Inspector Notes
Catawba ISFSI Inspection
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Catawba ISFSI
(INSPECTOR NOTES)

Category: Cranes **Topic:** Control of Heavy Loads

Reference: NUREG 0612, Section 5.1

Requirement: Various alternative approaches are listed that provide acceptable measures for the control of heavy loads when using non-single-failure-proof cranes including ensuring that: (I) the release of radioactive material from damage to spent fuel is well within 10 CFR Part 100 limits, (II) damage to fuel from an accidental drop does not result in configuration of the fuel such that Keff is larger than 0.95, (III) damage to the spent fuel pool is limited such that water leakage could not uncover the fuel, (IV) damage to equipment in redundant or dual safe shutdown paths will not result in loss of required safe shutdown functions.

Finding: This requirement was achieved. The licensee had evaluated the potential impact to the operating Part 50 facility and determined that a drop of the spent fuel cask would not result in the loss of safe shutdown functions since there were no safety related equipment located in the vicinity of the cask transport path and there were no safety related components located below the concrete floor. The potential for the drop of the transfer cask into the spent fuel pool had also been evaluated and determined not to impact the spent fuel stored in the pool by Calculation 1139.09-01. The Catawba Updated Final Safety Analysis Report (UFSAR) documented that a cask drop would not allow the canister to fall into the spent fuel pool. A raised concrete wall separated the cask loading pit area from the spent fuel pool, which prevented the cask from falling or tipping into the spent fuel pool. The cask loading pit could be separated from the spent fuel pool with a gate providing isolation between the pool and the pit in the event of a cask drop into the cask loading pit.

The licensee had evaluated the potential safety impact of a canister drop using LS-DYNA software and determined that the consequences of the drop would not result in a rupture of the spent fuel canister confinement and therefore no radiation would be released. Seven bounding drop cases were evaluated in the calculation. A letter dated March 1, 2007 documented that the fuel would be maintained in a configuration such that Keff would remain less than 0.95 from an analyzed drop.

The inspector questioned the possible safety significance to a loaded canister should the crane fall upon the transfer cask during a seismic event. The licensee provided an evaluation which documented that the probability of occurrence of an SSE during movement of the transfer cask with loaded with fuel is less than 1 EE-6, and therefore would be below the threshold of probability.

Documents Reviewed: Calculation 12418-2008, "Catawba Transfer Cask and Canister Drop Analysis," Revision 0; Catawba UFSAR, Dated October 24, 2004; Calculation File No. 1139.09-01, "Catawba Nuclear Dropped Cask Accident," Dated August 14, 1975; Calculation File No. CNC-1139.09-01-0001, "Design of Spent Fuel Building- Dropped Cask Study," Dated November 6, 2006; Letter dated March 1, 2007 from NAC International to Mr. Jack Jenkins; Email from Michael Barrett to George Strickland on April 12, 2007

Category: Cranes **Topic:** Crane Design

Reference: NUREG 0612, Sect 5.1.1 (7); CMAA #70; ANSI B30.2

Requirement: The crane should be designed to meet the applicable criteria and guidelines in Chapter 2-1 of ANSI B30.2 "Overhead and Gantry Cranes" and CMAA #70 "Specifications for Electric Overhead Traveling Cranes."

Finding: This requirement was achieved. The Unit 1 and Unit 2 Catawba fuel handling cranes are non-single-failure-proof Whiting cranes. The main hoist is rated at a 125 ton capacity. NUREG 0954 evaluated the design features of the fuel handling cranes and found that they met the requirements of ASME B30.2 and CMAA-70.

Documents Reviewed: NUREG 0954, Supplement No. 2, Safety Evaluation Report Related to the Operation of Catawba Nuclear Station Units 1 and 2,

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Category: Cranes **Topic:** Hoist Limit Switch Tested Each Shift

Reference: ANSI B30.2, Chap 2-3.2.4

Requirement: Prior to the initial use of any hoist during each shift, the operator shall verify operation of the primary upper limit switch under no-load conditions. Extreme care shall be exercised. The block shall be "inched" into the limit or run at a slow speed.

Finding: This requirement was achieved. Section 9.1.2 of the Lifting Program specified the minimum pre-operational inspection requirements for all cranes include among other items "test upper limit devices by raising the block into the limit at a slow speed under no load." Table 9.1-1 specified the inspection intervals for each type of crane and indicated that the bridge cranes should have a pre-operational check performed prior to operation of the equipment one time at the beginning of each shift. The lifting program also contained a "Bridge & Gantry Crane Pre-Operational Inspection Checklist," which included a requirement in item number 44 to check the "upper limit switch."

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12

Category: Cranes **Topic:** Inspection, Testing & Maintenance

Reference: NUREG 0612, Sect 5.1.1 (6); ANSI B30.2, Chap 2-2

Requirement: The crane should be inspected, tested and maintained in accordance with Chapter 2-2 of ANSI B30.2 except that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspections or tests or where the frequency of crane use is less than the specified inspection and test frequency.

Finding: This requirement was met. The licensee established the requirements for inspections of all the cranes in the Duke Energy Carolinas Lifting Program. Inspection intervals were listed for each type of crane and hoist that were used, including initial, pre-operational, quarterly and periodic inspections. Checklists along with inspection criteria were provided for pre-operational, periodic and annual inspections of the bridge & gantry cranes.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Procedure MP/0/B/7300/026, "Catawba Nuclear Station Quarterly/Annual Inspection and Servicing of Overhead and

Gantry Cranes," Revision 1; Unit 1 Preventative Maintenance Task No. 01712379-01; Unit 2 Preventative Maintenance Task No. 01120256-01.

Category: Cranes **Topic:** Inspections - Annual

Reference: ASME B30.2; Section 2-2.1.3

Requirement: Periodic or annual crane inspections shall be performed to check: (a) deformed, cracked or corroded members, (b) loose or missing bolts, nuts, pins or rivets, (c) cracked or worn sheaves and drums, (d) worn, cracked or distorted parts, (e) excessive wear of brake system, (f) excessive wear of drive chain, (g) deterioration of controllers or switches, (h) motion limit devices that interrupt power, and (i) rope reeving

Finding: This requirement was achieved. Duke Energy had implemented several overlapping program requirements that applied to the Catawba fuel handling cranes. The Lifting Program included inspection criteria for Bridge & Gantry Crane Periodic/Annual Inspections. The site had also implemented two inspection procedures for the fuel handling cranes. The older process used Procedure PM/IG-022 which provided instructions for monthly, annual and bi-annual inspections of the crane components. The more recent crane inspection Procedure MP/0/B/7300/026 provided instructions for performing quarterly and annual inspections of the fuel handling cranes. Several of the work tasks were reviewed and two of the maintenance workers were interviewed as part of the inspection. The Duke Catawba crane inspection program considered as a whole provided the specified crane inspections.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Procedure PM/IG-022, "Whiting 125/10 Ton Fuel Building Crane," Approved January 20, 1987; Unit 1 Preventative Maintenance Task No. 01712379-01; Unit 2 Preventative Maintenance Task No. 01120256-01; Procedure MP/0/B/7300/026, "Catawba Nuclear Station Quarterly/Annual Inspection and Servicing of Overhead and Gantry Cranes," Revision 1

Category: Cranes **Topic:** Inspections - Frequent

Reference: ASME B30.2; Section 2-2.1.2

Requirement: Frequent or monthly crane inspections (except for severe service which should be weekly) shall be performed to check: (a) operating mechanisms, (b) upper limit devices, (c) air and hydraulic systems, (d) hooks and hook latches, (e) hoist ropes and end connections, and (f) rope for proper spooling onto drum and sheave.

Finding: This requirement was met. The licensee used the Duke Energy Carolinas Lifting Program and Procedure OP/0/A/6550/016 to perform pre-operational inspections of the fuel handling crane each shift. The pre-operational bridge and gantry crane inspection criteria and checklist was very detailed and included among other items; verify that the crane quarterly inspection is current, operate pneumatic system for signs of leaks, operate and observe proper spooling on the drum, check sheaves and hook for signs of damage, and check upper / lower limit switches. Enclosure 4.2 of Procedure OP/0/A/6550/016 also specified inspection criteria for the 125 ton crane including crane operator requirements.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Procedure OP/0/A/6550/016, "Overhead Fuel Building Cranes," Revision 017; Procedure PM/IG-022, Duke Energy

Carolinas Lifting Program, Revision 12; Procedure PM/IG-022, "Whiting 125/10 Ton Fuel Building Crane," Approved January 20, 1987

Category: Cranes **Topic:** Load Test - 100%

Reference: ASME B30.2, Sect 2-2.2.2

Requirement: After the 125% static load test and adjustments required as a result of the test, the crane handling system should be given a full performance test with 100% of the maximum critical load for all speeds and motions for which the system is designed. This should include verifying all limiting and safety control devices. The features provided for manual lowering of the load and manual movement of the bridge and trolley during an emergency should be tested with the maximum critical load attached.

Finding: This requirement was achieved for the both the Unit 1 and 2 fuel handling cranes during original installation. The licensee used Construction Procedure 465 to perform the crane load tests. The initial portion of the test consisted of a no load functional test followed by the 125 percent load test. After the 125 percent load had been conducted, the operation of the main hoist, trolley and bridge were tested with the 125 percent load suspended. The completed procedures for both the Unit 1 and 2 cranes documented that the cranes had passed the loaded functional tests.

The crane vendor identified a 10 CFR Part 21 issue that required both the Unit 1 and Unit 2 fuel handling cranes to be derated, pending repairs. After the 10 CFR Part 21 modification had been completed on the Unit 1 and Unit 2 cranes, a crane functional test was performed using a test load of 77 tons using Work Order 0170162415 and 0170162119, for the Unit 1 and Unit 2 cranes, respectively. Following the functional tests a crane inspection was performed including a visual inspection of the main hoist bull and pinion gears and the bridge crane trucks. No cracks, indications, galling or unusual indications were observed by the crane maintenance personnel on either crane.

Documents Reviewed: Construction Procedure 465, "125/10 Ton Fuel Handling Crane Test - Units 1 and 2", Revision 2, Dated October 5, 1984 for Unit 2 and October 10, 1983 for Unit 1; Work Order 0170162415, "CD201004(ISFSI) U2 Fuel Building Crane Upgrade Per 10CFR 21 Issue; Work Order 0174767807, "CD101003-ISFSI-NDE Welds for Unit 1 Fuel Bldg. Crane Upgrade," Dated June 4, 2007; WO 0170162109, "CD101003(ISFSI)U1 Fuel Building Crane Upgrade Per 10CFR21 Issue," Dated March 6, 2007

Category: Cranes **Topic:** Load Test - 125%

Reference: ASME B30.2, Sect 2-2.2.2

Requirement: The crane system should be static load tested at 125% of the maximum critical load. The tests should include all positions generating maximum strain in the bridge and trolley structures and other positions as recommended by the designer and manufacturer.

Finding: This requirement was achieved for both the Unit 1 and 2 fuel handling cranes during original installation. The licensee used Construction Procedure 465 to perform the crane load tests. The initial portion of the test consisted of a no load functional test followed by the 125 percent load test. The Unit 1 fuel handling crane was load tested to 125 percent (156 tons) on September 9, 1983. The Unit 2 fuel handling crane was load tested to 123 percent (154) tons on October 4, 1984. The test load for the Unit 2 crane was within the ASME B30.2 interpretation for the 125 percent load test tolerance of +0 and -4 percent. For both load tests the procedure directed the user to hold the load for a minimum of one minute. If no problems were encountered, the procedure directed the user to then perform a series of hoist movements. Both procedures documented that no problems were experienced during either the Unit 1 or Unit 2 fuel handling crane load tests.

Documents Reviewed: Construction Procedure 465, "125/10 Ton Fuel Handling Crane Test - Units 1 and 2", Revision 2, Dated October 5, 1984 for Unit 2 and October 10, 1983 for Unit 1

Category: Cranes **Topic:** Minimum of Two Wraps of Rope

Reference: ASME B30.2, Section 2-1.14.3(c)

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

Finding: This requirement was met for crane use during dry fuel storage demonstration on Unit 2. During the pre-operational demonstrations the 125-ton overhead fuel building crane was used to lower the transfer cask into the decontamination pit. This is the lowest elevation which the main crane hook will be during dry fuel storage operations. The number of wraps of wire rope remaining on the Unit 2 crane was observed to be greater than 10 at the lowest position.

Documents Reviewed: None

Category: Cranes **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: The NUREG 0612 review of the Catawba cranes were evaluated by the NRC and documented in NUREG 0954. The Catawba Unit 1 and Unit 2 fuel handling cranes are non-single-failure-proof cranes that were manufactured by Whiting. The main hoist is rated for a capacity of 125 tons. NUREG 0954 compared both the Unit 1 and Unit 2 cranes against the criteria of NUREG 0612 and determined that all the requirements were achieved, except for the use of slings. The specific guidelines that were reviewed for the main hoists were the rated capacity, safe load paths, procedures, crane operator training, special lifting devices, crane inspection and design. The Catawba sling program will be addressed separately in this inspection report.

At Catawba the maximum weight to be lifted with the crane included the transfer cask and canister filled with water and fuel. The weight of this lift documented in Table 3.2-1 of the NAC-UMS FSAR was 201,900 pounds, which is well within the rated capacity of the 125 ton fuel handling cranes.

Documents Reviewed: NUREG 0954, Supplement No. 2, Safety Evaluation Report Related to the Operation of Catawba Nuclear Station Units 1 and 2; NAC-UMS FSAR, Revision 3

Category: Cranes **Topic:** Operator Training/Qualifications

Reference: NUREG 0612, Sect 5.1.1 (3); ANSI B30.2, Chap 2-3

Requirement: Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2 "Overhead and Gantry Cranes." This may include specific physical qualifications necessary to perform the job and passing a written and oral exam and a practical operating exam administered by the employer. Exam requirements may be waived for employees who meet specific qualifications and experience.

Finding: This requirement was achieved. Duke Energy had established a lifting program training course that included training for riggers and crane operators. Section 3.8 of the Duke Lifting Program listed the requirements for crane operators that included successfully passing the rigger lifting process training course, the crane category related training course, completing the task related training course and performing the practical demonstration of skills. The licensee maintained a database of operators that were qualified for the overhead fuel building cranes. The maintenance supervisor utilized this database to select a qualified crane operator.

Documents Reviewed: ST2027 Qualification Report, "CN-MECH-OT-0175-RO1 Operate the Overhead Fuel Building Cranes", Dated February 28, 2007; Duke Energy Carolinas Lifting Program, Revision 12; Lesson Plan CN-MECH-OT-0175, "Operate the Overhead Fuel Building Cranes," Revision 1a

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Category: Cranes **Topic:** Preventive Maintenance Program

Reference: ASME B30.2; Section 2-2.3.1

Requirement: A preventive maintenance program should be established based on the recommendations outlined in the crane manufacturer's manual.

Finding: This requirement was met. Selected recommendations for crane maintenance from the crane vendor manual were compared to the licensee fuel handling crane maintenance and inspection procedures. No discrepancies were identified during the comparison between selected recommendations from the vendor manual to the licensee procedures.

Documents Reviewed: Vendor Manual for Whiting 125 Ton Crane; Procedure MP/0/B/7300/026, "Catawba Nuclear Station Quarterly/Annual Inspection and Servicing of Overhead and Gantry Cranes," Revision 1; Procedure PM/IG-022, "Whiting 125/10 Ton Fuel Building Crane," Approved January 20, 1987

Category: Cranes **Topic:** Rope Inspections

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

Requirement: All ropes should be visually inspected at the start of each shift. A thorough inspection of all ropes shall be made at on a periodic basis as defined by ASME B30.2. Annually, the inspection should include the entire length of the rope.

Finding: This requirement was achieved. The licensee crane program required an inspection of the crane main hoist wire rope for signs of deterioration each shift that the crane was operated. Additionally, the crane wire rope had been inspected on a periodic (annual) basis per the instructions contained in Procedure PM/IG-022. The directions for how to inspect the wire rope included among other things how to properly inspect the wire rope for signs of twisting, crushing and wear. Preventative maintenance task numbers 01712379-01 and 0112056-01 documented that the main hoist wire rope had been inspected on both of the fuel handling cranes within the past year.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Procedure PM/IG-022, "Whiting 125/10 Ton Fuel Building Crane," Approved January 20, 1987; Unit 1 Preventative Maintenance Task No. 01712379-01; Unit 2 Preventative Maintenance Task No. 01120256-01.

Category: Cranes **Topic:** Rope Replacement

Reference: ASME B30.2; Section 2-2.4.2

Requirement: The rope shall be replaced when inspection of the rope finds conditions that meet ASME B30.2, Section 2-2.4.2 indicating excessive wear or damage, broken strands, heat damage or distortion.

Finding: This requirement was achieved. The Duke Lifting Program required that a visual inspection be performed of the main hoist wire rope by the operator each shift to find obvious deficiencies. A detailed inspection of the wire rope was required to be conducted quarterly by Procedure MP/0/B/7300/026. The acceptance criteria for the wire rope inspection was included in Enclosure 13.2 to the procedure along with diagrams of how to properly perform the rope measurements. The condition of the main hoist wire rope was observed to be in good condition while performing a walk-down of the Unit 2 crane on February 28, 2007 and on the Unit 1 crane on July 23, 2007.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Procedure MP/0/B/7300/026, "Catawba Nuclear Station Quarterly/Annual Inspection and Servicing of Overhead and Gantry Cranes," Revision 1; Unit 1 Preventative Maintenance Task No. 01712379-01; Unit 2 Preventative Maintenance Task No. 01120256-01.

Category: Cranes **Topic:** Sling Selection and Use (ANSI B30.9)

Reference: NUREG 0612, Section 5.1.1.(5)

Requirement: Slings should be installed and used in accordance with the guidelines of ANSI B30.9 "Slings." The load used to select the sling should be the sum of the static and dynamic loads.

