their requirements in order to prevent their inadvertent use or installation. These measures must include procedures for identification, documentation, segregation, disposition and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures.

Finding: This requirement was implemented. The licensee's Quality Assurance program sections and procedures related to nonconformances were reviewed and found to be well developed and adequately implemented. A review of the computer system supporting the licensees nonconformance system was reviewed and a list of nonconformances associated with ISFSI operations and procurements had been generated. A random sampling of the ISFSI nonconformances determined that the nonconforming items had been adequately identified in a timely manner and had been dispositioned appropriately, as required. Tagging and storage of nonconforming items was observed in the warehouse. Card readers were used to limit access to authorized personnel.

Documents Reviewed: Procedure PI-AA-2000, "Corrective Action", Revision 0
Procedure DNAP-1802, "Quality Assurance Program Elements for Supply Chain Management (Generation)", Revision 2

Category: Quality Assurance *Topic:* Procurement Controls

Reference: 10 CFR 72.154(a)/(b)/(c)

Requirement: The licensee shall establish measures to ensure that purchased material, equipment, and services conform to procurement documents. These measures must include provisions for source evaluation and selection, objective evidence of quality furnished by the contractor/subcontractor, inspection at the contractor/subcontractor source and examination of product on delivery.

Finding: This requirement was implemented. During the team inspection on June 18-22, 2007, the Final Document Package for the OS187H transfer cask was reviewed and the

Certificate of Conformance (CoC) was found to be statused as "interim". Condition Report No. 014436 was generated to evaluate this condition. Research showed that, at the time the CoC was issued, the Transnuclear design had not been approved by the NRC. Therefore, the "interim" status was correct. The "final" status CoC was received on July 7, 2007.

During the team inspection on June 18-22, 2007, two Transnuclear Non-Conformance Reports were identified; NCR 2007-638 and NCR 2007-639. These NCRs documented inadequate traceability for the Boral poison plates installed in dry shielded canister basket assemblies 10-1 through 10-6. It was not apparent at the time that the installed poison plates had been drawn from material that had been inspected by Quality Control and released prior to installation.

The subsequent evaluation performed by Transnuclear determined that the each basket contained the required compliment of poison plates installed in the correct locations; each poison plate had better than the minimum boron content required by the CoC; and the poison plates were dimensionally acceptable and without damage. Therefore the CoC requirements were met and Transnuclear dispositioned the two NCRs as Use-As-Is. The licensee concurred with the disposition.

Documents Reviewed: Transnuclear OS187H Transfer Cask, Serial No. 1, Final Documentation Package, dated March 02, 2006
Transnuclear Supplier Nonconformance Evaluation, Form 15.3.1, SNR No. NCR 2007-638, dated 6/08/07
Transnuclear Supplier Nonconformance Evaluation, Form 15.3.1, SNR No. NCR 2007-639, dated 6/11/07

Category: Radiation Protection *Topic:* ALARA Measures

Reference: 10 CFR 72.104(b)

Requirement: Operational restrictions shall be established to meet ALARA objectives for direct radiation levels associated with ISFSI operations.

Finding: This requirement was implemented. Procedure HP-1061.500 and Radiation Work Permit (RWP) 07-0-1102 provided controls to limit the exposure of individuals involved in the spent fuel canister loading. The loading operations with the highest potential for overexposure or contamination included transfer cask removal from the spent fuel pool, removal of the annulus seal, transfer cask decontamination, welding the canister lids, draining the canister, and inserting the canister into the Horizontal Storage Module (HSM). The MGP Telepole and Ludlum Model 12-4 Rem Ball instruments were used extensively for performing radiation surveys. Overall, the ALARA measures were effective. The total exposure projected for the first canister was 0.703 person-rem and the actual was 0.581 person-rem. This was consistent with an industry range of 0.300 to 0.700 person-rem for first loadings. Further, there were no personnel contamination events.

Documents Reviewed: Procedure HP-1061.500, "NUHOMS Spent Fuel Cask Preparation / Loading and Transport to ISFSI", Revision 0
Radiation Work Permit (RWP) 07-0-1102, Revised June 21, 2007

Category:	Radiation Protection *Topic:* Canister Gas Sampling During Unloading
Reference:	FSAR 1030, Section 8.2.2.12
Requirement:	Once the vent and drain port cover plates are removed, obtain a sample of the canister atmosphere. Confirm acceptable hydrogen concentration and check for presence of fission gas indicative of degraded fuel cladding.
Finding:	This requirement was implemented. The licensee had developed Procedure 0-OP-FH-076 for unloading a spent fuel canister. The procedure established Radiation Protection controls for minimizing exposure to workers and radiological releases to the environment, during sampling. Section 6.3 of Procedure 0-OP-FH-076 described the process for removing the vent and drain port cover plates and collecting gas samples from the canister. Controls such as a tent, negative pressure, etc., were used for minimizing airborne activity. Temporary shielding was used for minimizing personnel exposure. Step 6.3.11 established the acceptable hydrogen concentration as less than 2.4% and, if exceeded, required a helium purge prior to continuing. A Note prior to Step 6.3.13 stated, "If degraded fuel is suspected, additional measures appropriate for the specific conditions are to be planned, reviewed and implemented to minimize exposure to workers and radiological releases to the environment".
Documents Reviewed:	Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1