Finding: This requirement was implemented. Lifting Rig Set #1 was used for lifting the empty canister. Set #1 consisted of four (4) Twin Path slings connected to the canister through four (4) Jergens swivel hoist rings. Each sling and hoist ring had a Working Load Limit (WLL) of 10,000 pounds. The four slings provided a total WLL of 40,000 pounds. The empty canister had a static weight of 24,700 pounds. Adding 15% for dynamic loading increased the total weight to 28,405 pounds. With a total WLL of 40,000 pounds, lifting rig set #1 was capable of safely lifting the intended load.

Lifting Rig Set #2 was used for lifting and setting the canister shield lid underwater. Set

#2 consisted of: three (3) alloy sling chains each with a WLL of 18,400 pounds; three (3) Jergens swivel hoist rings each with a WLL of 10,000 pounds; three (3) Crosby jaw and jaw turnbuckles each with a WLL of 3,500 pounds; and three (3) Crosby alloy steel hooks each with a WLL of 22,000 pounds. The most limiting components were the Crosby jaw and jaw turnbuckles. Each turnbuckle had a WLL of 3,500 pounds and the three turnbuckles provided a total WLL of 10,500 pounds. The canister shield lid had a static weight of 7,000 pounds. Adding 15% for dynamic loading increased the total weight to 8,050 pounds. With a limiting WLL of 10,500 pounds, lifting rig set #2 was capable of safely lifting the intended load.

Lifting Rig Set #3 was used for lifting and lowering the loaded canister into the vertical concrete cask. Set #3 consisted of two (2) Twin Path long slings each with a WLL of 70,700 pounds in a basket hitch configuration and four (4) Jergens swivel hoist rings each with a WLL of 30,000 pounds. The most limiting components were the Jergens swivel hoist rings. Each swivel hoist ring had a WLL of 30,000 pounds and the four hoist rings provided a total WLL of 120,000 pounds. The loaded canister had a static weight of 76,000 pounds. Adding 15% for dynamic loading increased the total weight to 87,400 pounds. With a limiting WLL of 120,000 pounds, lifting rig set #3 was capable of safely lifting the intended load.

Lifting Rig Set #4 was used for lifting the transfer cask adaptor. Set #4 consisted of four (4) Twin Path slings each with a working Load Limit (WLL) of 25,000 pounds and four (4) Crosby S-253 4" shackles each with a WLL of 41,000 pounds. The most limiting components were the Twin Path slings. Each sling had a WLL of 25,000 pounds and the four slings provided a total WLL of 100,000 pounds. The transfer cask adaptor had a maximum weight of 25,000 pounds. Adding 15% for dynamic loading increased the total weight to 28,750 pounds. With a limiting WLL of 100,000 pounds, lifting rig set #4 was capable of safely lifting the intended load.

Documents Reviewed: Calculation No. CNC-1126.01-00-0001, "ISFSI Lifting/Rigging Equipment Evaluation", Revision 47

Category: Cranes **Topic:** Welding

Reference: ASME B30.2, Section 2-1.4.1

Requirement: All welding procedures and welding operator qualifications to be used on load-sustaining members shall be in accordance with ANSI/AWS D1.1 except as modified by ANSI/AWS D14.1.

Finding: This requirements was achieved. The licensee FSAR specified that all the welding and procedures conformed to the requirements of AWS D1.0-69. The FSAR further stated that the structural welds for the bridge, trucks drums and trolleys are 100 percent inspected by magnetic particle testing or by liquid penetrate testing. Recently, the licensee had placed stiffeners on portions of the bridge girder end sections as required by Whiting Corporation in a Part 21 notice issued on March 30, 2006. Based on a letter from Whiting Corporation dated July 19, 2006, it was determined that a rated load test was not required for the girder end section modifications. As part of the upgrade a proof load of 77-tons was placed on the crane and moved to provide assurance that no issues would be present during the dry fuel storage operations. No problems were identified during the proof load movement.

Based on the questions from the NRC inspector, the licensee issued PIP C-07-2028 which documented that the licensee had failed to perform the weld surface NDE (MT or PT) as specified in the Catawba UFSAR. The licensee subsequently performed the weld examinations prior to fuel movement which were found to be acceptable. The Catawba Resident Inspectors issued a Green NCV (NCV 0500413,414/2007003-05) for failure to perform the required weld inspections.

The licensee utilized Welding Procedure Specification (WPS) FCOO0101-01 and GTSM0101-01 to perform the welding on the crane. These specifications were qualified to ASME IX welding requirements. The licensee provided a memorandum dated July 3, 2007, which reconciled the requirements of the WPS to the requirements of AWS D1.1.

Documents Reviewed: Catawba UFSAR, Dated April 24, 2006; Letter from Whiting Corporation to Duke Energy dated July 19, 2006; Work Order 0170162415, "CD201004(ISFSI) U2 Fuel Bldg Crane Upgrade Per 10CFR21 Issue," Dated March 8, 2007; PIP C-07-2028; Memorandum on CNS Fuel Building Crane Dated July 3, 2007;

Category: Emergency Planning **Topic:** ISFSI 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 achieved. The licensee had incorporated the ISFSI into the existing emergency plan. The highest level of alert classification for the ISFSI was a level of "Unusual Event." Procedure RP/0/A/5000/001 was revised to include the ISFSI and address the potential of fires, explosion, tornado, vehicle crash and flooding.

Documents Reviewed: Procedure RP/0/A/5000/001, "Classification of Emergency," Revision 18

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: The requirement was achieved prior to loading. The inspector identified the need to include the ISFSI pad in the Fire Protection Plan and the licensee documented this deficiency in PIP C-07-01020.

The licensee revised Procedure RP/0/B/5000/029 to include an inspection after any fire event that affects or has the potential to affect the ISFSI. The inspection included a review of the general condition of the cask concrete for damage and that the NAC-UMS TS required that following an off-normal event the visual inspection of the VCC must be performed within 4 hours.

The fire protection fire strategy BD-1 was subsequently reviewed and found to include proper actions to take if a fire was encountered at the ISFSI, but did not include other areas of the plant where the loaded VCC could be exposed to a fire. Corrective Action Sequence 38 to PIP C-07-01922 was issued to revise Procedure RP/0/B/5000/029 to include other areas where a loaded VCC could be exposed to a fire including the transport route and inside the fuel building.

Documents Reviewed: Catawba Fire Protection Pre-Plan, Revision 30; Catawba Procedure RP/0/A/5000/009, "Collision/Explosion," Revision 010; Catawba Procedure RP/0/A/5000/007, "Natural Disaster and Earthquake," Revision 026; Catawba Procedure MP/0/A/7650/182, "Operation of a Dry Cask Transporter," Revision 004; NAC-UMS FSAR, Revision 6; Catawba Nuclear Station ISFSI 10CFR72.212 Evaluation, DRAFT; Nuclear Station Directive NSD 313 "Control of Combustible and Flammable Material," Revision 6; Procedure RP/0/B/5000/029, "Fire Brigade Response," Revision 15; PIP C-07-01922 CA No. 38; Catawba Nuclear Station Dry Cask Pad ISFSI Structure Fire Strategy BD-1

Category: Fire Protection **Topic:** Fire/Explosion Potential

Reference: CoC 1015, Tech Spec B.3.4.1.5

Requirement: The potential for fire or explosion shall be addressed, based on site-specific considerations. This includes the condition that the fuel tank of the cask handling equipment used to move the loaded concrete cask onto or from the ISFSI site contain no more than 50 gallons of fuel.

Finding: This requirement was achieved prior to loading. The program inspection identified that the licensee had not performed a site specific fire / explosive hazards analysis as required by the Technical Specification. Subsequently the licensee performed that analysis and the results of the analysis were documented in Calculation CNC-1435.00-00-0041. The calculation determined that there were no credible existing explosive hazards at the site due to spatial separation and shielding provided by intermediate structures. Transient explosive materials were noted to be administratively controlled by Procedure NSD-313, which included the ISFSI area.

The licensee used the bounding fire exposure criteria found in the NAC-UMS FSAR that consisted of a fire from a 50 gallon diesel fuel pool fire burning for 8 minutes at a temperature of 1475 degrees F. The licensee reviewed several site scenarios and found that all were bounded by the NAC-UMS FSAR analysis.

In addition to analyzing the existing fire hazards at Catawba the calculation also provided specific separation distances between the transporter haul path and the source of the flammable or combustible material. A distance of 20 feet was specified for gas cylinders and 10 feet for fossil fueled vehicles with a fuel tank capacity of no more than 50 gallons.

Prior to using the transporter to move the loaded VCC, the prerequisites in Procedure MP/0/A/7650/182 required that obstructions be removed from the path, all ignition sources within 35 feet of the haul path be suspended, all temporary structures of combustible construction be at least 10 feet from the haul path, all ordinary combustibles and flammable liquids are greater than 10 feet from the haul path, all flammable gas cylinders are greater than 20 feet from the haul path, all fossil fueled vehicles with less than or equal to 50 gallons of fuel are greater than 10 feet from the haul path and that the WCC confirmed that no large trucks transporting flammable or explosive material are expected in the haul path.

Additionally, the fuel tank capacity of the transport vehicle was verified by the licensee to be 49 gallons (<50 gallons), which was necessary to meet the NAC-UMS FSAR bounding criteria.

Documents Reviewed: Catawba Procedure MP/0/A/7650/182, "Operation of a Dry Cask Transporter," Revision 006; NAC-UMS FSAR, Revision 6; Catawba Nuclear Station ISFSI 10CFR72.212 Evaluation, DRAFT;
Nuclear Station Directive, NSD 313 "Control of Combustible and Flammable Material," Revision 6; Calculation CNC-1435.00-00-0041, "Fire/Explosion Hazards for the Dry Cask Transfer Route," 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 for accessibility to the equipment of onsite and available offsite emergency facilities and services such as hospitals, fire and police departments, ambulance services, and other emergency agencies.

Finding: This ISFSI components had been designed to permit emergency personnel adequate access. The training for offsite support organizations had not been completed by the licensee at the time of the inspection. In order to ensure that adequate training was provided to state and local supporting offsite organizations the licensee documented the training need in their corrective action system as PIP C-07-03683. The licensee planned to track the training of each agency until completed.

Documents Reviewed: Catawba annual PowerPoint slides presented to offsite personnel; Catawba Fire Protection Pre-Plan, Revision 30; NAC-UMS FSAR, Section 11.2.6, Revision 6; PIP C-07-03683, Dated July 23, 2007

Category: Fuel Verification **Topic:** Classifying Intact Fuel

Reference: CoC 1015, Tech Spec B.2.1.1

Requirement: Intact fuel assemblies may be stored in the NAC-UMS system.

Finding: Requirement was not initially satisfied, but was corrected prior to fuel loading. During the initial inspection two separate issues were identified with how Duke classified fuel assemblies as intact. The first issue involved the ability to classify fuel assemblies as intact based on a visual examination of the exterior portion of the fuel assembly. The second issue identified during the inspection involved classifying fuel assemblies as intact which have top nozzle corrosion that require the use of a special handling tool. These issues are described in further detail below.

Regarding the ability to classify fuel assemblies as intact based on a visual examination of the fuel assembly, the inspectors questioned the ability of visual examinations of the exterior portion of the fuel assembly to quantify defects as no greater than pinhole leaks or hairline cracks. In accordance with CoC 1015 Technical Specification B.2.1.1 only intact fuel assemblies can be stored in the NAC-UMS System for plants other than Maine Yankee. Section A.1.1 of the NAC-UMS technical specification defines Intact Fuel as "A fuel assembly or fuel rod with no fuel rod cladding defects, or with known or suspected fuel rod cladding defects not greater than pinhole leaks or hairline cracks." The inspectors indicated that a four faced visual inspection of the exterior of the fuel assembly would not view significant portions of the surface of the interior fuel rods in an assembly. One estimate is that a four faced exterior visual inspection only views 18 percent of the fuel assembly cladding area and would not by itself ensure that a defect no greater than a pinhole leak or hairline crack existed in an interior fuel pin. The licensee indicated that four faced visual inspections were used at McGuire to qualify fuel assemblies as intact and that the NRC reviewed this procedure during a previous inspection.

The inspectors reviewed "McGuire Nuclear Station - Independent Spent Fuel Storage Installation (ISFSI) Dry Run NRC Inspection Report 07200038/2004003," dated January 21, 2005 (ADAMS Accession Number ML050250227). The inspection report notes that "Fuel Engineering personnel indicated that any fuel assembly discharged from a core known to have leaking assemblies, and not inspected previously to determine if it was the leaking assembly, are required to have full-faced video inspections per procedure PT/0/A/4550/035, Fuel Assembly Examination and Debris Removal." The inspection also noted that "based on review of licensee procedures related to fuel selection for storage as well as discussions with licensee personnel, no negative issues were identified." The Catawba inspection team noted that, although no negative issues were identified in a previous McGuire inspection report with using visual inspections as a means to qualify fuel assemblies as intact, this was not an acceptable practice going forward. Based on this discussion, Catawba revised its fuel selection procedure XSFM-009 to provide additional guidance in determining that a fuel assembly met the definition for intact fuel. Regarding McGuire, the staff will pursue any additional regulatory actions that maybe needed separate from this inspection report. The staff believes that the storage of potentially damaged fuel in the NAC-UMS storage system at McGuire does not present a safety issue for fuel storage under 10 CFR Part 72. However, the staff is still assessing whether the potentially damaged fuel assemblies which only received a visual examination prior to loading into the NAC-UMS system at McGuire are in compliance with the NAC-UMS CoC. In addition, the staff has not yet determined if there is a safety issue associated with transporting potentially damaged fuel assemblies that are not enclosed in a damaged fuel container and whether McGuire would be in compliance with the 10 CFR Part 71 transportation CoC (71-9270) if it were to use this CoC for offsite transportation.

For Catawba, procedure XSFM-009, Section 3.3.2 defined "Intact Fuel" as "A fuel assembly or fuel rod with no fuel rod cladding defects, or with known or suspected fuel rod cladding defects not greater than pinhole leaks or hairline cracks." In the revised Procedure XSFM-009, Enclosure 5.3 provided additional criteria to meet the intact fuel requirement. Methods specified in Enclosure 5.3 included: 1) chemistry records for the operating cycle associated with when the fuel was discharged indicate that there were no fuel leakers for that cycle, 2) UT inspection records or sipping data records of the fuel assembly indicate no damage or the damage is not greater than pinhole leaks or hairline cracks, or 3) additional justification if core chemistry or operational inspections were unable to classify the assembly as intact. The inspectors noted that whatever additional justification was proposed by the licensee, the condition of the fuel assemblies must still demonstrate that there were no fuel rod cladding defects, or that any known or suspected fuel rod cladding defects were not greater than pinhole leaks or hairline cracks.

A potential problem with stress corrosion cracking has been identified with the fuel assemblies from the original cores for Unit 1 and Unit 2, which contain stainless steel in the top nozzle area. This was a known problem with this vintage of Westinghouse fuel that had been manufactured with a SS-304 guide sleeve. The guide sleeve was attached to the top nozzle by a braising process that sensitized the 304 stainless steel. This sensitization made the 304 material susceptible to stress corrosion cracking. Several events have occurred with the design where the stress corrosion cracking lead to failure of the guide sleeve and separation of the top nozzle from the fuel assembly.

Enclosure 5.3 of XSFM-009 discussed how the fuel assemblies susceptible to this top nozzle corrosion failure mechanism could meet the definition of intact fuel. The staff agreed with the licensee that the suspect fuel assemblies may meet the definition of intact fuel for the purposes of storage under 10 CFR Part 72 if no evidence of cracking is observed and the assemblies can be placed into the canister. However, the staff has stated to the licensee that the fuel that is known to be susceptible to stress corrosion cracking has not been analyzed for transport under 10 CFR Part 71, and may not be able to be qualified for transportation unless it is placed in a damaged fuel container. Similar to the visual inspection issue discussed above, the staff is aware that McGuire had selected fuel assemblies for loading into the NAC-UMS canisters which were susceptible to stress corrosion cracking. The staff will pursue any additional regulatory actions that maybe needed for McGuire separate from this inspection report.

The fuel selected for loading into the first two canisters at Catawba were reviewed to ensure that they met the NAC-UMS Technical Specification definition of Intact Fuel and that the fuel assemblies susceptible to stress corrosion cracking were not selected. The inspectors did not discover any discrepancies with fuel assemblies selected for the initial two canister loadings planned by the licensee.

Documents Reviewed: Procedure XSFM-009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," Revision 0;

Category: <u>Fuel Verification</u> **Topic:** <u>Fuel Specifications</u>

Reference: CoC 1015, Tech Spec B.2.1.1

Requirement: Intact fuel assemblies meeting the limits specified in Tables B.2-1 through B.2-5 may be stored in the NAC-UMS canister.

Finding: This requirement was achieved prior to loading fuel. Procedure XSFM-009 provided the instructions for selecting fuel assemblies that would meet the specified NAC-UMS Technical Specification requirements. Each requirement associated with the Technical Specification tables was discussed in detail in the procedure and a description was provided for how the requirement was achieved. Selected sources of data used to ensure compliance were reviewed. Specifically, a sample of parameters contained in CNC-1553.12-00-0017, and SDQA-30625-NGO were reviewed to ensure that they were transferred properly to the datasheets contained in CNEI 0400-**** that were used to verify compliance with the technical specification. Procedure XSFM-009 also addressed fuel requirements contained in the NAC-UMS FSAR. No discrepancies were identified.

The inspectors reviewed selected fuel assemblies from Calculation CNEI 0400-143 and CNEI 0400-144 that had been identified for loading into the first and second canisters from Unit 1, respectively. The review compared fuel criteria documented in the calculations to the Technical Specification requirements, including burnup, initial enrichment and decay heat. No discrepancies were discovered for the selected fuel assemblies reviewed.

An inspector witnessed the majority of the fuel assembly transfers from the spent fuel pool to the NAC-UMS canister and the subsequent verifications of fuel assembly location. The fuel assembly transfer was accomplished using Procedure PT/0/A/4150/037. Enclosure 13.1 of Procedure PT/0/A/4150/037 documented the specific fuel assembly transfers and included a signoff for the individual making the fuel assembly transfer as well as that of an independent verifier. The inspectors reviewed the documentation included in Enclosure 13.1 and observed that the fuel assembly locations matched the specified locations from Calculation CNEI 0400-143. The licensee also documented the storage locations of the fuel assemblies in Enclosure 4.5 of Procedure OP/0/A/6550/019. Enclosure 4.5 also included a signature of the performer, a checker and a verifier for the fuel assembly storage locations in the first canister.

Documents Reviewed: Procedure XSFM-009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," Revision 0; Calculation CNEI 0400-****, "Catawba Nuclear Station CNZ-045 2-1(1)," DRAFT; Calculation CNC-1553.12-00-0017, "Assembly Specifications for Fuel Qualification for Dry Storage Canisters at Catawba Nuclear Station," Dated June 19, 2007; Procedure SDQA-30625-NGO, "Catawba Dry Storage: Irradiated Fuel Assembly Database," DRAFT; Calculation CNEI 0400-144, "Catawba Nuclear Station CNZ-028 1-2(2)," Dated July 2, 2007; Calculation CNEI 0400-143, "Catawba Nuclear Station CNZ-028 1-1(1)," Dated June 28, 2007; Enclosure 13.1, "Internal Transfer Sheet," Dated July 18, 2007 of Procedure OP/0/A/6550/011, "Internal Transfer of Fuel Assemblies and Components," Revision 28; Enclosure 4.5, "NAC-UMS TSC Storage Array Orientation Schematic," Dated July 24, 2007 of Procedure OP/0/A/6550/019, "NAC-UMS Fuel Assembly Loading/Unloading Procedure," Revision 000

Category: Fuel Verification **Topic:** Material Balance, Inventory, and 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 achieved. Procedure PT/0/A/4150/037 had been revised to reflect that SNM will be moving to the ISFSI pad. Enclosure 13.5, "MANTIS File Generation" had been revised to indicated how to delineate the NAC-UMS cask number that the fuel assemblies were being transferred into.

Documents Reviewed: Procedure PT/0/A/4150/037, "Fuel/Component Movement Accounting," Revision 010

Category: Fuel Verification **Topic:** Maximum Initial Enrichment

Reference: FSAR 1015, Section 1.3.1.4

Requirement: The maximum initial enrichment for PWR fuel shall not exceed 5.0% U-235.

Finding: This requirement was met. Step 3.3.3.3 of Procedure XSFM-009, documented compliance with the Technical Specification regarding maximum enrichment. The verification portion of this step noted that no variably enriched uranium oxides have been used to date. Single enrichment assemblies and axial blanket assemblies have been used. For the single enrichment assemblies Catawba considers the assembly average enrichment to represent the maximum enrichment. This is the value that is used to ensure compliance with the technical specification for single enrichment assemblies.

For axial blanket assemblies, Catawba considered the maximum enrichment to be the value for the higher enriched central region of the fuel rod. This value was determined from the nominal design enrichment for the central region of the fuel assembly that is documented in the Final Fuel Cycle Design, Final Design Data book or another reference considered appropriate by Duke.

The maximum enrichment value of 5% U-235 in the UFSAR assumes boron credit in the spent fuel pool water. Catawba does not take credit for boron in the spent fuel pool, therefore the limit for maximum enrichment is based on the values contained in Tech Spec table B2-2, which are 4.5% for the Westinghouse robust fuel assembly and MkBW fuel assembly and 4.3% for the Westinghouse optimized fuel assembly.

A review of the data sheet for the 24 fuel assemblies to be stored in the first canister loaded from Unit 1 at Catawba, indicated that the highest enrichment is 3.556% U-235 for fuel assembly number H31.

Documents Reviewed: Procedure XSFM-009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," DRAFT; Inspection of Engineering Instruction CNEI 0400-****, "Catawba Nuclear Station CNZ-045 2-1(1)", DRAFT; Calculation CNC-1553.12-00-0017, "Assembly Specifications for Fuel Qualification for Dry Storage Canisters at Catawba Nuclear Station," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Dry Run Procedure," Revision 2; Inspection of Engineering Instruction CNEI 0400-144, "Catawba Nuclear Station CNZ-028," Revision 0

Category: Fuel Verification **Topic:** Non-Fuel Hardware

Reference: FSAR 1015, Section 1.3.1.11

Requirement: Flow mixers (thimble plugs), in-core instrument thimbles, burnable poison rods or solid stainless steel rods may be placed in PWR guide tubes as long as the maximum fuel assembly weights listed in Table 2.1.1-1 are not exceeded and no credit for soluble boron is taken.

Finding: This requirement was met. Catawba analyzed loading non-fuel hardware in the PWR guide tubes. Specifically, Calculation CNC-1553.12-00-0017, step 9.1 provided a discussion of the control components and provided an analysis for burnable and thermal plug control components. The analysis in section 9.1 documented the various parameters for the control components used at Catawba Units 1 and 2. This information was combined with the fuel assembly design parameters to ensure that the overall physical characteristics for the fuel assembly parameters that were contained in the NAC UMS FSAR are met.

Regarding soluble boron credit, Steps 3.2.1 and 3.6.3.1 of Procedure XSFM-009 prohibited taking credit for soluble boron. Step 3.3.3.3 of Procedure XSFM-009 verified the maximum enrichment was met assuming no credit for soluble boron.

Documents Reviewed: Procedure XSFM-009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," DRAFT; Engineering Instructions CNEI 0400-****, "Catawba Nuclear Station CNZ-045 2-1(1)," DRAFT; Calculation CNC-1553.12-00-0017, "Assembly Specifications for Fuel Qualification for Dry Storage Canisters at Catawba Nuclear Station," DRAFT

Category: <u>Fuel Verification</u> **Topic:** <u>Total Decay Heat Limit of 23 kW</u>

Reference: FSAR 1015, Section 1.3.1.2

Requirement: The total decay heat of the stored PWR fuel shall not exceed 23 kW

Finding: The acceptance criteria was met. Step 3.3.3.5 of Procedure XSFM-009, verified that the decay heat of each assembly was less than or equal to 958.3 watts. Therefore, the decay heat for a canister with 24 assemblies would be less than 23kW. In addition, step 3.6.7.1 of Procedure XSFM-009 established the Catawba administrative limit for decay heat of less than or equal to 20 kW for each cask.

A review of the data sheet for the first canister contained in CNEI 0400-144, indicated that the hottest fuel bundle planned to be loaded in the first canister was 0.724 kW. The total decay heat load for the first cask was calculated to be 12.936 kW.

Documents Reviewed: Procedure XSFM-009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," DRAFT; Procedure CNEI 0400***, "Catawba Nuclear Station CNZ-045 2-1(1)," DRAFT; Inspection of Engineering Instruction CNEI 0400-144, "Catawba Nuclear Station CNZ-028," Revision 0

Category: <u>General License</u> **Topic:** <u>Changes, Tests, and Experiments</u>

Reference: 10 CFR 72.48(c)(1)

Requirement: A licensee can make changes to their facility or storage cask design if certain criteria are met as listed in 10 CFR 72.48.

Finding: Requirement was not initially satisfied but was corrected prior to fuel loading. To implement the requirements of 10 CFR 72.48, Duke Power had established a Nuclear System Directive (NSD) 211. The process described in NSD 211 was compared to NEI 96-07, Appendix B, "Guidelines for 10 CFR 72.48 Evaluations," which has been previously endorsed by the agency. NSD 211 included the instructions to adequately perform a screening or evaluation in accordance with the requirements of 10 CFR 72.48. The inspectors noted that NSD 211 only required that individuals performing 10 CFR 72.48 screenings and evaluations be trained in the 10 CFR 50.59 process. The training requirements specified in NSD 211 neglected to include specific requirements contained in 10 CFR Part 72 and provided no overview of the NAC-UMS CoC, Technical Specifications nor FSAR. The training deficiency is discussed in additional detail in the QA Category.

Several of the 10 CFR 72.48 Screens performed by station personnel were reviewed after training was provided to the responsible station personnel. The 10 CFR 72.48 Screens were adequate. No 10 CFR 72.48 Evaluations were reported to have been performed.

Documents Reviewed: Nuclear System Directive (NSD) 211, "10 CFR 72.48 Process," Revision 5; 10 CFR 72.48 Screen, "Operation of Dry Cask Transporter MP/0/A/7650/182, Rev 5," Dated May 14, 2007; 10 CFR 72.48 Screen, "Spent Fuel Dry Storage Cask Troubleshooting Procedure, MP/0/A/7650/184, Rev 001," Dated May 14, 2007; 10 CFR 72.48 Screen, "Fuel/Component Movement Accounting, PT/0/A/4150/037, Rev 010," Dated April 23, 2007; 10 CFR 72.48 Screen, "Inventory of Fuel Special Nuclear Material PT/0/A/4550/015, Rev 06," Dated May 30, 2007; 10 CFR 72.48 Screen, "NAC-UMS Fuel Assembly Loading/Unloading Procedure OP/0/A/6550/019, Rev 000," Dated April 12, 2007;

Category: General License **Topic:** Evaluation of Effluents/Direct Radiation

Reference: 10 CFR 72.212(b)(2)(i)(C) & 10 CFR 72.104

Requirement: The general licensee shall perform a written evaluation prior to use 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 who is located beyond the controlled area must not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other critical organ during normal operations and anticipated occurrences,

Finding: This requirement was achieved. The licensee analyzed the annual dose equivalent to any real individual located at the controlled area boundary in Section 7.3 of the CNS 10 CFR 72.212 Evaluation. The evaluation reviewed the loading plans by year and the number of casks that were planned to be placed on the ISFSI in three phases. At the end of the third loading phase, the licensee planned to have as many as 264 casks located on 11 ISFSI pads. The radiological dose rates attributed to the casks located on the ISFSI pads at the end of the third loading phase were calculated to be below 1 mrem per year at the 2500 feet exclusion area boundary.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007

Category: General License **Topic:** Flood Conditions

Reference: CoC 1015, Tech Spec B.3.4.1.4

Requirement: An analyzed flood condition of 15 feet/sec water velocity and a height of 50 feet of water (full submergence of the loaded cask) will not be exceeded.

Finding: This requirement has been achieved. The licensee documented in the 72.212 report that the site is not subject to flood conditions. The top of the ISFSI pad is at elevation 602.0 and the maximum flood level is at an elevation of 593.7 feet. Therefore the flood conditions specified in the Technical Specification will not be exceeded.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Initial Compliance Evaluation Against CoC

Reference: 10 CFR 72.212(b)(2)(i)(A)

Requirement: A general licensee shall perform written evaluations, prior to use, that establish that the conditions set forth in the Certificate of Compliance have been met.

Finding: This requirement was achieved. The licensee evaluated in Section 7.0 of the CNS 10 CFR 72.212 Evaluation that the following conditions set forth in the Certificate of Compliance were met:

Cask Model and Cask Description
Operating Procedures
Acceptance Test and Maintenance Procedures
Quality Assurance
Heavy Load Requirements
Approved Contents
Design Features
Changes to the Certificate of Compliance
Authorization

The inspector found the licensee's evaluation documented in the 72.212 report to be adequate.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007

Category: General License **Topic:** Initial Compliance Evaluation Against FSAR

Reference: 10 CFR 72.212(b)(3)

Requirement: The general licensee shall review the FSAR referenced in the CoC and the related NRC Safety Evaluation Report, prior to use of the general license, to determine whether or not the reactor site parameters, including analysis of earthquake intensity and tornado missiles, are enveloped by the cask design basis considered in these reports. The results of this review must be documented in the evaluation made in 10 CFR 72.212(b)(2).

Finding: This requirement was achieved. The licensee evaluated the following reactor site parameters in Section 9.0 of the CNS 10CFR72.212 Evaluation:

Earthquake Intensity
Tornado and Tornado Missiles
Average Ambient Temperatures and Temperature Extremes
Snow and Ice Loadings
Flooding
Lightning
Fire and Explosion
Loss of Power

Based on a review of the NAC Safety Analysis Report the licensee determined that the reactor site parameters were bounded by the cask design basis values in the NAC design basis documents. Many of the site parameters listed above are discussed further in other datasheets that are part of this report.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007

Category: General License **Topic:** Initial Evaluation Against Part 50 License

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 evaluation made in 10 CFR 72.212(b)(2).

Finding: This requirement was achieved. The licensee documented in the 10 CFR 72.212 Report that the design and construction of the ISFSI haul road had been evaluated in CNS Design Change CD500920 and the bridge over the RN piping header had been evaluated in Design Change CD500624. The licensee had performed 10 CFR 50.59 screenings for implementation of procedures MP/0/A/7650/181, 182 and 183. The results of the safety screens were satisfactory.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007; 10 CFR 50.59 Screen, MP/0/A/7650/181, "Loading Spent Fuel Assemblies into NAC-UMS Casks," Dated May 10, 2007; 10 CFR 50.59 Screen, MP/0/A/7650/183, "Unloading Spent Fuel Assemblies from NAC-UMS Casks," Dated May 14, 2007; 10 CFR 50.59 Screen, MP/0/A/7650/182, "Operation of Dry Cask Transporter," Dated May 14, 2007

Category: General License **Topic:** Program Review - RP, EP, QA, and Training

Reference: 10 CFR 72.212(b)(6)

Requirement: The general licensee shall review the reactor emergency plan, quality assurance program, training program and radiation protection program to determine if their effectiveness is decreased and, if so, prepare the necessary changes and seek and obtain the necessary approvals.

Finding: This requirement was achieved. The inspector confirmed that Section 12 of the 10 CFR 72.212 Evaluation adequately addressed the requirement to review the reactor emergency plan, quality assurance program, training program and radiation protection program to determine if their effectiveness was decreased. The licensee concluded that the programs' effectiveness was not decreased as a result of incorporating ISFSI activities.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Revisions to 72.212 Analysis

Reference: 10 CFR 72.212(b)(2)(ii)

Requirement: The general licensee shall evaluate any changes to the written evaluations required by 10 CFR 72.212(b)(2) using the requirements of 10 CFR 72.48(c). A copy of this record shall be retained until spent fuel is no longer stored under the general license issued under 10 CFR 72.210.

Finding: This requirement was met. Section 8.0 of the CNS 10 CFR 72.212 Evaluation determined that changes to the 72.212 Evaluation would be made in accordance with the requirements of NSD 211 and retained until spent fuel was no longer stored under a general licensee in accordance with the requirements of NSD-701.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007; Nuclear System Directive 211, "10 CFR 72.48 Process," Revision 5; Nuclear System Directive 702, "Records Management," Revision 6

Category: General License **Topic:** Seismic Acceleration

Reference: CoC 1015, Tech Spec B.3.4.1.3

Requirement: The design basis earthquake horizontal and vertical seismic acceleration levels at the top of the surface of the ISFSI pad or at the center of gravity of the loaded concrete casks on the ISFSI pad must be less than 0.26g horizontal in each of the two orthogonal directions and 0.26g corresponding vertical g-level.

Finding: The intent of this requirement was achieved. Sections 7.1.7 and 9.1 of the 10 CFR 71.212 Evaluation provided the results of CNS's evaluation of the site seismic characteristics and their acceptability. CNS concluded that although the site design basis earthquake acceleration levels exceed the NAC-UMS seismic design values, they were able to show compliance with the NAC-UMS system through a methodology provided in NUREG/CR-6865 "Parametric Evaluation of Seismic Behavior of Freestanding Spent Fuel Dry Storage Cask Systems," dated February 2005. No concerns were identified with the use of this methodology by CNS and their conclusion of seismic acceptability to use the NAC-UMS system at CNS.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Temperature Average for Site

Reference: CoC 1015, Tech Spec B.3.4.1.1

Requirement: The temperature of 76 degrees F is the maximum average yearly temperature. The 3-day average ambient temperature shall be 106 degrees F or less.

Finding: This requirement was achieved. The Catawba 72.212 report documented that the site maximum average temperature is 71.2 degrees F and the record high temperature at Catawba is 104 degrees F. Both of these values are less than the maximums specified in the Technical Specification.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Temperature Extremes for the Site

Reference: CoC 1015, Tech Spec B.3.4.1.2

Requirement: The allowable temperature extremes, averaged over a 3-day period, shall be greater than minus 40 degrees F and less than 133 degrees F.

Finding: This requirement was achieved. Based on information contained in the Catawba 72.212 report, the record low temperature at Catawba is -5 degrees F and the record high temperature is 104 degrees F. The site extremes are less than the averaged 3 day extreme temperatures as specified in the Technical Specification.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Tornado/Wind Design Parameters

Reference: FSAR 1015, Sections 2.2.1.1 & 2.2.1.3

Requirement: The tornado and wind design parameters applicable to the NAC UMS system are listed in Section 2.2.1.1 and 2.2.1.3 of the NAC UMS FSAR. The design parameters for the general licensed site must be within the NAC UMS evaluated tornado and wind design parameters.

Finding: This requirement has been met. The licensee 72.212 report compared the wind characteristics between the NAC-UMS FSAR conditions to the Catawba UFSAR. There are small differences that exist between the two, such as the Catawba rotational wind speed of 300 mph and translational wind speed of 60 mph versus the NAC-UMS rotational wind speed of 290 mph and translational wind speed of 70 mph.

There were several differences between the types of missiles evaluated in the NAC-UMS FSAR versus the Catawba UFSAR. The 72.212 report evaluated each of the missiles and determined that the Catawba missile and wind design parameters equivalent to or enveloped by the NAC-UMS FSAR design parameters.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: General License **Topic:** Vertical Concrete Cask Arrays

Reference: FSAR 1015, Sections 1.4 & 8.1.3

Requirement: Actual spacing and dimensions of the ISFSI pad are dependent on the site specific layout, access roads and site boundary conditions, but must provide a minimum of 15 feet center-to-center spacing between the concrete casks.