Category:	Radiation Protection *Topic:* Canister Unloading - Reflooding
Reference:	FSAR 1030, Section 8.2.2.14
Requirement:	Fill the canister with water through the drain port with the vent port open. The vented steam and gas should be routed though a monitored and filtered pathway. Monitor the vent pressure and regulate the fill rate to ensure canister pressure does not exceed 15 psig.
Finding:	This requirement was implemented. Procedure 0-OP-FH-076, Step 6.3.18 began reflooding the canister through the drain port, at a rate low enough to prevent pressurizing the canister to greater than 15 psig. The vented steam and gas were routed out of the vent port through the installed plant systems in the north bay of the decontamination building. This pathway was both monitored and filtered.
Documents Reviewed:	Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1

Category:	Radiation Protection *Topic:* Contamination Survey of Canister
Reference:	CoC 1030, Tech Spec 5.2.4.d
Requirement:	Following placement of each loaded transfer cask into the cask decontamination area and prior to transfer to the ISFSI, the smearable surface contamination levels on the outer top

1 foot surface of the canister shall be less than 2,200 disintegrations per minute (dpm) per 100 square cm from beta and gamma emitting sources and less than 220 dpm/100 square cm from alpha emitting sources. The contamination limits are based on the allowed removable external radioactive contamination specified in 49 CFR 173.443.

Finding: This requirement was implemented. Procedure HP-1061.500, Step 6.5.11.g required a contamination survey of the top one foot of the canister exterior and transfer cask interior immediately following removal of the annulus seal. A procedure CAUTION stated that the purpose of the survey was to verify that the integrity of the annulus seal was maintained during fuel loading. Further the CAUTION prohibited decontamination of the area below the seal until the contamination survey was performed.

Procedure HP-1061.500 referenced out to Procedure 0-HSP-ISFSI-002 for performance and documentation of the contamination survey. The survey was performed in accordance with Section 6.2, and documented on Attachment 6, of Procedure 0-HSP-ISFSI-002. Although the technical specification limits for contamination were 2,200 dpm/100 square cm beta/gamma and 220 dpm/100 square cm alpha, the licensee elected to use more conservative limits of 1,000 dpm beta/gamma and 20 dpm alpha. The actual survey results during loading of the first NUHOMS cask were less than 1,000 dpm beta/gamma and 20 dpm alpha.

Documents Reviewed: Procedure HP-1061.500, "NUHOMS Spent Fuel Cask Preparation/Loading and Transport to ISFSI", Revision 0
Procedure 0-HSP-ISFSI-002, "NUHOMS Dry Spent Fuel Storage System Surveillance", Revision 0

Category: Radiation Protection *Topic:* Criticality - Minimum Boron Concentration

Reference: CoC 1030, Tech Spec 3.2

Requirement: The dissolved boron concentration of the spent fuel pool water and the water added to the cavity of a loaded canister shall be at least the boron concentration shown in Table 7 for the basket type and fuel enrichment selected. The boron concentration will be determined within 4 hours prior to commencing LOADING operations and 48 hours thereafter while water is in the canister. The boron concentration will be determined within 4 hours prior to flooding the canister during UNLOADING operations and 48 hours thereafter while water is in the canister. All boron concentrations shall be determined by two independent measurements.

Finding: This requirement was implemented. The fuel assemblies selected for loading into the first NUHOMS canister were Westinghouse 15X15 intact fuel assemblies with a maximum assembly average initial enrichment of 4.01 wt. % U-235. The first NUHOMS canister was equipped with a Type C basket. For this configuration, Technical Specification Table 7 required a minimum boron concentration of 2,300 ppm, which was reflected in the ISFSI Fuel Assembly and Insert Component Certification memorandum. During the demonstration, the actual spent fuel boron concentration was 2,439 ppm.

During loading operations, Procedure 0-OP-FH-072, Step 5.1.10 recorded the minimum spent fuel pool boron concentration required by the ISFSI Fuel Assembly and Insert

Component Certification memorandum. Procedure 0-OP-FH-072, Steps 5.4.3 and 5.4.4 required spent fuel pool boron concentration to be determined by two independent samples within 4 hours prior to flooding the canister and every 48 hours thereafter while water is in the canister.

During unloading operations, Procedure 0-OP-FH-076, Step 3.9 recorded the minimum spent fuel pool boron concentration required by the ISFSI Fuel Assembly and Insert Component Certification memorandum. Procedure 0-OP-FH-076, Step 6.3.16 required spent fuel pool boron concentration to be determined by two independent samples within 4 hours prior to re-flooding the canister and every 48 hours thereafter while water is in the canister.

During the first NUHOMS system loading, the two independent spent fuel pool boron samples indicated boron concentrations of 2416 and 2425 ppm boron.

Documents Reviewed: Procedure 0-OP-FH-072, "NUHOMS 32PTH Dry Shielded Canister Loading and Handling", Revision 5
Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1
Dominion Memorandum DOM-32PTH-001-C NUHOMS Canister, dated June 15, 2007, "ISFSI Fuel Assembly and Insert Component Certification and Canister Loading Map".

Category: Radiation Protection *Topic:* Criticality - Monitoring and Alarm System

Reference: 10 CFR 72.124.c

Requirement: A criticality monitoring system shall be maintained in each area where special nuclear material is handled, used, or stored which will energize clearly audible alarm signals if accidental criticality occurs. Underwater monitoring is not required, nor is monitoring of dry storage areas where special nuclear material is packaged in its stored configuration. The NRC has defined "packaged" to begin when the canister lid closure weld is complete.

Finding: This requirement was implemented. The criticality monitoring system consisted of 6 area radiation monitors, each with an audible alarm. Area radiation monitor 1-RM-RI-153 was located on the fuel handling bridge. This monitor had a remote readout in the control room. A portable Eberline AMS-4 area radiation monitor was located on the south wall of the spent fuel pool, directly south of the cask loading area.

Four MGP Instrument ANP-50 area radiation monitors were placed in north bay of the decontamination building. One ANP-50 was located on each level at the 27', 33', 38', and 45' elevations. Each monitor had a remote readout in the weld control center. Section 6.2 of Procedure HP-1061.500 required setting the ANP 50s alarm setpoints to 250 mr/hr and verifying the audible alarms were functional. The criticality alarm system was observed in operation during the first NUHOMS system loading.

Documents Reviewed: Procedure HP-1061.500, "NUHOMS Spent Fuel Cask Preparation / Loading and Transport to ISFSI", Revision 0

Category: Radiation Protection *Topic:* HSM-H Dose Rate Evaluation

Reference: CoC 1030, Tech Specs 5.4.1 through 5.4.3

Requirement: The licensee shall perform an analysis to confirm that the limits of 10 CFR Part 20 and 10 CFR 72.104 will be satisfied under actual site conditions, assuming a fully loaded ISFSI. On the basis of the analysis, the licensee shall establish dose rate limits for the HSM-H front surface, door centerline, and end shield wall exterior. The dose rate limits established based on the analysis shall not exceed 800 mrem/hour at the front bird screen, 2 mrem/hour on the door centerline, and 2 mrem/hour on the end shield wall exterior.

Finding: This requirement was implemented. The 1986 NRC Safety Evaluation Report (SER) for the Surry ISFSI concluded that the cumulative radiological effect of normal operation of the ISFSI and the Surry reactors was less than 25 millirem per year to the nearest individual. This evaluation was performed for 3 ISFSI pads containing a total of 84 vertical storage casks. The TN-32 cask was the bounding design in terms of radiological effect.

On June 14, 2007, the licensee performed Calculation PA-0235 to evaluate the additional radiological effect from adding a fully loaded NUHOMS-HD ISFSI pad to the inventory. The radiation source terms used in the calculation were extracted from the NUHOMS FSAR. Calculation PA-0235 yielded a peak dose rate at the ISFSI perimeter fence of approximately 2.5 millirem per hour (mr/hr). The calculation further yielded a peak dose rate at the site boundary of 0.0033 mr/hr. Using an occupancy rate of 260 hours per year, based on non-employee visits to the wildlife sanctuary for recreational purposes, the annual dose at the site boundary would be 0.86 millirem. The dose to the nearest resident, located at 1619 meters, was 4.7 X 10(-6) mr/hr. Assuming a 100% occupancy rate, the annual dose to the nearest resident would be 0.041 millirem. These dose rates were within the 10 CFR Part 20 and 10 CFR 72.104 limits.

Using Calculation PA-0235, the licensee established dose rate limits for the HSMs that were below the technical specification limits. The dose rate limits were:

HSM front bird screen	752 mr/hr
door centerline	1.6 mr/hr
north and south end shield walls	1.4 mr/hr
roof centerline	15.1 mr/hr
roof bird screen	170 mr/hr

Procedure HP-1061.500, Step 6.7.12 required a dose rate survey of the HSM front bird screen, door centerline, north and south end shield walls, roof centerline, and roof bird screen following each Horizontal Storage Module (HSM) loading. Procedure HP-1061.500 referenced out to Procedure 0-HSP-ISFSI-002 for performance and documentation of the dose rate survey. The survey was performed in accordance with Section 6.4, and was documented on Attachments 2, 3, and 4, of Procedure 0-HSP-ISFSI-002. The dose rates measured for the first loaded HSM were within the limits established.

Documents Reviewed: Safety Evaluation Report of Surry Dry Cask Independent Spent Fuel Storage Installation, May 1986
Calculation Number PA-0235, "Dose Rate Evaluation of the Surry ISFSI Based on TN-

32 and NUHOMS HD Storage Systems", Revision 0.
Procedure HP-1061.500, "NUHOMS Spent Fuel Cask Preparation/Loading and Transport to ISFSI", Revision 0
Procedure 0-HSP-ISFSI-002, "NUHOMS Dry Spent Fuel Storage System Surveillance", Revision 0

Category:	Records	*Topic:*	CoC and Related Documents
Reference:	10 CFR 72.212(b)(7)		
Requirement:	The general licensee shall maintain a copy of the Certificate Of Compliance (CoC) and documents referenced in the certificate. The referenced documents include, as a minimum, the Technical Specifications, Final Safety Analysis Report (FSAR) and the NRC Safety Evaluation Report (SER).		
Finding:	This requirement was implemented. The licensee provided current copies of the CoC, Technical Specifications, FSAR and the NRC SER. Documents were of the latest amendment, revision number and effective date.		
Documents Reviewed:	None.		