Finding: This requirement was implemented. The licensee had constructed two ISFSI pads (north and south) with a total capacity for 48 vertical concrete storage casks. Each ISFSI pad was configured for 24 storage casks in a 2 X 2 X 12 cask array. Placement markers for the storage casks were stenciled on the ISFSI pad. The cask center-to-center distances were measured and verified to be 15 feet, 2 inches.

Documents Reviewed: None

Category: Heavy Loads **Topic:** Canister Hoist Rings

Reference: FSAR 1015, Section 3.4.3.2

Requirement: The hoist rings used to lift the canister are American Drill Bushing Co. Model 23200 Safety Engineered Hoist Rings rated at 30,000 lbs (or comparable ring from an alternate manufacturer) with a safety factor of 5 on ultimate strength.

Finding: This requirement was achieved. The licensee specified the use of Jergens Number 23435 center pull hoist rings in Procedure MP/0/A/7650/181. The rated load for these hoist rings was 30,000 pounds with a rated strength factor of 5:1.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," Revision 000; Jergens Center-Pull Style Hoist Rings Datasheet

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Category: Heavy Loads **Topic:** Concrete Cask Transport

Reference: FSAR 1015, Section 8.1.3

Requirement: Section 8.1.3 provides the sequence of event to be taken during the transport and placement of the loaded concrete cask on the ISFSI pad depending, on which mode of transport is chosen by the general licensee. The methods include use of a heavy-haul transporter, air pads or a mobile lifting frame.

Finding: This requirement was implemented. Procedure MP/0/A/7650/182 provided the sequence to be taken during the transport and placement of the loaded concrete cask onto the ISFSI pad. The licensee was using a vertical cask transporter (crawler) and the procedural sequence was consistent with section 8.3 of the NAC-UMS FSAR.

Documents Reviewed: Procedure MP/0/A/7650/182, "Operation of Dry Cask Transporter", Revision 004

Category: Heavy Loads **Topic:** Heavy Loads Safety Evaluation

Reference: CoC 1015, Condition 4

Requirement: Each lift of a NAC-UMS TSC, transfer cask or VCC must be made in accordance with the existing heavy loads requirements and procedures of the licensed facility at which the lift is made. A plant specific safety review (50.59/72.48) is required to show operational compliance with existing plant specific heavy loads requirements.

Finding: This requirement was implemented. 10 CFR 50.59 and 10 CFR 72.48 safety screens were conducted for Procedures MP/0/A/7650/181 and MP/0/A/7650/182.

Procedure MP/0/A/7650/181 controlled heavy lifts inside the spent fuel building and included: a) movement of the empty canister from the storage cask to the transfer cask; b) movement of the transfer cask containing the empty canister into the spent fuel pool; c) movement of the transfer cask containing the loaded canister from the spent fuel pool to the decontamination area; and d) transferring the loaded canister from the transfer cask into the storage cask in the railroad bay.

Procedure MP/0/A/7650/182 controlled heavy lifts outside the spent fuel building and included: a) movement of the storage cask containing the empty canister from the ISFSI pad to the railroad bay of the spent fuel building; and b) movement of the storage cask containing the loaded canister from the railroad bay to the ISFSI pad. A storage cask lift height limit was imposed when crossing the nuclear service water piping buried under the haul path.

Documents Reviewed: 0 CFR 50.59 and 10 CFR 72.48 screens for Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies into NAC-UMS Cask", Revision 000; 10 CFR 50.59 and 10 CFR 72.48 screens for Procedure MP/0/A/7650/182, "Operation of Dry Cask Transporter", Revision 001

Category: Heavy Loads **Topic:** Lifting Yoke Load Test

Reference: FSAR 1015, Section 2.3.3.1

Requirement: The lifting yoke is designed to meet the requirements of ANSI N14.6 and NUREG 0612 and is designed as a special lifting device for critical loads. The lifting yokes are proof load tested to 300% of the design load when fabricated. Since there are no welds in the lifting path, the yokes are disassembled after the load test and the bolted connections are inspected for deformation. The lifting yoke is inspected for visible defects prior to each use and is inspected annually.

Finding: This requirement was implemented. The design capacity of the lifting yoke was 115 tons (230,000 pounds), as stated in NAC International Calculation 12418-2001. Therefore, the 300% proof load test was 690,000 pounds.

The lifting yoke was tested to 704,565 pounds on September 24, 2002 in accordance with Paragraph 4.1 of Procedure 01-020-LT. A test bridge was installed on top of the transfer cask, spanning the diameter. Hydraulic rams were then placed on top of the bridge. The lifting yoke was suspended above the hydraulic rams while the lifting yoke arms were engaged with the primary trunnions. The hydraulic rams were then extended to transfer the weight of the lifting yoke from the crane to the rams. Hydraulic pressure, equivalent to a load of 704,565 pounds, was then applied to the rams. The upward force against the lifting yoke and arms was opposed by the hold down force of the primary trunnions. The proof load was maintained for 11 minutes and, while still under load, the lifting yoke was visually inspected. No damage or cracking was identified.

Following load testing, the lift yoke was disassembled and the load bearing components and bolted connections were visually inspected for deformation. Liquid Penetrant (PT) testing was performed on the lift yoke pins and no relevant indications were identified.

The lifting yoke was also used to set the shield lid weighting 7,000 pounds, on the canister loaded with fuel while underwater. To provide the correct rigging for this operation, a shank hook was secured to the bottom of the lifting yoke. The weight of the shield lid was below the 10,000 pound lower limit specified by ANSI N 14.6, however the intent of the requirement for a "non-critical lift" was achieved by performing a load test of 150% of the weight of the shield lid and by satisfying the minimum material yield and ultimate strength requirements as specified in ANSI N 14.6. WO 01759808 documented that a load test of the shank hook was performed on July 9, 2007 using a test weight of 12,000 pounds followed by a satisfactory NDE examination of the hook. Thus the load test had been conducted at 170% of the weight of the shield lid.

Documents Reviewed: Hi Tech Manufacturing Procedure 01-020-LT, "Load Test Procedure," Revision 1; Hi Tech Manufacturing Proof/Load Test Certification, Dated September 30, 2002; NAC International Calculation 12418-2001, "McGuire Lift Yoke Structural Evaluation," Revision 1; WO 0175980801, "OFC-Perform Load Test on ISFSI Shank Hook Attached to Yoke," Dated July 19, 2007;

Category: Heavy Loads **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 achieved. Enclosure 13.26 of Procedure MP/0/7650/181 showed the approved load paths for movement of the transfer cask into the cask pit loading area and to the decontamination area. The load was prohibited from being moved above the refueling floor elevation. Crane stops prevented the crane from movement of the load over the fuel in the spent fuel pool. Concrete walls separated the cask loading pit from the spent fuel pool and the decontamination pit. After decontamination of the transfer cask was completed, the transfer cask was lifted from the decontamination pit to the stack-up position on top of the vertical concrete cask.

Documents Reviewed: Procedure MP/0/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT

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Category: <u>Heavy Loads</u> **Topic:** <u>Spent Fuel Cask Drop</u>

Reference: NUREG 0612, Appendix A, Section 3

Requirement: When a cask drop analysis is performed for non-single-failure-proof cranes, the analysis should consider the conditions specified in Appendix A, Section 3 to assure that the evaluation criteria of Section 5.1 are satisfied.

Finding: This requirement was satisfied. Licensee Calculation 1139.09-01 evaluated two different cask sizes in the cask drop accident. The bounding size and weight of cask analyzed was a cask 10 feet in diameter by 25 feet long that weighted 125 tons. The calculation determined that there was insufficient cask momentum to allow the transfer cask to fall into the spent fuel pool during cask movement activities. Calculation CNC-1139.09-01-0001 evaluated the potential for the NAC UMS spent fuel transfer cask to fall into the spent fuel pool and evaluated the potential for the transfer cask to be dropped and damage the spent fuel pool liner causing a loss of spent fuel water inventory. This calculation used a maximum drop weight of 207,000 pounds for the type of NAC-UMS canister that will be used at Catawba. The calculation concluded that a dropped cask into the spent fuel pool loading pit could damage the liner and concrete, but would not affect the water level in the spent fuel pool and that the cask pit could be isolated from the spent fuel pool with the weir gate.

The remaining sections of the transfer cask travel path are over concrete and would not impact any safety related equipment or systems in the event of a cask drop.

Documents Reviewed: Calculation File No. CNC-1139.09-01, "Catawba Nuclear Dropped Cask Accident," Dated August 14, 1975; Calculation File No. CNC-1139.09-01-0001, "Design of Spent Fuel Building- Dropped Cask Study," Revision 37

Category: <u>Heavy Loads</u> **Topic:** <u>Temperature Minimum Limits for Storage Cask</u>

Reference: CoC 1015, Tech Spec B.3.4.1.8

Requirement: The storage cask shall only be lifted by the lifting lugs with surrounding air temperatures greater than or equal to 0 degrees F.

Finding: This requirement was implemented. Step 6.9 of Procedure MP/0/A/7650/182 contained the temperature restrictions specified above for both the loading and unloading operations.

Documents Reviewed: Procedure MP/0/A/7650/182, "Operation of Dry Cask Transporter", Revision 004

Category: <u>Heavy Loads</u> **Topic:** <u>Temperature Minimum Limits for Transfer Cask</u>

Reference: CoC 1015, Tech Spec B.3.4.1.7

Requirement: Transfer cask operations shall only be conducted with surrounding air temperatures greater than or equal to 0 degrees F.

Finding: This requirement was implemented. Steps 11.6.11 and 11.6.12 of Procedure MP/0/A/7650/182 contained the temperature restrictions from CoC 1015, Tech Spec B.3.4.1.7 for both the loading and unloading operations.

Documents Reviewed: Procedure MP/0/A/7650/182, "Operation of Dry Cask Transporter", Revision 004

Category: Heavy Loads **Topic:** Transfer Cask Annual Inspection

Reference: FSAR 1015, Section 9.2.2

Requirement: Annually the lifting trunnions, shield door and shield door rails shall be either dye penetrant or mag particle examined in accordance with ASME Section V. Acceptance criteria shall be in accordance with Section III, Subsection NF, Article NF-5350 or NF-5340. The annual examination may be delayed for periods of nonuse, provided the exam is performed prior to next use of the cask. Also, the coating applied to any carbon steel surfaces of the transfer cask shall be inspected annually and any chips, cracks or other defects in the coating repaired.

Finding: This requirement was implemented. Annual inspection of the transfer cask was completed on March 12, 2007, under Work Order #01706131 and Procedure PT/0/A/4150/041. Paint was removed from all areas subjected to nondestructive testing and was re-applied upon completion of testing. The transfer cask was inspected under Procedure PT/0/A/4150/041, Section 12.4 and Enclosure 13.2. The nondestructive examinations included: a) PT testing of the trunnion surfaces; b) MT testing of the trunnion to outer shell welds; c) MT testing of the trunnion to inner shell welds; and d) MT testing of the door rail to base plate liner welds. No relevant indications were identified. The visual inspection included all load bearing welds and critical areas of the transfer cask. No defects, deformation, cracks, signs of wear, or damage were identified. All surfaces of the transfer cask were inspected for damage to the coatings and touch up paint was applied as needed.

Documents Reviewed: Work Order #01706131 released for work on January 30, 2007; Procedure PT/0/A/4150/041, "Annual Inspection Of ISFSI Lifting Devices," Revision 2

Category: Heavy Loads **Topic:** Transfer Cask Bottom Shield Doors

Reference: FSAR 1015, Section 2.3.3.1

Requirement: The transfer cask bottom shield doors support the canister from the bottom during handling of the canister. The shield doors are load tested to 300% of the maximum calculated service load, which includes the weight of the loaded canister and water in the canister. Following the load test, the load bearing surface areas of the doors, rails and attachment welds are examined for evidence of cracking or deformation.

Finding: This requirement was implemented. The bounding weight of a fully loaded canister full of water including the shield lid was 84,600 pounds as listed in Table 3.2-1 of the NAC-UMS FSAR. Therefore, the 300% proof load was 253,800 pounds.

The bottom shield doors were load tested to 300,860 pounds on September 24, 2002 in accordance with Paragraph 4.3 of Procedure 01-020-LT. A load test pedestal was installed inside the transfer cask. Hydraulic rams were then placed on top of the pedestal under the lifting yoke.

The lifting yoke was suspended above the hydraulic rams while the lifting yoke arms were engaged with the secondary trunnions. The hydraulic rams were then extended to transfer the weight of the lifting yoke from the crane to the rams. The transfer cask was lifted off the floor approximately 1 foot to ensure the shield doors were not supported from below.

Hydraulic pressure, equivalent to a load of 300,860 pounds, was then applied to the rams. The upward force against the lifting yoke main beam was transmitted downward against the shield doors. The proof load was maintained for 11 minutes and, while still under load, the primary trunnions were visually inspected. No damage or cracking was identified.

Following the load testing, the doors were cycled to check for proper operation and the rails and doors were visually inspected for evidence of cracking, galling, and permanent deformation. Magnetic Particle (MT) testing was performed on the door rails to bottom ring welds. No relevant indications were identified.

Documents Reviewed: Hi Tech Manufacturing Procedure 01-020-LT, "Load Test Procedure," Revision 1; Hi Tech Manufacturing Proof/Load Test Certification, dated September 30, 2002; NAC-UMS FSAR 1015, Revision 3

Category: Heavy Loads **Topic:** Transfer Cask Trunnion Inspection Prior To Use

Reference: FSAR 1015, Section 9.2.2

Requirement: The transfer cask trunnions and shield door assemblies shall be visually inspected for gross damage and proper function prior to each use.

Finding: This requirement was implemented. Section 4.8 of Procedure TT/0/A/9100/099 contained a detailed checklist for inspecting the transfer cask prior to each use. The checklist included the transfer cask trunnions and shield door assemblies for gross damage and proper function.

Documents Reviewed: Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002

Category: Heavy Loads **Topic:** Transfer Cask Trunnion Tests

Reference: FSAR 1015, Section 2.3.3.1

Requirement: The transfer cask lifting trunnions are designed to meet the requirements of ANSI N14.6 and NUREG 0612. Each pair of trunnions are designed as a special lifting device for critical loads. The lifting trunnions are proof load tested to 300% of the design load when fabricated. The service load includes the transfer cask as well as the canister loaded with fuel and water. Following the load test, the trunnion welds and other welds in the load path are inspected for indications of cracking or deformation.

Finding: This requirement was implemented. The bounding weight of the transfer cask containing a fully loaded canister with a full water volume and with the shield lid installed was 205,500 pounds, as specified in Table 3.2-1 of the NAC-UMS FSAR. Therefore, the 300% proof load was 615,000 pounds.

The transfer cask primary trunnions were tested to 704,565 pounds on September 24, 2002 in accordance with Paragraph 4.1 of Procedure 01-020-LT. A test bridge was installed on top of the transfer cask, spanning the diameter. Hydraulic rams were then placed on top of the bridge. The lifting yoke was suspended above the hydraulic rams while the lifting yoke arms were engaged with the primary trunnions. The hydraulic rams were then extended to transfer the weight of the lifting yoke from the crane to the rams. Hydraulic pressure, equivalent to a load of 704,565 pounds, was then applied to the rams. The upward force against the lifting yoke was transmitted to the primary trunnions through the lifting yoke arms. The proof load was maintained for 11 minutes and, while still under load, the primary trunnions were visually inspected. No damage or cracking was identified.

The transfer cask secondary trunnions were also tested to 704,565 pounds on September 24, 2002 in accordance with Paragraph 4.2 of Procedure 01-020-LT. The test bridge was rotated 90 degrees and the lifting yoke arms were engaged to the secondary trunnions. The process used for testing the primary trunnions was repeated for the secondary trunnions.

Following load testing, the transfer cask load bearing welds and trunnions were visually inspected for evidence of cracking, galling, and permanent deformation. Magnetic Particle (MT) testing was performed on the: a) trunnion to outer shell weld; b) trunnion to inner shell weld; c) inner shell to bottom ring weld; d) outer shell to bottom ring weld; e) inner shell circumferential seam weld; f) inner shell longitudinal seam weld; g) outer shell circumferential seam weld; h) outer shell longitudinal seam weld; and i) lift yoke arm and palm and slot surfaces. No relevant indications were identified.

Documents Reviewed: Hi Tech Manufacturing Procedure 01-020-LT, "Load Test Procedure," Revision 1; Hi Tech Manufacturing Proof/Load Test Certification, Dated September 30, 2002; NAC-UMS FSAR 1015, Revision 3

Category: Heavy Loads **Topic:** Walls Supporting the Crane

Reference: N/A

Requirement: The crane supporting structure must be able to support the crane during design load conditions. The design loadings may also include seismic. Typically, the supporting structure will also include the cane support rails and the rail attachments.

Finding: This requirement was achieved. The inspectors reviewed selected structural components that would be necessary to support the crane during design load conditions. Both of the Catawba fuel handling cranes are non-single-failure-proof cranes manufactured by Whiting. The Catawba UFSAR and the NRC SER stated that the cranes were seismically designed, however the seismic loads are not considered acting simultaneously with the crane in a loaded condition. The inspectors selected the concrete corbels supporting the crane rails and the anchorage of the rails to review. The concrete corbels were analyzed in calculation CNC 1139.09-01-0001. The dead load analyzed in the calculation consisted of 125 tons live load, the crane weight of 22 tons and an impact loading of 25 percent. The heaviest load lifted during the dry fuel loading activities is the transfer cask and loaded canister with fuel and water with a calculated weight of 207,800 pounds (104-tons). The analysis of the rails, rail clips and anchors were reviewed by the licensee. The rail clips were installed using ASTM-A325 or A490 bolts using turn of the nut method. The licensee performed a visual inspection of the rail clips and bolts during the annual inspections.