Category:	Records	*Topic:*	Maintaining the 72.212 Analysis
Reference:	10 CFR 72.212(b)(2)(i)		
Requirement:	A copy of the 10 CFR 72.212 analysis shall be retained until spent fuel is no longer stored under the general license issued under 10 CFR 72.210.		
Finding:	This requirement was implemented. The requirement to maintain a copy of the 10 CFR 72.212 analysis until spent fuel is no longer stored under the general license, was established in the licensee's Procedure, VPAP-1701.		
Documents Reviewed:	Procedure, VPAP-1701, "Records Management", Revision 18		

Category:	Records	*Topic:*	Notice of Initial Loading
Reference:	10 CFR 72.212(b)(1)(i)		
Requirement:	The general licensee shall notify the NRC at least 90 days prior to first storage of spent fuel.		
Finding:	This requirement was implemented. The notice of initial loading was accomplished on February 28, 2007 via a letter from Virginia Electric and Power Company to the NRC/SFPO. First loading occurred on July 30, 2007, making the notification greater than the 90 days required.		
Documents Reviewed:	Letter from Eugene Grecheck of Virginia Electric and Power Company to the Director NRC/SFPO, "Notification Pursuant To 10 CFR 212(b)(1)(i) Prior To First Storage of Spent Fuel Under a General License", dated February 28, 2007		

Category:	Records	*Topic:*	Registration of Casks with NRC

Reference: 10 CFR 72.212(b)(1)(ii)

Requirement: The general licensee shall register the use of each cask with the NRC no later than 30 days after using the cask to store spent fuel.

Finding: This requirement was implemented. Procedure AA-NF-NSF-401 was revised on July 27, 2007. A new Step 5.15 was added which read, "Prepare a cask use registration letter to the NRC, in accordance with 10 CFR 72.212(b)(1)(ii)".

The first NUHOMS cask, DOM-32PTH-001-C, was placed in service on August 6, 2007 and the registration letter was sent to the NRC on August 24, 2007.

Documents Reviewed: Procedure NF-AA-NSF-401, "ISFSI Fuel Selection and Certification", Revision 0

Category:	Records	*Topic:*	Special Nuclear Material Records

Reference: 10 CFR 72.72(a)

Requirement: Each licensee shall keep records showing the receipt, inventory (including location), disposal, acquisition, and transfer of all SNM with quantities specified in 10 CFR 74.13(a)(1).

Finding: This requirement was implemented. Surry Power Station maintained a nuclear material database, Tracworks-FAS, Version 3.1.0, to generate Material Balance Reports (MBRs). TracWorks-FAS assimilated data for each type of Special Nuclear Material (SNM) held under the SNM license for the facility. Operations Support conducted a physical inventory of the spent fuel pool and ISFSI at intervals not to exceed 12 months, in accordance with Sections 6.8.3 and 6.8.5 of Procedure VPAP-1406. The licensee's material inventory program was reviewed and found to be adequately implemented with the transfer of spent fuel to the ISFSI, including the amount of SNM stored in each cask.

Documents Reviewed: Procedure, VPAP-1406, "Nuclear Material Control", Revision 16
Dominion Memo M.S. Laidlow to R.L. Ridder, "2006 Annual Material Balance Report North Anna and Surry", dated 8/03/2006

Category:	Special Lifting Devices	*Topic:*	Acceptance Testing

Reference: ANSI N14.6, Section 5.2.1

Requirement: Prior to initial use, special lifting devices shall be subjected to a load test equal to 150% of the maximum service load. After sustaining the load for a period of not less than 10 minutes, critical areas, including load bearing welds, shall be subject to nondestructive testing using liquid penetrant or magnetic particle examination.

Finding: This requirement was implemented. In their response to NRC Generic Letter 81-07 concerning the control and handling of heavy loads, Virginia Electric and Power Company (VEPCO) had committed the Surry Power Station to the requirements of ANSI N14.6 - 1978, with exceptions to allow: a) load testing to 100% of the maximum service load rather than 150%; and b) performing a visual examination of the critical areas following load testing, rather than a liquid penetrant or magnetic particle examination. The NRC granted these exceptions through acceptance of the Franklin Research Center

Technical Evaluation Report (TER).

Documents Reviewed: Letter from Steven A. Varga of the NRC to W. L. Stewart of VEPCO dated May 16, 1984
Technical Technical Evaluation Report (TER) on Control of Heavy Loads performed by Franklin Research Center and dated April 23, 1984

Category: Special Lifting Devices *Topic:* Annual Testing For Continued Compliance

Reference: ANSI N14.6, Section 5.3.1

Requirement: Annually, not to exceed 14 months, special lifting devices shall be subjected to either of the following: 1) a load test equal to 150% of the maximum service load. After sustaining the load for a period of not less than 10 minutes, critical areas, including load-bearing welds, shall be subject to visual inspection for defects and all components shall be inspected for permanent deformation; or 2) In cases where surface cleanliness and conditions permit, the load testing may be omitted and dimensional testing, visual inspection and nondestructive testing of major load-carrying welds and critical areas shall suffice.

Finding: This requirement was implemented. In their response to NRC Generic Letter 81-07 concerning the control and handling of heavy loads, Virginia Electric and Power Company (VEPCO) had committed the Surry Power Station to the requirements of ANSI N14.6 - 1978, with an exception to ensure continuing compliance through: a) conducting visual inspections of the special lifting devices prior to and immediately after all lifts; and b) performing liquid penetrant or magnetic particle non-destructive examinations of critical welds and parts as part of the licensee's 10 year in-service inspection (ISI) program.

The NRC granted this exception through acceptance of the Franklin Research Center Technical Evaluation Report (TER). Section 9B.2.4.4 of the Surry Power Station UFSAR contained the 10 year ISI requirement.

Documents Reviewed: Letter from Steven A. Varga of the NRC to W. L. Stewart of VEPCO dated May 16, 1984
Technical Technical Evaluation Report (TER) on Control of Heavy Loads performed by Franklin Research Center and dated April 23, 1984,
Surry Power Station Updated Final Safety Analysis Report (UFSAR), Revision 38
Engineering Transmittal ET-CCE-07-0001, "In-Service Inspection of Dry Cask Handling Tools", Revision 1

Category: Special Lifting Devices *Topic:* Chain Hoist Used As Special Lifting Device

Reference: ANSI B30.16; ANSI N14.6

Requirement: Prior to initial use, all new overhead hoists (underhung) shall be dynamically tested to at least 125% of the rated load. (ANSI B30.16, Sect 16-2.2.2 (b))

Prior to initial use, each special lifting device shall be subjected to a load test equal to 150% of the maximum service load. After sustaining the load for a period of not less

than 10 minutes, critical areas, including all load bearing welds, shall be subjected to liquid penetrant or magnetic particle nondestructive testing. (ANSI N14.6, Section 5.2.1)

Finding: This requirement was implemented. Through acceptance of the Franklin Research Center Technical Evaluation Report (TER), the NRC granted an exception to the ANSI N14.6 code requirement for 150% load testing of special lifting devices prior to initial use.

The Neuhaus air operated chain hoist was purchased under ASME code B30.16, which referenced ASME B30.9 for load testing. ASME B30.9 specified a 125% load test. The air operated chain hoist was rated at 10 tons (20,000 pounds) and was load tested by the manufacturer to 25,000 pounds. Since the ANSI N14.6 code exception allowed testing of special lifting devices to 100% of maximum service load, the hoist test at 125% was adequate.

The air operated chain hoist had a capacity of 20,000 pounds and was load tested to 25,000 pounds. Both of these values were over what was needed for this application. The heaviest shield lid ever used during dry fuel storage operations at the Surry Power Station weighed 14,000 pounds.

Documents Reviewed: Neuhaus America Corp. JDN Air Hoist Vendor Manual
J.D. Neuhaus Works Certificate, dated September 9, 1986

Category: Special Lifting Devices *Topic:* Load Testing - Transfer Cask Trunnions

Reference: ANSI N14.6, Section 5.2.1

Requirement: Prior to initial use, each trunnion shall be subjected to a load test equal to 150% of the maximum service load. After sustaining the load for a period of not less than ten minutes, critical areas, including load bearing welds, shall be subject to non destructive testing using the liquid penetrant or magnetic particle methods.

Finding: This requirement was implemented. Both upper transfer cask trunnions were load tested simultaneously on May 11, 2005 by Hitachi Zosen Diesel & Engineering Co., LTD, using Procedure 032-T-PLT. The Proof Load Test Record documented that a load test of 380.35 tons was held for 11 minutes, followed by a liquid penetrant (PT) examination of the critical areas. The results of the PT examination were acceptable, as documented on the Record of Visual Weld/Liquid Penetrant Examination. Both the Proof Load Test Record and the Record of Visual Weld/Liquid Penetrant Examination were contained in Section 9 of Transnuclear's Certificate of Conformance for the OS187H transfer cask.

Documents Reviewed: Final Documentation Package OS187H Transfer Cask Serial No. 1 stamp dated March 2, 2006
Procedure 032-T-PLT, "Proof Load Test Procedure," Revision 4

Category: Special Lifting Devices *Topic:* Major Maintenance and Alterations

Reference: ANSI N14.6, Section 5.3.2

Requirement: Acceptance testing prior to initial use shall be repeated following major maintenance or alteration. Major maintenance or alteration is defined as repair or design change in

which load bearing members are subjected to heat above 300 degrees F, removal of significant quantities of metal, welding other than for surface repair, or plastic deformation of metal.

Finding: This requirement was implemented. On May 15, 2007, Surry Power Station machined 1/4" of metal off the inner surface of both arms of the lifting yoke to accommodate the wider trunnion spacing on the OS197H transfer cask. This modification involved removal of significant quantities of metal. Therefore, the lift yoke was subject to a repeat of acceptance testing prior to continued use.

Procedure OP-4.20 provided instructions for performing the post modification load test and the non-destructive examinations (NDE) following the modification. Surry performed a post modification load test of the lifting yoke to 150%, followed by liquid penetrant testing and magnetic particle testing of the critical areas, including load bearing welds. The non-destructive examinations of critical welds and parts were performed as part of the licensee's 10 year in-service inspection (ISI) program. Section 9B.2.4.4 of the Surry Power Station UFSAR contained the 10 year ISI requirement.

Documents Reviewed: Procedure VPAP-0809, "NUREG-0612 Heavy Load Program," Revision 8
Procedure OP-4.20, "Operating Procedure for Load Test of Castor V/21 Lifting Yoke and GNSI Universal Lifting Yoke," Revision 2
Surry Power Station Updated Final Safety Analysis Report (UFSAR), Revision 38

Category: Special Lifting Devices *Topic:* Special Lifting Device Inspection Prior to Use

Reference: ANSI N14.6, Section 5.3.6

Requirement: Special Lifting Devices shall be visually inspected by operating personnel for indications of damage or deformation prior to each use.