Documents Reviewed: Calculation CNC 1139.09-01-0001, "Catawba Fuel Handling Crane Corbel

Modifications Unit 1," Revision 2; Catawba Updated Final Safety Analysis Report (FSAR) Chapter 9, Dated April 24, 2006; Drawing CN-1213-1; NUREG-0954, "Safety Evaluation Report related to the Operation of Catawba Nuclear Station Units 1 and 2," Supplement No. 2

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

Reference: CoC 1015, Tech Spec A.3.1.3

Requirement: The canister helium backfill pressure shall be 0 (+1,-0) psig

Finding: This requirement was achieved. Section 12.13 in Procedure TT/0/A/9100/099 and Section 11.13 in Procedure MP/0/A/7650/181 specified the steps to backfill the canister between 0 and 1.0 psig with helium. During the pre-operation demonstration the licensee performed the backfill between 0 and 1.0 psi with helium as measured on the two gauges. The gauges had been calibrated on June 6, 2006 and were all within an acceptable error range of .1% of the gauge reading.

The licensee had procured two Phoenix 200 VDS and each skid had two separate gauges capable of measuring between 0 and 2000 Torr. The Phoenix 200 VDS converted the pressure reading from Torr to pounds per square inch (psi) gauge. The backfill limits for the helium backfill were pre-set to 0.250 psig low and 0.750 psig high. During the helium backfilling operation on the initial canister the inspector observed the licensee perform the backfill operation to approximately 0.5 psig.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; MKS Calibration 012762588, 012762585, 012762586, 012762587

Category: Hydro/Drying/Helium **Topic:** Helium Leak Rate Test

Reference: CoC 1015, Tech Spec A.3.1.5

Requirement: There shall be no indication of a helium leak at a sensitivity of 1.0 X 10(-7) cubic cm/sec through the canister shield lid to canister shell confinement weld to demonstrate a helium leak rate equal to or less than 2.0 X 10(-7) cubic cm/sec.

Finding: This requirement was implemented. On June 7, 2007 the licensee demonstrated helium leak rate testing using a Varian Macro-Torr Helium Mass Spectrometer Leak Detector (HMSLD) and a test stand. The demonstration was conducted using a leak standard with a calibrated leak rate of 6.024 X 10(-8) ref-cc/sec. The minimum sensitivity of the Varian HMSLD was 1.0 X 10(-9) ref-cc/sec and the actual leak rate measured was 6.60 X 10(-8) ref-cc/sec. This test demonstrated the ability of the HSMLD to identify a helium leak rate equal to or less than the Technical Specification limit of 2.0 X 10(-7) ref-cc/sec.

During the initial canister loading at Catawba, the helium leak test was performed and the recorded reading was 0 while using the minimum equipment sensitivity on the 10-9 cc/sec scale. The sensitivity of the HMSLD was tested before the leak test and shown to detect helium down to 6.37 X 10-8 cc/sec.

Documents Reviewed: None

Category: Hydro/Drying/Helium **Topic:** Helium Purity - Controls for Use

Reference: FSAR 1015, Sections 7.1.1.2 & 8.1.1.32

Requirement: The minimum helium purity level of 99.9% specified in Section 8.1.1 of the Operating Procedures maintains the quantity of oxidizing contaminants to less than one mole per canister for all loading conditions.

Finding: This requirement was achieved. Procedure MP/0/A/7650/181, Step 11.13.1 required the operator to verify that all bottles in the rack used to backfill the canister are helium with a purity of at least 99.9% before starting the backfill operation. The other gas bottles containing argon or nitrogen had been disconnected from the VDS by the licensee during the demonstration prior to beginning the helium backfill operation. This precaution was also included in Step 11.13.5 and 11.13.6 in Procedure MP/0/A/7650/181. The licensee had purchased 60 bottles of helium with a purity level of 99.9995% pure helium for McGuire. A portion of the helium purchased for McGuire had been transferred to Catawba for use in the NAC-UMS canisters.

During the initial canister loading the inspector observed the licensee verifying that the helium used to perform the backfill exceeded the required helium purity level of 99.9%.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; Purchase Order MN 88818, Purchase Order MN 89319

Category: Hydro/Drying/Helium **Topic:** Pressure Test on Canister

Reference: FSAR 1015, Sections 3.4.4.1.7 & 8.1.1

Requirement: With approximately 70 gallons of water removed, the canister is pressure tested to 35 psia and held for 10 minutes. The hydrostatic pressure test is performed in accordance with the requirements of ASME Code Subsection NB-6220.

Finding: This requirement was achieved. During the pre-operational demonstration the licensee used the Phoenix 200 VDS to perform the pressure test. Approximately 70 gallons of water had been removed prior to beginning the welding operations. After the welding of the shield lid had been completed, the evacuated area was pressurized with nitrogen and held at a pressure of 20 psig (35 psia) for 10 minutes.

The inspector observed the licensee performing the pressure test during the initial canister loading. The licensee recorded the pressure as 35 psia (20.73 psig) for the initial canister hydro test.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

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Category: Hydro/Drying/Helium **Topic:** Returning Canister to Spent Fuel Pool

Reference: CoC 1015, Tech Spec A.3.1.1

Requirement: If the time limit for drying the canister cannot be achieved, the cask must be backfilled with helium and returned to the spent fuel pool per Technical Specification A.3.1.1, Action A.2.1.1 within 2 hours and cooled for at least 24 hours "OR" per Action A.2.2.1, supplied air can be connected to the canister annulus with a flow rate of 375 CFM and maximum temperature of 76 degrees F for 24 hours.

Finding: This requirement was implemented. Technical Specification 3.1.1.1 requires the canister to be dried and backfilled within a specified time dependent on the canister decay heat load. The vacuum drying and helium backfill time clock started when canister draindown was completed in Step 12.11.6 of Procedure TT/0/A/9100/099. If canister drying and helium backfill cannot be completed within the technical specification time allowed, the canister must undergo in-pool cooling.

The canister and transfer cask rested on the cask loading pit shelf during welding and draindown operations. In this location, the spent fuel pool water level was just below the transfer cask trunnions. In-pool cooling involved backfilling the canister with helium and moving the transfer cask from the shelf to the deep end of the cask loading pit.

The helium backfilling segment of the in-pool cooling operation was demonstrated in the ISFSI storage building using a canister mockup, the spare VDS system, and Attachment 13.12 of Procedure TT/0/A/9100/099.

Movement of the transfer cask from the shelf to the deep end of the cask loading pit for in-pool cooling would also be accomplished using Attachment 13.12 of Procedure TT/0/A/9100/099. However, since the transfer cask movement from the shelf to the deep end was the same for normal loading operations as it was for in-pool cooling operations, the licensee elected to demonstrate the transfer cask movement portion of in-pool cooling using Section 12.6 of Procedure TT/0/A/9100/099.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002

Category: Hydro/Drying/Helium **Topic:** Time Limit after Helium Backfill

Reference: CoC 1015, Tech Spec A.3.1.4

Requirement: The total cumulative time a loaded and helium filled canister may remain in the transfer cask is limited to 600 hours. For canisters loaded with PWR fuel with a heat load greater than 20 kW OR with BWR fuel with a heat load greater than 17 kW, there are intermediate time limits that apply while the canister is in the transfer cask without forced air or in-pool cooling.

Finding: This requirement was achieved. Enclosure 13.1 of Procedure MP/0/A/7650/181 noted that the maximum time for the canister in the transfer cask was limited to 600 hours and tracked the time that the helium backfill was completed until the canister was removed from the transfer cask. Step 11.13.19 recorded the date and time the helium backfill was completed and Step 11.21.83 recorded the date and time that the canister had been removed from the transfer cask.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT;

Category: Hydro/Drying/Helium **Topic:** Time Limit for Vacuum Drying

Reference: CoC 1015, Tech Spec A.3.1.1

Requirement: The technical specifications provide time limits for vacuum drying based on the kW loading of the cask. The vacuum drying time limit begins at the completion of draining the canister and ends when the canister has been backfilled with helium. Exceeding the time limit requires the licensee to initiate actions to cool the fuel within a certain time frame.

Finding: This requirement was achieved. The time limit to achieve the required vacuum was determined in Procedure OP/0/A/6550/019 using the value for the kW loading placed in the canister supplied in procedure XSFM-009. The time that the vacuum drying time limit started was then recorded in procedure MP/0/A/7650/181, Enclosure 13.1.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT; Procedure XSFM - 009, "Workplace Procedure for Selecting Spent Fuel Assemblies to be Stored in the NAC-UMS Storage System at the Catawba General License Independent Spent Fuel Storage Installation," DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; Procedure OP/0/A/6550/019 NAC-UMS Fuel Assembly Loading/Unloading Procedure

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Category: Hydro/Drying/Helium **Topic:** Vacuum Drying Below 65 Degrees F

Reference: FSAR 1015, Section 8.1.1.31

Requirement: If the spent fuel pool water temperature for canister vacuum dried in the pool, or the cask preparation area ambient temperature is below 65 degrees F, the vacuum drying of the canister shall be extended below the standard pressure value of less than or equal to 10 torr until a cavity pressure of less than or equal to 5 torr is achieved. The dryness verification shall be performed meeting the acceptance criteria specified in LCO 3.1.2, but limiting any pressure rise during the 10-minute hold period to less than or equal to 5 torr.

Finding: This requirement was achieved. The licensee had included a precautionary note in Procedure MP/0/A/7650/181 stating that a more stringent dryness test was required in accordance with Section 8.1.1 of the NAC-UMS FSAR if the spent fuel pool water temperature was less than 65 degrees F. The licensee planned to leave the transfer cask immersed in the spent fuel pool during the entire vacuum drying process. Therefore, the canister controlling temperature would be the spent fuel pool and the canister would not be influenced by the ambient temperature of the spent fuel pool area. Based on historical evidence, the licensee anticipated that the temperature of the spent fuel pool would always be higher than 65 degrees F.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," Revision 000

Category: Hydro/Drying/Helium **Topic:** Vacuum Drying Pressure

Reference: CoC 1015, Tech Spec A.3.1.2

Requirement: The canister vacuum drying pressure shall be less than or equal to 10 mm (torr) of mercury. Pressure shall be held for not less than 10 minutes with the vacuum pump isolated and turned off.

Finding: This requirement was achieved. The licensee has acquired two separate Phoenix 200 Vacuum Drying Skids (VDS) for use during the vacuum drying operations. Each VDS used two separate vacuum gauges to verify the pressure was less than the prescribed Tech Spec limit. The gauges used by the licensee had been initially calibrated by MKS using a standard traceable to a NIST standard. Each gauge had a range of 0 - 100 torr with a maximum error in percent of reading of -0.08 percent. The licensee set the minimum limit at 7.5 torr for the required time of 10 minutes to account for any error in the gauges. Section 11.12.4 of Procedure MP/0/A/7650/181 required that the vacuum reading be less than 7.5 torr for 10 minutes for acceptance.

During the preoperational demonstration the licensee performed the initial vacuum drying to remove the moisture and nitrogen that was in the canister. After achieving the required value of 7.5 torr for 10 minutes, the licensee swapped the temporary drain lines to the permanent drain lines and backfilled with helium and performed two additional vacuum drying operations. Based on inspector questioning, the licensees subsequently revised Procedure MP/0/7650/181 to take the official recorded measurement after the final vacuum drying operation.

During the initial loading operation, the inspector observed the licensee obtaining the final vacuum drying reading after the permanent drain line and vent line connections had been installed. The initial pressure at the start of the 10 minute hold was 1.79 torr and after 10 minutes the pressure had increased to 6.97 torr.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies Into NAC-UMS Casks," DRAFT and Revision 0; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; MKS Calibration 012762555, 012762556, 012762557, 012762558

Category: NDE Personnel Quals **Topic:** Certification Records

Reference: SNT-TC-1A, Section 9

Requirement: Certification records should contain the name of the certified individual, the certification level and method, the individual's educational background and NDE experience, a statement of satisfactory completion of training per the employer's written practice, visual examination results, evidence of successful completion of examinations including grades, date of certification, and the signature of the employer.

Finding: This requirement was implemented. Section 16.0 of Procedure NDEMAN-NDE-B contained the requirements for development and maintenance of NDE examiner certification records. The information required for inclusion in the certification records was consistent with the requirements of SNT-TC-1A. The Certificate of Method Qualification Records for the NDE examiners performing the demonstration were reviewed and found to be complete.

Documents Reviewed: Procedure NDEMAN-NDE-B, "Training, Qualification and Certification of Non Destructive Examination Personnel", Revision 028; Certificate of Method Qualification Records

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Category: <u>NDE Personnel Quals</u> **Topic:** <u>Recertification</u>

Reference: SNT-TC-1A, Section 9

Requirement: Maximum recertification intervals are 3 years for Levels I and II, and 5 years for Level III. Recertification may be granted without testing provided there is documented continuing satisfactory performance. "Continuing" must be defined in the written practice. Without documented continuing satisfactory performance, reexamination is required for those sections deemed necessary by the Level III examiner.

Finding: This requirement was implemented. Procedure NDEMAN-NDE-B was the Duke Energy written practice for administering the training, examination and certification of Non Destructive Testing personnel. The maximum recertification intervals contained in Section 17 of Procedure NDEMAN-NDE-B were consistent with SNT-TC-1A.

Sections 18, 19, and 20 of Procedure NDEMAN-NDE-B contained the circumstances under which NDE recertification may be granted without testing. In all circumstances, "continuing" satisfactory performance was defined as performing a minimum of 10 hours of work in the NDE process certified, at the level of certification, within the past year. Without documented continuing performance, the certification expired and reexamination was required.

Documents Reviewed: Procedure NDEMAN-NDE-B, "Training, Qualification and Certification of Non Destructive Examination Personnel", Revision 028

Category: <u>NDE Personnel Quals</u> **Topic:** <u>Visual Acuity</u>

Reference: SNT-TC-1A, Section 8.2

Requirement: The NDE examiner should have natural or corrected near-distance acuity in at least one eye capable of reading Jaeger Number 1 at a distance of not less than 12 inches on a standard Jaeger test chart, or capable of perceiving a minimum of 8 on an Ortho-Rater test pattern. This should be verified annually. The NDE examiner should demonstrate the capability of distinguishing and differentiating contrast among colors used in the applicable method. This should be verified every 3 years.

Finding: This requirement was implemented. Section 12.1 of Procedure NDEMAN-NDE-B contained the visual acuity requirements for NDE examiners. Section 21.0 identified an Eye Examination Record, NDE-B-3, with which to document the results of the eye examinations. The eye examination records for the NDE examiners performing the demonstration were reviewed. The records indicated certified near distance visual acuities of 20/30 or better in each eye on a Jaeger Number 1 test chart, and normal color contrast acuity. All of the eye examinations were current within the past year.

Documents Reviewed: Procedure NDEMAN-NDE-B, "Training, Qualification and Certification of Non Destructive Examination Personnel", Revision 028; Certificate of Method Qualification Records, NDE-B-3 Eye Examination Record

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Category: NDE Personnel Quals **Topic:** Written Practice

Reference: SNT-TC-1A, Section 5

Requirement: The employer shall establish a written practice for control and administration of NDT personnel training, examination and certification. The written practice should describe the responsibility of each level of certification for determining the acceptability of material or components. The written practice shall describe the training experience and examination requirements for each level of certification.

Finding: This requirement was implemented. Procedure NDEMAN-NDE-B was the Duke Energy written practice for administering the training, examination and certification of Non Destructive Testing personnel. The written practice defined the responsibilities of each level of certification, along with the training, experience, and examination requirements for each level.

Documents Reviewed: Procedure NDEMAN-NDE-B, "Training, Qualification and Certification of Non Destructive Examination Personnel", Revision 028

Category: NDE Procedures - PT **Topic:** Acceptance Criteria

Reference: ASME Section III, Article NB-5352

Requirement: Only indications with major dimensions greater than 1/16 inch should be considered relevant. The following relevant indications are unacceptable: (1) any cracks or linear indications. Linear indications have a length at least 3 times greater than the width; (2) rounded indications with dimensions greater than 3/16 inch (4.8 mm); (3) more than four rounded indications in a line, separated by 1/16 inch (1.6 mm) or less edge to edge; and (4) more than ten rounded indications in any 6 square inch area in the most unfavorable location relative to the indications being evaluated.

Finding: This requirement was implemented. Appendix A of Procedure NDEMAN-NDE-35 provided the acceptance standards for welds. The acceptance standards were consistent with the ASME Section III, Article NB-5352 requirements. During the demonstration, liquid penetrant testing of the shield lid-to-shell root pass identified one round indication and one undercut. Both indications were less than 1/16 inch and considered not relevant.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - PT **Topic:** Contaminants

Reference: ASME Section V, Article 6, T-641

Requirement: The user shall obtain certification of contaminant content for all liquid penetrant materials used on austenitic stainless steels. The certifications shall include the manufacturers batch number and sample results. Sub-article T-641(b) limits the total halogen (chlorine plus fluorine) content of each agent (penetrant, cleaner and developer) to 1.0 weight percent (wt.%) when used on austenitic stainless steels.

Finding: This requirement was implemented. Section 6.0 of Procedure NDEMAN-NDE-35 specified the liquid penetrant testing materials (cleaner, penetrant, and developer) to be used for both standard and high temperature testing. During the demonstration, the standard temperature chemicals were used. Section 6.0 of Procedure NDEMAN-NDE-35 specified Magnaflux Spotchek SKC-S cleaner; SKL-SP or SKL-SP1 penetrant; and

SKD-S2 developer for standard temperature PT.

The Magnaflux certification sheets for the SKL-SP1 penetrant and the SKD-S2 developer used during the demonstration stated the total halogen (chlorine plus fluorine) content was less than .0010 wt. % of residue, for both products. The SKC-S cleaner contained no halogens. The batch numbers on the products used in the field matched the certification sheets.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021
Magnaflux Spotchek certification sheets

Category: NDE Procedures - PT **Topic:** Final Interpretation

Reference: ASME Section V, Article 6, T-676.1

Requirement: Final interpretation shall be made after allowing the penetrant to bleed-out for 7-60 minutes under standard temperatures (50 and 125 degrees F). The 7-60 minute clock starts immediately after application of a dry developer. For wet developer, the clock starts when the coating is dry.