Finding: This requirement was implemented. Procedure VPAP-0809, Section 6.5.2 required a visual inspection of the lift yoke prior to use. The inspection points were: a) rust and/or corrosion; b) tightness of fasteners; c) tack welds on fasteners for cracks; d) structural welds for cracks; and e) other components for damage or deformation.

The air operated chain hoist was defined as a tool and was controlled under Procedure VPAP-0214. Attachment 20 contained the inspection requirements prior to issuing the chain hoist to the field for use. The inspection points included: a) operating mechanisms for proper operation; b) leakage in air lines and regulator; c) hooks for cracks, increased throat opening, and twist; d) hook latches for proper operation; and e) chain for gouges, nicks, corrosion, weld splatter, distorted links, and tightness of fasteners.

Documents Reviewed: Procedure VPAP-0809, "NUREG-0612 Heavy Load Program," Revision 8
Procedure VPAP-0214, "Tool Room Control", Revision 18

Category: Training *Topic:* Approved Training Program

Reference: 10 CFR 72.44(b)(4)

Requirement: The licensee shall have a training program in effect that covers the training and certification of personnel that meet the requirements of Subpart I before the licensee receives spent fuel at the ISFSI.

Finding: This requirement was implemented. The training program for the NUHOMS system was developed using the Systematic Approach To Training (SAT) process, and was described in Appendix F1 to the Nuclear Control Room Operator Development Program (NCRODP) Guide.

The knowledge requirements for each task were developed into 5 lesson plans, followed by a written examination. The skill requirements for each task were developed into Job Performance Measures (JPMs). Two existing JPMs were modified and 6 new JPMs were developed for training personnel on the NUHOMS-HD systerm.

Once the classroom training, written examination and JPMs were successfully completed, the candidate was fully qualified to perform the task. The training program for the NUHOMS system was approved by the Surry Power Station Operations Manager on June 13, 2007, as documented in the training center memorandum referenced.

Documents Reviewed: Training Center Memorandum, "NUHOMS Qualification Program Addition to NFHTP", dated June 13, 2007
Appendix F1 to the Nuclear Control Room Operator Development Program (NCRODP) Guide, "Nuclear Fuel Handling Training Program (Surry)"

Category: Training *Topic:* Cask System Overview

Reference: CoC 1030, Tech Spec 5.2.2

Requirement: Training modules shall be developed to include an overview of the NUHOMS-HD system design, ISFSI facility design, Systems, Structures and Components (SSCs) Important To Safety, NUHOMS-HD System FSAR and the NRC SER. The modules shall include more specific training on the Certificate of Compliance (CoC) conditions, NUHOMS-HD system technical specifications, applicable regulatory requirements, required instrumentation and use, and operating experience reviews.

Finding: This requirement was implemented. NUHOMS Lesson Plans #1 and #4 presented an overview of the NUHOMS-HD system design, ISFSI facility design, Systems, Structures and Components (SSCs) Important To Safety, NUHOMS-HD System SAR and the NRC SER.

NUHOMS Lesson Plan #4 provided a detailed discussion of the Certificate of Compliance (CoC) conditions and Technical Specifications. NUHOMS Lesson Plans #1, #2, and #3 provided information on required instrumentation and use during presentation of each system or component.

Surry Power Station used the corporate Operating Experience group and the Condition Reporting system to gather ISFSI related operating experience. The lessons learned

were presented during pre-job briefings.

Documents Reviewed: NUHOMS-LP-1, "NUHOMS General System Overview", Revision 0
NUHOMS-LP-2, "NUHOMS Transfer System Overview", Revision 0
NUHOMS-LP-3, "Alignment Operations", Revision 0
NUHOMS-LP-4, "NUHOMS Code of Compliance", Revision 0

Category: Training *Topic:* Cask System Procedures

Reference: CoC 1030, Tech Spec 5.2.2

Requirement: Training modules shall be developed for the operation and maintenance of the NUHOMS-HD System and the ISFSI. These modules shall include the procedures used for: a) fuel loading; b) rigging and handling; c) loading operations as described in Chapter 8 of the FSAR; d) unloading operations including reflooding; e) auxiliary equipment operation; f) transfer operations; g) surveillance operations; h) radiation protection; i) maintenance as described in Section 9.2 of the FSAR; and j) off-normal and accident conditions responses and corrective actions.

Finding: This requirement was implemented. Fuel loading training was provided under the Surry Power Station Nuclear Fuel Handling Training Program. This training included the fuel loading and fuel handling equipment procedures.

Rigging and handling training was provided through the MIT Crane and Rigging Course and Job performance Measures (JPMs). The JPMs included: a) Rig the lifting yoke or lift beams for cask movement into the vertical position (FH00001); b) Upend and downend the transfer cask on the transfer trailer (FH00041); c) Receive and upend a canister (FH00042); d) Prepare the transfer cask and canister to receive fuel (FH00043); e) Prepare a loaded canister for storage (FH00044); and f) Store a loaded canister in a Horizontal Storage Module (FH00045). Successful completion of the Crane and Rigging Course and the JPMs was documented in the Productive Work Evaluation Record (PWER).

Loading operations training was provided in NUHOMS Lesson Plan #1. This lesson plan provided specific training on the construction and operation of the: a) transfer cask; b) lifting yoke; c) canister; d) Horizontal Storage Module (HSM); and f) transfer trailer. The loading sequence and procedures were consistent with Chapter 8 of the FSAR.

Unloading operations training was provided during pre-operational testing using Procedure 0-OP-FH-076. The unloading operations included gas sampling, hydrogen monitoring, canister reflooding, and removing the canister lids.

Auxiliary equipment training in was provided in NUHOMS Lesson Plan #1. This lesson plan provided specific training on operation of the Automated Welding System (AWS), vacuum drying system, helium backfilling system, and helium leak testing system.

Transfer operations training was provided in NUHOMS Lesson Plans #2 and #3. Lesson Plan #2 provided specific training on construction and operation of the transfer trailer,

including its brakes, steering, hydraulic skid positioning system, vertical jacks, and hydraulic ram system. Lesson Plan #3 provided specific training on aligning the transfer cask for canister insertion into the HSM, using survey transits and targets.

Surveillance operations training was provided in NUHOMS Lesson Plan #4. This lesson plan provided a detailed discussion of: a) vacuum drying time limits; b) helium leak rate testing; c) HSM air inlet and outlet vents surveillance; and d) transfer cask lifting heights.

Radiation protection training was provided in NUHOMS Lesson Plan #4. This lesson plan provided a detailed discussion of: a) cask criticality control; b) radiation protection practices; and c) HSM dose rate evaluation.

System maintenance training was provided during pre-operational testing, using Procedure 0-OP-FH-072. The maintenance actions included; a) Inspect and lubricate the transfer cask trunnion bearing surfaces; b) Inspect and lubricate the ram access cover and transfer cask lid o-rings; c) Inspect and clean the transfer cask lid and ram access cover bolts and holes; d) Inspect the interior surface of the transfer cask; and e) Inspect and test the neutron shield and transfer cask quick-connect fittings. These maintenance actions were consistent with Section 9.2 of the FSAR.

Off-normal and accident conditions training was provided in NUHOMS Lesson Plan #4. This lesson plan discussed: a) a jammed canister during loading or unloading operations; b) extreme temperatures; c) cask drop; d) earthquake; e) tornado wind and missile effects; f) flood; g) blockage of HSM air vents; h) lightning; and i) fire and explosion.

Documents Reviewed:
NUHOMS-LP-1, "NUHOMS General System Overview" Revision 0
NUHOMS-LP-2, "NUHOMS Transfer System Overview", Revision 0
NUHOMS-LP-3, "Alignment Operations", Revision 0
NUHOMS-LP-4, "NUHOMS Code of Compliance", Revision 0
Productive Work Evaluation Record (PWER) for the MIT Crane and Rigging Course
Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5
Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1

Category: Training *Topic:* Certification of Personnel

Reference: 10 CFR 72.190

Requirement: Operations of equipment and controls that have been identified as important to safety in the SAR and in the license must be limited to trained and certified personnel or be under the direct visual supervision of an individual with training and certification in the operation. Supervisory personnel who personally direct the operation of equipment and controls that are important to safety must also be certified in such operations.

Finding: This requirement was implemented. Classroom training on the NUHOMS system was provided by the vendor (Areva) on July 24-27, 2006. ISFSI personnel received training on general system operations, transfer operations, and alignment operations. Following

the classroom training, a written examination was administered with a minimum passing grade of 80%.

Between July 24, 2006 and June 13, 2007, AREVA trained and evaluated ISFSI personnel in field operations including: a) operations of the transfer trailer; b) upending and downending the transfer cask; c) receiving and upending a new canister; d) preparing the transfer cask and canister for fuel receipt; e) preparing a loaded canister for storage; and e) storing a loaded canister in the HSM. These operations were equivalent to Surry Power Station JPMs FH00040 through FH00045.

On June 11 and 15, 2007, classroom training was provided on the NUHOMS Code of Compliance and abnormal and off-normal operations. A written examination was administered with a minimum passing grade of 80%.

In addition, three ISFSI personnel from North Anna were qualified in lift yoke rigging and helium leak testing.

Documents Reviewed: Appendix F1 to the Nuclear Control Room Operator Development Program (NCRODP) Guide, "Nuclear Fuel Handling Training Program (Surry)"
Training Center Memorandum, "NUHOMS Qualifications", dated June 13, 2007
Training Center Memorandum, "NUHOMS Qualifications", dated June 15, 2007

Category: Training *Topic:* Dry Run Training Exercise

Reference: CoC 1030, Condition 8

Requirement: A dry run training exercise of the loading, closure, handling, unloading and transfer of the NUHOMS-HD System shall be conducted by each licensee prior to first use of the system to load spent nuclear fuel assemblies. The loading operations shall include: a) fuel loading; b) canister sealing; c) drying and backfilling operations; d) transfer cask downending and transport to the ISFSI; and e) canister transfer into the HSM-H. The unloading operations shall include: a) canister retrieval from the HSM-H; b) flooding the canister; and c) opening the canister.

Finding: This requirement was implemented. Fuel loading was demonstrated during this inspection using a dummy fuel assembly and Sections 5.2 through 5.8 of Procedure 0-OP-FH-072. The major steps of the operation included: a) preparing the transfer cask and canister for immersion in the spent fuel pool; b) sampling the spent fuel pool water for boron; c) filling the canister with spent fuel pool water; d) raising the transfer cask from the north bay of the decontamination building and lowering it into the cask loading area of the spent fuel pool; e) test fitting the dummy fuel assembly into four canister cell locations; f) installing the canister shield plug; g) removing the transfer cask from the spent fuel pool and returning it to the north bay of the decontamination building; and h) removing the annulus seal and performing a contamination survey to determine seal effectiveness.