Finding: This requirement was implemented. Step 14.1.6 of Procedure NDEMAN-NDE-35 required a bleed-out time of 10 to 30 minutes at temperatures from 60 up to 125 degrees F, and a bleed-out time of 15 to 30 minutes at temperatures from 60 down to 50 degrees F. During the demonstration, the liquid penetrant examinations were performed at temperatures between 90 and 100 degrees F, as measured with a RayTek infrared temperature monitor. The temperature monitor was controlled under M&TE #CNQUA33094 and was within its calibration interval. A dry developer was used and all bleed-out times were maintained between 10 and 30 minutes.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - PT **Topic:** Light Intensity

Reference: ASME Section V, Article 6, T-676.3

Requirement: For color contrast penetrants, a minimum light intensity of 50 foot-candles (500 lux) is required to ensure adequate sensitivity during examination and evaluation of indications.

Finding: This requirement was implemented. Step 10.1 of Procedure NDEMAN-NDE-35 required a minimum of 100 foot-candles (1000 lux) when performing color contrast penetrant examinations. During the demonstration, a Lutron light meter was used and light intensity exceeded 1000 lux. The light meter was controlled under M&TE #CNQUA18476 and was within its calibration interval.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - PT **Topic:** Minimum Elements

Reference: ASME Section V, Article 6, T-621

Requirement: Each liquid penetrant (PT) procedure shall include the: (1) materials, shapes or sizes to be examined; (2) type of each penetrant, remover, emulsifier, and developer; (3) pre-examination cleaning and drying, including the cleaning materials used and minimum time allowed for drying; (4) applying the penetrant, the length of time the penetrant will remain on the surface (dwell time), and the temperature of the surface during examination; (5) removing excess penetrant and drying the surface before applying the developer; (6) length of developing time before interpretation; and (7) post-examination cleaning.

Finding: This requirement was implemented. The licensee performed liquid penetrant testing in accordance with Procedure NDEMAN-NDE-35. This procedure incorporated all of the elements required by ASME Section V, Article 6, T-621.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - PT **Topic:** Non Standard Temperature

Reference: ASME Section V, Article 6, T-653

Requirement: When performing liquid penetrant examinations outside the range of 50 to 125 degrees F, the examiner may use a standard temperature procedure or a non-standard temperature procedure. In either case, the examination procedure requires qualification at the proposed higher or lower temperature. This shall require the use of a quench cracked aluminum block, also designated as a liquid penetrant comparator block.

Finding: This requirement was implemented. Procedure NDEMAN-NDE-35 was qualified for both standard and high temperature liquid penetrant examinations. High temperature examinations were performed in accordance with Section 14.5 of Procedure NDEMAN-NDE-35. Section 14.5 specified the penetrant dwell times and bleed out times for 4 discreet temperatures ranges from 125 to 350 degrees F.

Section 6.0 of Procedure NDEMAN-NDE-35 specified the penetrant materials (cleaner, penetrant, and developer) to be used for both standard and high temperature liquid penetrant testing.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - PT **Topic:** Surface Preparation

Reference: ASME Section V, Article 6, T-642 (b)

Requirement: Prior to each liquid penetrant examination, the surface to be examined and all adjacent areas within one inch must be dry and clean.

Finding: This requirement was implemented. Step 12.5 of Procedure NDEMAN-NDE-35 required the surface to be examined, and adjacent areas within one inch, to be dry and free of dirt, grease, lint, water, scale, welding flux, weld splatter, oil, paint or any other extraneous matter that could interfere with the examination. During the demonstration, the surface preparation was performed in accordance with the procedure.

Documents Reviewed: Procedure NDEMAN-NDE-35, "Liquid Penetrant Examination", Revision 021

Category: NDE Procedures - VT **Topic:** Procedure Validation

Reference: ASME Section V, Article 9, T-941

Requirement: The visual testing (VT) procedure shall contain, or reference, a report of what method was used to demonstrate that the examination procedure was adequate. In general, a fine line 1/32 inch (0.8 mm) or less in width, an artificial imperfection or a simulated condition, located on the surface or a similar surface to that to be examined, may be considered as a method for procedure demonstration. The condition or artificial imperfection should be in the least discernible location on the area surface to be examined to validate the procedure.

Finding: This requirement was implemented. Section 3.0 of Procedure NDE-60 referenced ASME Section V, Article 9 for validation of both direct and remote visual examination methods. Section 6.0 of Procedure NDE-60 described the methods and equipment for performing visual examinations and the description was consistent with ASME Section V, Article 9, T-941. During the demonstration, visual inspections were performed in accordance with the procedure.

Documents Reviewed: Procedure NDE-60, "Visual Examination of Welds and Brazed Joints", Revision 010

Category: NDE Procedures-MSLT **Topic:** HMSLD Minimum Sensitivity

Reference: ANSI N14-5, Section 8.4

Requirement: The helium mass spectrometer leak detector (HMSLD) shall have a minimum sensitivity of 1/2 the acceptance leak rate. For example, a package with a leak tight acceptance criteria of 1.0 X 10(-7) ref-cc/sec requires a minimum HMSLD sensitivity of 5.0 X 10(-8) ref-cc/sec. This sensitivity requirement applies to both the hood and detector probe methods. The HMSLD shall be calibrated to a traceable standard.

Finding: This requirement was implemented. The maximum acceptable helium leak rate for the NAC-UMS canister was 2.0 X 10(-7) ref-cc/sec. Therefore, the minimum required sensitivity for the helium mass spectrometer leak detector (HMSLD) was 1.0 X 10(-7) ref-cc/sec. The licensee was using a Varian MacroTorr 960 helium mass spectrometer with a minimum sensitivity of 1.0 X 10(-9) ref-cc/sec.

However, it was discovered during the pre-operational demonstration that the four leak rate calibration standards supplied by Vacuum Instrument Corporation had leak rates ranging from 2.95 X 10(-7) to 8.36 X 10(-7) ref-cc/sec. These leak rates were too high to calibrate the HMSLD to the minimum required sensitivity of 1.0 X 10(-7) ref-cc/sec. The licensee generated PIP C-07-01774 to obtain new calibration standards with leak rates in the 10(-8) ref-cc/sec range.

Prior to the initial loading, the licensee demonstrated the calibration of the helium mass spectrometer using a helium standard in the appropriate range. During the initial loading campaign, the helium mass spectrometer was calibrated using a leak rate standard of 6.37 X 10(-8) ref-cc/sec.

Documents Reviewed: Instrument Certifications for Helium Flow Rate Calibration Standards

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Category: Pre-Operational Tests **Topic:** Pre-Operational Testing and Training Exercise

Reference: CoC 1015, Tech Spec A.5.2

Requirement: A dry run training exercise on loading, closure, handling, unloading, and transfer of a NAC-UMS Storage System shall be conducted by the licensee prior to the first use of the system to load spent fuel assemblies. Technical Specification A.5.2 provides a list of 14 demonstrations that must be performed.

Finding: This requirement was achieved. The requirements for pre-operational demonstrations specified in Technical Specification A 5.2 included the following:

A. Moving the Concrete Cask into its designated loading area.
B. Moving the Transfer Cask containing the empty Canister into the spent fuel pool.
C. Loading one or more dummy fuel assemblies in the Canister including independent verification.
D. Selection and verification of fuel assemblies requiring preferential loading.
E. Installing the shield lid.
F. Removal of the Transfer Cask from the spent fuel pool.
G. Closing and sealing of the Canister to demonstrate pressure testing, vacuum drying, helium backfilling, welding, weld inspection and documentation, and leak testing.
H. Transfer Cask movement through the designated lad path.
I. Transfer Cask installation on the Concrete Cask.
J. Transfer of the Canister to the Concrete Cask.
K. Concrete Cask shield plug and lid installation.
L. Transport of the Concrete Cask to the ISFSI.
M. Canister unloading, including reflooding and weld removal or cutting.
N. Canister removal from the Concrete Cask.

During the pre-operational demonstrations conducted between April 2, 2007 and July 23, 2007, the licensee demonstrated the ability to successfully perform each of the requirements specified above. Portions of the unloading operations, including the removal of the welds from the canister had been previously demonstrated by a specialty vendor and documented in a video. Many of the details associated with the individual requirements are found in other datasheets within this report. Since the licensee did not plan to perform preferential loading of the spent fuel in the NAC-UMS canister, the fuel selection criteria demonstrated conformed to the standard method allowed in the NAC-UMS Technical Specification.

Documents Reviewed: None

Category: <u>Procedures & Tech Specs</u> **Topic:** <u>Annual Cask Inspections</u>

Reference: FSAR 1015, Section 9.2.1

Requirement: An annual inspection of the concrete cask is required to include visual inspection of concrete surfaces for chipping, spalling or other surface defects. Defects larger than 1" in diameter and deeper than 1" shall be regrouted according to the manufacturer's recommendations. Corrosion-inhibiting (external) coatings shall be re-applied on accessible corroded surfaces, including concrete cask lifting lugs, if present.

Finding: This requirement was achieved. The licensee elected to use a work order to perform the annual inspection and maintenance. WO 01736118 had been prepared to perform an inspection of the outside of the concrete cask in accordance with the NAC-UMS FSAR Section 9.2.1. Specifically included in the work order were instructions to perform a visual inspection of concrete surfaces for chipping, spalling or other defects larger than 1 inch and regrout any deficiencies that were found. The licensee planned to use a work order on an annual basis to document the inspection of the concrete casks and any associated repairs.

Documents Reviewed: Catawba Work Order 01736118, "Maintenance Perform Annual Inspection of ISFSI (Cask)," Dated May 31, 2007

Category: Procedures & Tech Specs **Topic:** Canister Unloading - Hydrogen Monitoring

Reference: FSAR 1015, Section 8.3.19

Requirement: During the canister unloading process, Section 8.3.19 of the FSAR specifies that monitoring for hydrogen gas will be implemented prior to beginning lid removal operations through the completion of the lid removal cutting process. The hydrogen detector shall be mounted on the vent port line so as to detect hydrogen prior to cutting and continuously monitored during the cutting process. The system shall be capable of detecting 60% LEL of hydrogen, which equates to 2.4% hydrogen. If hydrogen is detected at or above 2.4%, stop cutting operations and evacuate gas before proceeding with cutting operations.

Finding: This requirement was implemented. Hydrogen monitoring during the unloading process was demonstrated in the ISFSI storage building using a canister mockup and a spare Vacuum Drying System (VDS). The hydrogen monitoring was performed in accordance with Section 12.31 and Enclosure 13.23 of Procedure TT/0/A/9100/099.

The hydrogen monitor used during the demonstration was a PureAire Monitoring System, Inc., Model STX-PA. The hydrogen concentration was displayed on a digital monitor located on the welding platform and when the hydrogen concentration reached 2.4% hydrogen, an alarm actuated on the VDS control panel.

Initially, the VDS took a suction from the canister vent port and admitted argon gas into the drain port. This provided gas flow through the VDS system and hydrogen monitor. As the canister shield lid weld was breached, air entered the canister through the breach and the VDS throttled down the argon flow to compensate.

The MP 183 procedure has not been finalized during the initial inspection. Section 11.8 of procedure 183, Removing TSC Shield Lid Weld, item 11.8.7, describes the method for monitoring hydrogen gas. Specifically, item 11.8.7.F.3, describes the requirement to evacuate the air space below the shield lid with the VDS for 30 minutes if the hydrogen detector alarms. Enclosure 13.7 of the procedure listed above, Hydrogen Detector Operation, describes how to set up, perform a response test, and use the hydrogen detector as well as the acceptable values.

Documents Reviewed: Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision DRAFT; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002

Category: Procedures & Tech Specs **Topic:** Canister Unloading - Lid Removal

Reference: FSAR 1015, Section 8.3

Requirement: During the unloading process the structural lid and shield lid must be removed from the canister, as well as the vent and drain port covers. The lids may be removed by abrasive grinding, hydrolaser or similar cutting equipment.

Finding: This requirement was achieved. The licensee had established a procedure for unloading the spent fuel assemblies and removing the lid from the NAC-UMS canister. The details of the process were included in Procedure MP/0/A/7650/183, which was a draft revision during the pre-operational demonstration.

The licensee had established a contract with the supplier of the lid removal equipment to ensure availability of the equipment in the event that it was necessary to remove a canister lid. As part of the contract, the equipment was in the process of being refurbished. The vendor had evaluated the lid removal equipment and stated that it was suitable for removal of canister lids from the NAC-UMS canister. A vendor Procedure 790-P-08 was provided that detailed the operations necessary to remove the canister lid. The licensee provided a digital recording of the demonstration of the use of the D L Ricci lid removal equipment performed for Maine Yankee in 2003. The inspectors reviewed the recording with the licensee, while going through a step by step review of the licensee's and contractor's procedures. Some areas for improvement were discussed with the licensee including improved FME control for the vent and drain port covers and an evaluation of the hydraulic fluid used in the rerounding tool in the event of a potential hydraulic leak upon the pool chemistry. The licensee was reviewing the inspector comments for inclusion into subsequent procedural controls.

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Documents Reviewed: Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies From NAC-UMS Casks," Revision DRAFT; Procedure RA/0/1100/018, "Radiation Protection Controls for Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision 000; NAC International Inc., Document No. 790-P-08, Rev. 0, dated 11/06/2002; Procedure 790-P-08, "Procedure for NAC-UMS Lid Cutting Operations," Revision 0

Category: Procedures & Tech Specs **Topic:** Cask Drop or Tipover

Reference: CoC 1015, Tech Spec A.5.4

Requirement: A response surveillance is required following off-normal, accident or natural phenomena events. The NAC UMS system shall be inspected within 4 hours after the occurrence of an off-normal, accident or natural phenomena event (this includes a cask drop or tipover). This inspection must specifically verify that all the concrete cask inlets and outlets are not blocked or obstructed.

Finding: This requirement was achieved. The licensee had incorporated the response surveillance requirement into Step 11.3 of Procedure PT/0/A/4600/031, to verify that the VCC air inlets and outlets are not blocked or obstructed within 4 hours of an accident or natural phenomena event. RP Procedures RP/0/A/5000/007 and RP/0/A/5000/009 also referenced the inspection requirements contained in Procedure PT/0/A/4600/031.

Documents Reviewed: Procedure PT/0/A/4600/031, "NAC-UMS Cask Surveillance," Revision DRAFT; Procedure RP/0/A/5000/007, "Natural Disaster," Rev 026; Procedure RP/0/A/5000/009, "Collision/Explosion," Revision 010

Category: <u>Procedures & Tech Specs</u> **Topic:** <u>Cask Heat Characteristics Test</u>

Reference: CoC 1015, Tech Spec A.5.3

Requirement: The heat transfer characteristics and performance of the NAC-UMS system will be recorded by air inlet and outlet temperature measurements of the first system placed in service with a heat load greater than 10 kW. A letter report summarizing the results of the measurements will be submitted to the NRC within 30 days of the cask being placed on the ISFSI pad. The report will include a comparison of the calculated temperatures of the heat load to the measured temperatures.

Finding: This requirement was achieved. The first NAC-UMS dry cask system with a heat load greater than 10 Kw was placed into service at the Palo Verde Nuclear Generating Station on May 15, 2003. Palo Verde sent a letter into NRC that the heat transfer characteristics and performance of the cask were in accordance with the NAC-UMS Tech Specs. Therefore the licensee is not required to submit this report to the NRC.

Documents Reviewed: ADAMS document ML032580084, email dated 09/11/2003, NAC Report on the Thermal Performance of NAC-UMS at Palo Verde; Letter dated 06/04/2003, from Arizona Public Service Company (APS), on Thermal Performance of NAC-UMS System to USNRC HQ

Category: <u>Procedures & Tech Specs</u> **Topic:** <u>Dissolved Boron Concentration</u>

Reference: CoC 1015, Tech Spec A.3.3.1

Requirement: During loading and unloading operations the dissolved boron concentration in the canister shall be greater than or equal to 1,000 parts per million. This shall be verified once within 4 hours prior to starting loading or unloading operations and every 48 hours thereafter while the canister is in the spent fuel pool or while water is being introduced into the canister.

Finding: This requirement was achieved. The licensee revised the note in Enclosure 4.2 of Procedure OP/0/A/6550/019 to require that the dissolved boron concentration of the water in the canister be greater than or equal to 1000 ppm when the enrichment limits exceeded the limits in Table B2-2 for the fuel assemblies taking no boron credit. Additionally, the concentration was required to be verified by two independent samples within 4 hours prior to commencing loading or unloading operations and every 48 hours thereafter while the canister is in the spent fuel pool or water is inside the canister.

Documents Reviewed: Procedure TT/0/A/9100/099, " NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002; Procedure OP/0/A/6550/019, "NAC-UMS Fuel Assembly Loading/Unloading Procedure," Revision 000

Category: <u>Procedures & Tech Specs</u> **Topic:** <u>Drop Limit</u>

Reference: CoC 1015, Tech Spec A.5.6

Requirement: The lifting height above the transport surface shall not exceed the limits in Table A 5-1, which limits the vertical height limit of the concrete cask to less than 24 inches. Additionally, the licensee shall ensure that the transport route conditions (i.e. surface hardness and pad thickness) are equivalent to or less limiting than those prescribed for the reference pad surface citied in Sections 11.2.12.3 and 11.2.15.1.1 of the NAC-UMS

FSAR.

Finding: The requirement was achieved before loading operations were started. The Technical Specification limited the lift height of the VCC to a maximum of 24 inches. Procedure MP/0/A/7650/182 limited the lift height of the loaded VCC to less than 24 inches under all circumstances. At Catawba, there were also several areas where the Part 50 structures and equipment required a reduced lift height. Due to site specific conditions, the height of the VCC was limited to:

8 inches maximum south of CP-13
Between 1/4 inch and 1 1/2 inches above the impact limiter over the RN piping
14 inches maximum in the gravel area just East of RN Bridge 14.