Canister sealing operations were demonstrated on August 8-10, 2006 using a canister mock-up. The demonstration included welding and weld testing of the canister inner lid, the vent and drain port cover plates, and the outer lid. The inspection results were

documented in Inspection Report 05000280/2006004; 05000281/2006004; 7200055/2006001, dated October 26, 2006 (ML0630000110).

Canister drying and backfilling operations were demonstrated during this inspection using a canister mock-up and Sections 5.10 and 5.11 of Procedure 0-OP-FH-072. The major steps of the operation included: a) pumping the water out of the canister; b) backfilling the canister free volume with helium; c) vacuum drying the canister; and d) pressure testing the canister with helium; and e) final helium backfilling.

Transfer cask downending and transport to the ISFSI were demonstrated during this inspection using the transfer cask with a ballasted canister and Sections 6.3 and 6.4 of Procedure 0-OP-FH-073. The major steps of the operation included: a) lifting the transfer cask from the north bay of the decontamination building; b) transferring the transfer cask to the crane enclosure building; c) downloading the transfer cask onto the transfer trailer; and d) hauling the transfer trailer from the crane enclosure building to the ISFSI.

Canister transfer into the HSM-H was demonstrated during this inspection using the transfer cask with a ballasted canister and Sections 6.5 through 6.9 of Procedure 0-OP-FH-073. The major steps of the operation included: a) venting the transfer cask; b) removing the transfer cask lid and ram access cover; c) aligning the transfer cask with the horizontal storage module; and d) inserting the canister into the horizontal storage module.

Canister retrieval from the HSM-H was demonstrated during this inspection using the transfer cask with a ballasted canister and Sections 6.8 and 6.9 of Procedure 0-OP-FH-074. The major steps of the operation included: a) aligning the transfer trailer with the horizontal storage module; b) engaging the canister with the ram grapple; and c) retrieving the canister from the horizontal storage module back into the transfer cask.

Flooding the canister during an unloading operation was demonstrated during this inspection using a canister mock-up and Section 6.3 of Procedure 0-OP-FH-076. The major steps of the operation included: a) obtaining a canister gas sample; and b) re-flooding the canister with spent fuel pool water.

Opening the canister was simulated on August 8-10, 2007. The NRC inspectors observed a videotape of canister lid removal performed at another facility. The lid removal process and equipment contained in the videotape were similar to what Surry intended to use. NRC acceptance of this videotape for meeting the requirement is documented in Inspection Report 05000280/2006004; 05000281/2006004; 7200055/2006001," dated October 26, 2006 (ML0630000110).

Documents Reviewed:

Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5
Procedure 0-OP-FH-073, "TC/DSC Transfer To ISFSI and DSC Transfer From TC To HSM", Revision 1
Procedure 0-OP-FH-074, "TC/DSC Transfer From ISFSI To Crane Enclosure and DSC Transfer From HSM To TC", Revision 1

Category:	Welding *Topic:* Hydrogen Monitoring During Lid Cutting
Reference:	FSAR 1030, Section 8.2.2.15
Requirement:	During unloading, the canister is reflooded through the drain port and vented through the vent port. Once flooded, the canister cavity must be monitored for hydrogen during all subsequent cutting operations. If the hydrogen concentration exceeds 2.4%, cutting operations are suspended and the canister is purged with an inert gas to reduce hydrogen concentration below the 2.4% limit.
Finding:	This requirement was implemented. Procedure 0-OP-FH-076 required hydrogen monitoring of the canister internals during outer top cover removal and during inner top cover/shield plug removal. Procedure 0-OP-FH-076, Step 6.4.2 installed the hydrogen monitor in the canister vent port following canister reflooding, and Step 6.4.4 established the hydrogen concentration limit at 2.4%. If this concentration was exceeded, a helium purge of the canister was required until hydrogen concentration decreased below 2%. The hydrogen monitor was removed in Step 6.4.15 following cutting of the outer top cover and was reinstalled in Step 6.4.20 prior to cutting the inner top cover/shield plug.
Documents Reviewed:	Procedure 0-OP-FH-076, "Unloading a NUHOMS OS187/32PTH Canister", Revision 1

Category:	Welding *Topic:* Hydrogen Monitoring During Welding
Reference:	FSAR 1030, Sections 8.1.1.3.9 and 8.1.1.3.10
Requirement:	Continuous hydrogen monitoring during welding of the inner top cover/shield plug is required. Insert a hydrogen monitor intake line through the vent port such that it terminates just below the inner top cover/shield plug. If the hydrogen concentration exceeds 2.4%, welding operations are suspended and the canister is purged with an inert gas via the vent port to reduce hydrogen concentration below the 2.4% limit.
Finding:	This requirement was implemented. Procedure 0-OP-FH-072, Step 5.9.1 installed the hydrogen monitor in the vent port prior to start of welding and Step 5.9.3 established the hydrogen concentration limit at 2.4%. If this concentration was exceeded, a helium purge of the canister was required until hydrogen concentration decreased below 2%.
Documents Reviewed:	Procedure 0-OP-FH-072, "NUHOMS 32 PTH Dry Shielded Canister Loading and Handling", Revision 5