To address the potential effect on the Part 50 facility, the locations of underground structures were determined with drawings and underground detection methods along the entire transport route. Four 10 feet diameter RC pipes cross under both the Unit 1 & 2 haul paths. Step 11.2.16 of Procedure MP/0/A/7650/182 required verification that the RC piping was pressurized and filled before driving the transporter over them. Section 11.8 of Procedure MP/0/A/7650/182 provided the instructions for crossing the bridge over the RN piping, including requirements to have the impact limiter in place.

The site elected to evaluate the potential effect of the transport route conditions on the concrete cask by analyzing the transport route conditions as being equivalent to or less limiting than those specified in Section 11.2.4.3 of the FSAR, where the storage surface is assumed to be an infinitely rigid surface. In this analysis the concrete cask body will crush until the impact energy is absorbed and no credit is taken for the underlying soil layers. In the unlikely event that a drop of the concrete cask occurred in this analysis, the stainless steel canister would remain intact. The method used by Catawba to show compliance with the Technical Specification condition was reviewed by the SFST Project Manager and found to be acceptable.

Documents Reviewed: Procedure MP/0/A/7650/182, "Operation of Dry Cask Transporter," Revision 007; TM/0/A/7550/037, "ISFSI Haul Road Testing," Revision 000; Duke Power Company Engineering Change, CD500920, ISFSI Haul Road; Duke Power Company Engineering Change, CD500624, RN Bridge;
MACTEC Concrete Test Reports, dated 01/16/2007, Set ID 200616848, Pour location turning point CP5; dated 01/22/2007, Set ID 200616856, Pour location turning point CP12; dated 04/18/2007, Set ID 200717199, Pour location Set 2 RN Bridge @ 60 Total Yards; dated 04/18/2007, Set ID 200717283, Pour location Set 2 Turning Pad
Drawing No. 5047955E, "ISFSI Project Haul Path & Upgrades, Plans, Sects. & Notes, " Revised per Engineering Change CD 500920, Rev A, dated 12/08/2004
Drawing No. 9039429D, "RN Bridge Impact Limiter," Revised per Engineering Change CD 500624, Rev A, dated 01/26/2007
Duke Power Co. Variation Notice Notices VN No. CD500920C, CD500920D, CD500920D

Category: <u>Procedures & Tech Specs</u> **Topic:** <u>Loading the Concrete Cask</u>

Reference: FSAR 1015, Section 8.1.2.12

Requirement: In preparation for lowering the canister from the transfer cask to the concrete storage cask, the canister is raised slightly (approximately 0.5 inches) to take the weight of the transfer cask shield doors. The canister should not be allowed to come in contact with the transfer cask retaining ring, as this could result in lifting of the transfer cask.

Finding: This requirement was achieved. Procedure TT/0/A/9100/099 contained a "caution" note in Step 12.21.9, that states when lifting the TSC off the shield doors, limit the TSC lift height to less than 2 inches to prevent engaging the retaining ring.

The inspectors observed this evolution on Wednesday, April 11, 2007. The crane operators used two cameras to provide different angles of view on the lower chain hoist hook to continuously monitor the lift for any signs of binding and to ensure that the canister did not engage the retaining ring. While lowering the TSC, the crane operator monitored for any indication that the TSC was dragging on the inside of the TFR or VCC. As the TSC is slowly lowered for the final portion into the VCC the slings were visually checked for slackening to indicate when the TSC is completely lowered.

Documents Reviewed: Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002

Category: Procedures & Tech Specs **Topic:** Procedures for Unloading a Canister

Reference: FSAR 1015, Section 8.3

Requirement: Section 8.3 of the FSAR provides an outline of the generic steps necessary to unload a canister.

Finding: This requirement was met. The licensee had written Procedure MP/0/A/7650/183 that provided detailed instructions for unloading a canister. Included in this procedure were Sections 11.4 to 11.14 which incorporated the generic steps from Section 8.3 of FSAR 1015. The procedure also included the site specific details necessary to unload a canister.

Documents Reviewed: Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies From NAC-UMS Casks," Revision DRAFT

Category: Procedures & Tech Specs **Topic:** Temperature Monitoring of Cask

Reference: CoC 1015, Tech Spec A.3.1.6

Requirement: On a 24 hr basis, verify that the difference between the average storage cask air outlet temperature and ISFSI ambient temperature is less than or equal to 102 degrees F (PWR) OR 92 degrees F (BWR).

Finding: This requirement was met. Procedure PT/0/A/4600/031 included the 24 hour surveillance requirement. Enclosure 13.1 of Procedure PT/0/A/4600/031 was required to be completed daily to verify that the difference in temperature between the cask inlet and outlets was less than or equal to 102 degrees F.

Procedure MP/0/A/7650/184 provided direction to the operators in the event that the cask temperature monitoring system was not operational, including the CoC 1015, Tech Spec A.3.1.6 requirement that the cask heat removal system be restored to operational status within 25 days.

Documents Reviewed: Procedure PT/0/A/4600/031, "NAC-UMS Cask Surveillance," Revision DRAFT; Procedure MP/0/A/7650/184, "Spent Fuel Dry Storage Cask Troubleshooting," Revision 000

Category: Procedures & Tech Specs **Topic:** Time to Boil Limit

Reference: FSAR 1015, Section 8.1.1.12

Requirement: A time to boil limit clock is monitored once the bottom of the transfer cask clears the spent fuel pool as described in Step 12 of FSAR, Section 8.1.1 through the draining of the water from the canister in Step 28. The time to boil limit for various heat loads is provided in Table 8.1.1-3 "Handling Time Limits Based on Decay Heat Load with a Canister Full of Water." In the event that the time limit is not met, the license must cool the canister with forced air or return the canister to the spent fuel pool for a 24 hour period OR establishing the time to complete Step 28 by measuring and monitoring the water temperature inside the canister in accordance with instructions contained in Step12.

Finding: This requirement was achieved. The licensee included procedural steps to track and control the "Time to Boil" clock. Procedure TT/0/A/9100/099, Step 12.9.6, directed the crew to raise the TFR until the lip of the TSC breaks the water surface. The note in the procedure for this step stated to record the time as the "Time to Boil" start time in Enclosure 13.1. Directions were provided in Enclosure 13.5, Time to Boil Contingencies, to cool the canister if the Time to Boil handling time limit was close to expiring or the water temperature in the canister exceeded the Time to Boil Maximum Water Temperature recorded in Enclosure 13.1.

Documents Reviewed: TT/0/A/9100/099, " NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002

Category: Procedures & Tech Specs **Topic:** Torque Values

Reference: FSAR 1015, Table 8.1.1-2

Requirement: Table 8.1.1-2 provides torque values for the transfer cask and canister.

Finding: Requirement was not achieved during the initial inspection, but was achieved prior to loading. During the team inspection it was discovered that the licensee had not included the torque value for the center hoist rings that were used to lower the loaded canister into the concrete cask.

FSAR Table 8.1.1-2 included the torque values for various pieces of NAC-UMS equipment. This table stated that the lifting hoist ring torque value for the loaded TSC should be 800 (+80, -0) ft-lbs. Enclosure 13.4 of Procedure TT/0/A/9100/099 included information for the lift rig sets, but did not provide the torque value for lift rig set #3, associated with the lifting hoist rings. Torque requirements for the other pieces of NAC-UMS equipment were reviewed and found to be satisfactory.

The licensee entered this discrepancy into their corrective action system and subsequently determined that the center hoist rings could be safely used for the canister rigging using a torque value of 100 ft-lbs. This was documented in Calculation CNC-1126.01-00-0001.

Documents Reviewed: NAC-UMS FSAR, Table 8.1.1-2, "Torque Values", Revision 6; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002; Calculation CNC-1126.01-00-001, "Aux. Bldg. Monorails, Cranes, and Misc. Lifting Devices, Revision 48

Category: Procedures & Tech Specs **Topic:** Written Procedures Required

Reference: 10 CFR 72.212(b)(9)

Requirement: The licensee shall conduct activities related to storage of spent fuel under this general license only in accordance with written procedures.

Finding: The requirement was met. During the pre-operational demonstration the inspectors reviewed licensee Procedure TT/0/A/9100/099 which had been prepared for the dry runs. The licensee had other procedures in draft form for the loading and unloading operations. The inspectors observed and compared selected demonstrations to the instructions contained in the dry run procedure.

During the demonstration of the transfer cask stack up on April 22, 2007, a copy of Procedure TT/0/A/9100/099 was observed in the work area where the supervisor and crane operators were visually following the evolution on the camera monitor. The supervisor read each step before it was started and would initial the step upon completion. The TSC was lowered into the VCC and the TFR was returned to the cask decon pit.

During the demonstration for the movement of the VCC from the refueling building on April 12, 2007, the inspector observed that the supervisor had the procedure present at the site. The licensee demonstrated moving the VCC out of the truck bay on the rail cart with the transporter, lifting the VCC off the rail cart with the transporter, hauling the VCC to the ISFSI pad, and setting it down on the pad. The supervisor was observed initialing the procedure at the completion of each step. The VCC was hooked up to the cask temperature monitoring panel OSFS 2. Licensee personnel went through the procedure to setup and test the cask temperature monitoring panel and where in contact with control room personnel during the process. Each step of the procedure was read out, repeated by the person working at the OSFS 2 panel, and then initialed as complete.

Documents Reviewed: TT/0/A/9100/099, " NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002

Category: QA **Topic:** 10 CFR 72.48 Training

Reference: 10 CFR 72.144(d)

Requirement: The licensee shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to ensure that suitable proficiency is achieved and maintained.

Finding: This requirement was not implemented at the time of the initial inspection and a Non-Cited Violation (NCV) has been issued due to failure to provide for indoctrination and training of personnel performing activities affecting quality, including performing 10 CFR 72.48 screenings and evaluations as required by 10 CFR 144(d).

During the pre-operational dry run activities, the inspectors found several instances where the requirements specified in the NAC-UMS FSAR and in the Technical Specifications were not included in the procedures that directed the work. The inspectors identified two discrepancies that existed between the instructions contained in Procedure TT/0/A/9100/099 and the general guidance provided for operating procedures contained in Chapter 8 of the NAC-UMS FSAR. The first discrepancy was that Procedure TT/0/A/9100/099 did not identify the requirement to torque the center hoist rings on the canister structural lid to 800 foot-lbs (+80, -0). The second discrepancy was a change to the unloading portion of the procedure that exceeded the FSAR Section 8.3.14 specified discharge line pressure of 45 psig. Step 12.29.21 of Procedure TT/0/A/9100/099 allowed the discharge line pressure to reach 50 psig. In both cases there was no discussion of the proposed change mentioned in the licensee's 10 CFR 72.48 reviews. A review of the licensee's draft loading and unloading procedures identified that the same discrepancies were present.

Technical Specification B 3.4.1(5) required that the potential for fire and explosion be addressed based on site-specific considerations. This requirement was not included in Procedure MP/0/A/7650/182, which was used to transport the loaded cask to the ISFSI pad nor was the deviation from the requirement mentioned in the 10 CFR 72.48 associated with the procedure's approval.

The inspectors then reviewed the requirements of NSD 211, which governed the implementation of the Duke 10 CFR 72.48 program . Section 211.9 of NSD 211 stated that "personnel that prepare 10 CFR 72.48 Screens and/or 10 CFR 72.48 Evaluations shall successfully complete Duke Power 10 CFR 50.59 Process training." The requirement to provide additional or supplemental training to personnel that would perform 10 CFR 72.48 reviews was not identified nor required by the directive. Interviews with selected station personnel that had performed 10 CFR 72.48 screenings revealed that additional training on the NAC-UMS Technical Specification, the FSAR and applicable portions of 10 CFR Part 72 had not been provided.

The requirements of 10 CFR 72.144(d) states in part that the licensee shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to ensure that suitable proficiency is achieved and maintained. Failure to provide training of personnel performing 10 CFR 72.48 screenings and evaluations was a violation of 10 CFR 72.144(d). This violation was identified by the NRC during the course of the inspection. The licensee entered the condition into their corrective action program as PIP C-07-01922, CA Sequence No. 36. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Section VI.A of the NRC Enforcement Policy (NCV 72-45/0701-01).

As part of the corrective action for PIP C-07-01922, a contractor was brought to Catawba to specifically provide training on the NAC-UMS FSAR, Technical Specification and CoC conditions.

Documents Reviewed: 10 CFR 72.48 Screen, "NAC-UMS Spent Fuel Cask Dry Run Procedure, TT/0/A/9100/099, Rev 000," Dated February 26, 2007; 10 CFR 72.48 Screen, "NAC-UMS Spent Fuel Cask Dry Run Procedure, TT/0/A/9100/099, Rev 001," Dated March

27, 2007; 10 CFR 72.48 Screen, "NAC-UMS Spent Fuel Cask Dry Run Procedure, TT/0/A/9100/099, Rev 002," Dated April 3, 2007; 10 CFR 72.48 Screen, "MP/0/A/7650/182, Rev 001," Dated February 13, 2007; 10 CFR 72.48 Screen, "Operation of Dry Cask Transporter, MP/0/A/7650/182, Rev 002," Dated February 27, 2007; CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT; Nuclear System Directive (NSD) 211, "10 CFR 72.48 Process," Revision 5

Category: QA **Topic:** Approved QA Program

Reference: 10 CFR 72.140(d)

Requirement: A QA 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 met. The licensee provided a copy of the letter that had been sent to the NRC, dated January 17, 2006. This letter stated that the Duke Quality Assurance Program (QAP) approved for use under 10 CFR Part 50 would also be applied to ISFSI activities. Additionally, the licensee stated that the QAP would not require any changes for implementation of ISFSI related activities.

Documents Reviewed: Letter to NRC Document Control Desk from Duke Energy Corporation, dated January 17, 2006 (ADAMS Accession Number ML060310480)

Category: QA **Topic:** CoC Issued for Fabrication of Canister

Reference: FSAR 1015, Table 1.2-3

Requirement: A Certificate of Conformance shall be issued by the fabricator stating that the canister meets the specifications and drawings.

Finding: This requirement was met. The licensee had been issued Certificate of Conformance (CoC's) for the various Important to Safety ISFSI components used to load the spent fuel.

The inspector reviewed a sample of the CoC’s issued by the fabricator and verified that they were complete and adequate. A review of the receiving inspection report verified that the licensee performed a complete review of all CoC’s. These documents were required to be established as QA records and transmitted to document control upon completion of final QA review.

Documents Reviewed: Certificates of Conformance for TSC’s 25, 28, 30, 34, 42, and 47; Receiving Inspection Report 85133 for Purchase Order DP 2613, Dated March 29, 2007

Category: QA **Topic:** Control of Material and Parts

Reference: 10 CFR 72.156

Requirement: The licensee shall establish measures for the identification and control of materials, parts and components. These measures must insure that identification of the item is maintained by heat number, part number, serial number, or other appropriate means, either on the item or on records traceable to the item as required, throughout fabrication, installation, and use of the item. These identification and control measures must be designed to prevent the use of the incorrect or defective materials, parts and components.

Finding: This requirement was met. The licensee implemented portions of their 10 CFR Part 50 Quality Assurance Program (QAP) for control of materials and parts. Section 17.3.2.6 of Duke Energy's QAP stated, in part "Materials, parts, components, assemblies, and subassemblies shall be identified either on the item or records traceable to the item." It also stated "upon receipt, procedures require that materials, parts or components undergo a receipt inspection to assure they are properly identified." Finally, it stated "upon receipt, a unique tracking number is assigned to provide traceability." The inspector reviewed the receipt inspection procedure and inspection reports and verified the licensee had confirmed that the correct parts were received by checking serial numbers. Once received, the licensee created unique tracking numbers (UTC's) to provide traceability of all parts back to their original serial numbers, and also to a unique catalog number (#561699). It should be noted that the licensee placed the TSC's into the VCC's and identified each combined package as a single component. The work order that implemented this action was reviewed, along with the implementing procedure, and it was verified that the correct serial numbered TSC's were placed in the corresponding serial numbered VCC's. Additionally, the inspector verified that nameplates were properly in place to identify each component by serial number.

Documents Reviewed: Supply Chain Directive SCD311, "QA Inspection & Testing," Revision 5; Duke Energy Quality Assurance Program (QAP), Amendment 34; Certificates of Conformance for TSC's 25, 30, and 47 and for VCC's 29, 34, and 42; Receiving Inspection Report 85133 for Purchase Order DP 2613; Work Order 98760387-01: Load TSC's into VCC's, Dated January 26, 2006; Procedure MP/0/A/7650/186, "Upending and Loading Transportable Storage Canisters Into Vertical Concrete Casks," Revision 002, completed 1/26/06

Category: QA **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 achieved. Section 5.1 of Procedure TT/0/A/9100/099 specified the measuring and test equipment that would be used during fuel loading operations. Calibration of the equipment was controlled through the Duke Energy Standards Laboratory, where calibrations were performed or sent to other companies for calibration. The Standards Laboratory ensured that outside calibration vendors meet specified quality requirements. It was the responsibility of the equipment user to verify that an instrument has not exceeded its calibration due date before each use. All of the above referenced instrument certifications were reviewed and found acceptable. A review of selected equipment indicated that the calibration intervals were all current.

Documents Reviewed: Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; Instrument Certification for Pressure Calibrator for Phoenix 200 VDS Digital Pressure Meters, Portable Baratron Transfer Standard CNMNT-20453; Instrument Certifications for Fuel Cask RTD Calibrators CNMNT-20427 and CNMNT-20428; Dated October 25, 2006; Instrument Certifications for Digital Pressure Measuring Devices, MKS part of Phoenix 200 Series VDS, range 0 to 2000 torr and range 0 to 100 torr (Serial numbers 012762588, 012762585, 012762586, 012762587, 012762555, 012762556, 012762557, and 012762558)" Dated June 6, 2006 and May 28, 2006.

Category: QA **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 nonconformance's 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 met. The inspector reviewed the referenced corrective action documents, which included both administrative and technical issues related to ISFSI. The inspector concluded that the licensee was identifying problems at an appropriate threshold and implementing appropriate corrective actions. None of the issues were deemed conditions adverse to quality, therefore no root cause evaluations were available for review.

Documents Reviewed: PIP C-07-01747, Procurement Quality CNS QA Specialist oversight for the receipt of the spent fuel transfer cask; PIP C-07-01774, ISFSI/Calibrated leaks used for helium detection; PIP C-06-01783, Track outstanding activities that need to be completed to finalize 72.212 evaluation for the Catawba ISFSI; PIP C-07-01748, Procurement specification exceptions not processed in accordance with EDM-140 requirements; PIP C-07-01020, Potential ISFSI issues and concerns that could affect the start date of the NRC observed dry runs

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Category: QA **Topic:** Handling, Storage and Shipping Control

Reference: 10 CFR 72.166

Requirement: The licensee shall establish measures to control, in accordance with work and inspection instructions, the handling, storage, shipping, cleaning 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: The requirements were achieved. The licensee had established measures to control the handling and storage of equipment to prevent damage or deterioration. Section 17.3.2.7 of the QAP stated that "QA Condition 1 materials, parts and components are stored in controlled, segregated areas designated for the storage of such items." The TSC's and VCC's were designated storage level D in the ISFSI product specification. This storage level was also translated correctly into the catalog listing of the items. Level D storage was designated for outside storage and had the least restrictive storage level requirements. The licensee stored the TSC/VCC combined packages on the ISFSI pad in accordance with the level D storage requirements. The licensee placed tarps over the tops of the VCC's (with TSC's inside) as an extra measure to ensure storage cleanliness. The inspector observed the ISFSI storage on the pad and found it adequate. The licensee did not inspect the TSC's prior to placement inside of the VCC's for storage, however the dry run Procedure TT/0/A/9100/099 required visual inspection of the TSC prior to use in fuel loading operations.

Documents Reviewed: Duke Energy Quality Assurance Program (QAP), Amendment 34; Attachment 2C of Catawba ISFSI Specification CNS 1140.00-00-0003, "NAC-UMS Universal MPC System for the UMS Universal Storage System," Revision 0; Catalog file number 561699, "TSC/VCC packages,"; Procedure TT/0/A/9100/099 "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

Category: QA **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 met. The licensee used Procedure SCD 311 to address nonconforming or rejected parts during receipt inspection. The QAP stated that "nonconforming or rejected materials, parts, or components are identified to assure that they will not be inadvertently used." Procedure SCD 311 had provisions for addressing nonconforming or rejected items and segregating them so they will not be used. The inspector reviewed a sampling of Certificates of Conformance and the receiving inspection report to verify that no items were found to be nonconforming.

Documents Reviewed: Supply Chain Directive SCD311, "QA Inspection & Testing," Revision 5; Duke Energy Quality Assurance Program (QAP), Amendment 34; Certificates of Conformance for TSC's 25, 30, and 47 and for VCC's 29, 34, and 42; Receiving Inspection Report 85133 for Purchase Order DP 2613, Dated March 29, 2007

Category: QA **Topic:** Procurement Controls for Material

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. Records shall be available for the life of the ISFSI. The effectiveness of the control of quality by contractors/subcontractors shall be assessed at intervals consistent with the importance, complexity and quantity of the product or service.

Finding: This requirement was met. Licensee Procedure SCD 311 required that the purchase order be verified during receipt inspection. This included verification that the product specification had been met for the item(s) being received. Acceptance by the receiving inspector on the receiving inspection report for the TSC/VCC components verified that these requirements had been met. The inspector independently reviewed the product specification and purchase order, and found the licensee's implementation of the procurement process for the TSC/VCC components to be adequate.

The licensee purchased the transfer cask from Maine Yankee as a non-QA component. Procedure SCD 250, "Recertification/Upgrade Certification," outlined the process with which non-QA items could be upgraded to quality grade. The inspector verified that the licensee followed their process and adequately documented items that needed resolution in their corrective action program. The transfer cask then underwent the receipt inspection process and was found acceptable as a quality grade item.

As discussed in the audits section, the licensee had conducted multiple surveillances at the fabrication facilities in which the QA inspectors verified conformance with product specifications at various stages during fabrication.

The licensee used Procedure NSD 701 to maintain the procurement documents as QA records. This procedure made the record owner or originator responsible for designating the retention code upon transmittal to document control. The licensee stated that all ISFSI related documents are coded under "Nuclear Fuel Records" (number 004994), however a procedure or document does not exist that specifically states ISFSI records should be classified under this code. Additionally, this code specifies a retention period of "Life of Station" rather than life of the ISFSI. The licensee is aware of these issues and will be evaluating them for inclusion in a new record retention program that is planned for deployment later this year.

Documents Reviewed: Attachment 1 to Catawba ISFSI Specification CNS 1140.00-00-0003, "NAC-UMS Universal MPC System for the UMS Universal Storage System," Revision 0; Letter from Duke Power to K. Rice, Jr. Exceptions to Specification CNS 1140.00-00-0003, Duke Energy Purchase Order Nos. DP2613, Dated November 11, 2003 and DS452, Dated April 26, 2005; Supply Chain Directive SCD311; "QA Inspection & Testing," Revision 5; Supply Chain Directive SCD250, "Recertification/Upgrade Certification," Revision 5; Nuclear System Directive 701 "Records Management," Revision 6; Purchase Order DP 2613Z; Purchase Order 00049856, Dated June 27, 2006; PIP C-07-01747, Procurement Quality CNS QA Specialist oversight for the receipt of the spent fuel transfer cask; Receiving Inspection Report 85334 for upgraded transfer cask, Catalog ID 858157

Category: QA **Topic:** QA Audits

Reference: 10 CFR 72.176

Requirement: The licensee shall carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the QA program and to determine the effectiveness of the program.

Finding: This requirement was achieved. The licensee had performed a comprehensive system of audits of the dry fuel system components. No internal audits of the Catawba ISFSI program have been undertaken to date.

The licensee evaluated an audit of NAC International that had been performed by NUPIC in June 2006. The audit was to assess the effectiveness and implementation of the NAC International Nuclear QA program. The NUPIC audit found no deficiencies and the Duke evaluation concluded that the NUPIC audit was acceptable per Duke requirements. Duke Power had a member of their own QA organization participate on the NUPIC audit.

Section 17.3.3.2.3, Internal Audits, of the QAP states that "an audit of all QA Condition 1 functions is completed within a period of two (2) years." Since the ISFSI became operational on July 30, 2007, no internal audits have been performed at Catawba. However, an audit is scheduled for November 2007 as verified by review of the audit schedule.

Additionally, the licensee conducted over fifty surveillances of the vendor and sub-vendors. Duke Power independently contracted QA inspectors to travel to fabrication facilities to perform these surveillances throughout the fabrication process. This included oversight of the TSC, VCC, and VCC liner fabrication. A surveillance was also conducted for the performance testing of the transfer cask. The inspector reviewed the surveillance summaries and verified that no deficiencies were noted as a result of these surveillances.

Documents Reviewed: NUPIC Audit No. 19541, "NAC International Audit for Engineering, Design Analysis, Spent Fuel Dry Storage and Transportation Products," June 13-15, 2006; Form SCD510B, Supplier Evaluation Report for Audit/Survey No: VA06054; Duke Energy Quality Assurance Program (QAP), Amendment 34; Qualified Supplier List (QSL), NAC International

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Category: Radiological **Topic:** ALARA

Reference: 10 CFR 72.104(b)

Requirement: Operational restrictions must be established to meet as low as is reasonably achievable objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations

Finding: This requirement was implemented through use of Procedure RA/2/1100/006 and good rad-worker practices. The licensee demonstrated the process of loading / transporting a canister using Procedure RA/2/1100/006 and TT/0/A/9100/099.

Procedure RA/2/1100/006 identified the radiological control practices utilized during specific times during the loading process. This included imposing the dose rate limits on workers; use of temporary shielding, contamination limits/ controls, use of radiological postings, access controls, air sampling / use of HEPA filters and radiological surveys.

The inspectors attended the High Radiation and Locked High Radiation pre-job briefings. The briefings were comprehensive, included three-way communication for Radiation Worker Permit (RWP) information, RP coverage levels, neutron survey information, access controls as well as use of communications, proper tools and low dose waiting areas. The total dose received by the team during the initial canister loading was 244 mrem versus a revised goal of 246.

Documents Reviewed: Procedure RA/2/1100/006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks", Revision 0; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 2; Duke Power Company System Alara Manual, Revision 17

Category: Radiological **Topic:** Canister Unloading - Cooldown

Reference: FSAR 1015, Section 8.3.14

Requirement: During the unloading process the licensee must cool the canister down by attaching a hose and refilling the canister with water that has a minimum temperature of 70 degrees F, with a supply pressure of 25 (+10, -0) psig to the drain port quick disconnect. A steam rated discharge line is connected to the vent port quick disconnect and routed to the spent fuel pool. If grossly failed or ruptured fuel rods were present, high levels of radiation could appear in the discharge line.

Finding: This requirement was achieved prior to the initial canister loading. Procedure MP/0/A/7650/183, Step 11.6 provides the instructions for reflooding the TSC using the Annulus Flush System. Additionally, Step 11.7 provides the steps to purge and re-flood the TSC using the Phoenix 200 VDS.

During the pre-operational demonstration, the inspectors noted that the licensee procedure allowed the operators to operate the cask flooding discharge line up to 50 psig. This exceeded the specified FSAR pressure limit of 45 psig on the cask flooding discharge line. The licensee entered the discrepancy into their corrective action system in PIP C-07-01922, Item 21. Subsequently the procedure was changed to limit the pressure on the discharge line to 45 psig.

Documents Reviewed: Procedure RA/0/1100/018, "Radiation Protection Controls for Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision 0; Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision 0

Category: Radiological **Topic:** Contamination Limits for Canister

Reference: CoC 1015, Tech Spec A.3.2.1

Requirement: Removable contamination on the accessible exterior surfaces of the canister or accessible interior surfaces of the transfer cask shall not exceed 10,000 disintegrations per minute/100 centimeters squared (dpm/100 cm squared) for beta/gamma and 100 dpm/100 cm square for alpha prior to transport. FSAR Sect 12, Appendix C, Section C.3.2.1 provides more information.

Finding: This requirement was met through use of Procedure RA/2/1100/006 and TT/0/A/9100/099 which specified the contamination limits for the Transportable Storage Canister (TSC) and the Transfer Cask (TFR). The licensee continuously flushed the annular gap between the TSC and TFR when the TFR was submerged in the cask loading pit. The surfaces of the TRF were rinsed with demineralized water when being raised from the SFP. Additionally, the TFR bottom was decontaminated with a long handle scrub brush and demineralized water.

Procedure RA/2/1100/006, Enclosure 5.4, Step 5.1 contained the limits for removable contamination of 10,000 dpm/100cm2 (beta/gamma) and 100 dpm/100cm2 (alpha) as required by Tech Spec A.3.2.1.

The NRC inspectors reviewed Survey M-041207-5 for the initial canister loaded from Unit 1 and found removable surface contamination levels below 3300 dpm/100cm2 (beta/gamma) and no detectable Alpha contamination. These contamination levels were within the limits required in Tech Spec A.3.2.1.

Documents Reviewed: Procedure RA/2/1100/006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks," Revision 0; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

Category: Radiological **Topic:** Controlled Area Radiological Doses

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 TEDE for accident conditions. Minimum distance from ISFSI to nearest boundary of controlled area must be 100 meters. Controlled area may include roads, railroads or waterways as long as arrangements are made to control traffic and protect public.

Finding: This requirement was achieved. The licensee had documented the controlled area boundary of the ISFSI in the 10 CFR 72.212 report as 2,500 feet, which exceeded the minimum requirement of 100 meters. The NAC-UMS FSAR evaluated the radiological results associated with accidents and determined that no credible accident existed that would result in a dose of greater than 5 rem beyond the postulated minimum controlled area boundary.

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007

Category: Radiological **Topic:** Criticality Monitoring

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 when special nuclear material is handled or stored beneath water shielding. Monitoring of dry storage areas where special nuclear material is packaged in its stored configuration is not required.

The NRC has defined "packaged" to begin when the canister lid is seal welded.

Finding: This requirement was implemented. Section 8.2 of Procedure TT/0/A/9100/099 required criticality radiation monitors 1EMF-20 and 1EMF-21 (Unit-1) and 2EMF-20 and 2EMF-21 (Unit 2) to be in continuous operation whenever moving irradiated fuel in each respective unit. Both monitors were provided with a clearly audible alarm signal if accidental criticality occurred.

Documents Reviewed: Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002

Category: Radiological **Topic:** Environmental Monitoring Program

Reference: CoC 1015, Tech Spec A.5.5 & 10 CFR 72.44(d)(2)

Requirement: A general licensee may incorporate their environmental monitoring program for the ISFSI into their Part 50 program. An annual report shall be submitted pursuant to 72.44(d)(3).

Finding: The intent of this requirement was met by the licensee. This requirement will be implemented through review of the licensee's annual Radiological Environmental Operating Report. The report documented the 40 Catawba Radiological Monitoring Program Sampling locations (TLD sites) and their distances and locations which would be used to monitor the ISFSI. The Selected Licensee Commitments (SLC) section 16.11-16 required that the Annual Radiological Environmental Operating Report covering the operation of the units during the previous calendar year be submitted prior to May 15 of each year.

Documents Reviewed: Procedure SH/0/B/2007/001, "Radiological Environmental Monitoring Program Data Evaluation," Revision 0; Report "2006 Annual Radiological Environmental Operating Report," Revision Draft

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Category: Radiological **Topic:** Loading Operations Using Transfer Cask

Reference: CoC 1015 & FSAR 1015, Section 1.2.1.4

Requirement: To minimize the potential for contamination of a canister or the inside of the transfer cask during loading operation in the spent fuel pool, clean water is circulated in the annular gap between the cask interior surface and the canister exterior surface. Clean water is processed or filtered spent fuel pool water, or any water exterior to the spent fuel pool that is compatible.

Finding: This requirement was implemented through use of Procedure RA/2/1100/006 and TT/0/A/9100/099, which required a continuous flush of the annular gap between the TSC and TFR when the TFR was submerged in the cask pit or on when sitting on the cask pit shelf. Step 12.5 of TT/0/A/9100/099 included instructions for initiating an annulus flush when placing the empty TSC onto the Cask Pit Shelf. Step 12.6 continued with the TSC being placed into the cask pit. The target upper and lower annulus flush flows are listed in step 12.6.19 and again in step 12.9 when moving the loaded TSC back to the Cask Pit Shelf. When the TFR is being raised from the water, Step 1.4 of Enclosure 5.2 of RA/2/1100/006 included rinsing the TFR exterior surfaces with demineralized water. Step 4.3 of Enclosure 5.4 involved decontaminating the TFR bottom with long handle scrub brush and demineralized water.

The NRC inspectors observed the activities which demonstrated the use of circulating filtered spent fuel pool water or demineralized water.

Documents Reviewed: Procedure RA/2/1100/006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks," Revision 0; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

Category: Radiological **Topic:** Neutron Energies for Dosimetry

Reference: FSAR 1015, Table 5.2-16

Requirement: Table 5.2-16 provides the design basis neutron energy spectrum for the canister.

Finding: The requirements for capturing neutron surveys for the canister after the TSC is drained was achieved in steps 14-16 of Enclosure 5.3 located in Procedure RA/2/1100/006. The neutron to gamma ratio survey was performed in step 15.2 of Procedure SH/0/B/2000/009.

The licensee had evaluated the survey instrument calibration program in Corrective Action 4 of PIP C-05-05847, utilizing an appropriate calibration source (Cf-252), to ensure neutron dose rates were taken into account.

The inspectors attended the High Radiation and Locked High Radiation pre-job briefings. The briefings were comprehensive and included appropriate neutron dose discussion as well as survey information.

Documents Reviewed: PIP C-05-05847, "Determine which neutron instruments are satisfactory for ISFSI neutron spectrum," Corrective Action #4; Procedure SH/0/B/2000/009, "Neutron Dose Tracking," Revision 2; Procedure RA/2/1100/006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks," Revision 0

Category: Radiological **Topic:** Radiation Limits for Storage Cask

Reference: CoC 1015, Tech Spec A.3.2.2 & FSAR Section 8.1.3

Requirement: The average surface dose rate of each storage cask shall not exceed the following limits a) 50 mrem/hr neutron and gamma on the side, 50 mrem/hr neutron plus gamma on the top and 100 mrem/hr neutron plus gamma at the air inlets and outlets. The dose rate measurements may be made prior to movement of the cask, at a location along the transport route or at the ISFSI. An optional supplemental shielding fixture may be installed in the concrete cask air inlets to reduce the radiation dose rate at the inlets.

Finding: This requirement was implemented through use of Procedure TT/0/A/9100/099 and Procedure RA/2/1100/006. Enclosure 5.4 of Procedure RA/2/1100/006 stated that the average surface dose rate allowable limits were 50 mrem/hr (neutron + gamma) on the side, 50 mrem/hr (neutron + gamma) on the top; and 100 mrem/hr (neutron + gamma) at the air inlets and outlets.

Procedure TT/0/A/9100/099, step 12.22.2 directed RP to measure the VCC dose rates. Procedure RA/2/1100/006, Enclosure 5.4 clearly identified the locations of the Tech Spec zones, "S", "V", and "T", where the dose rate readings were to be obtained.

The inspectors observed that the zones were clearly identified by survey numbers (S1, T2, V4 etc.) on the top, sides, and inlet and outlet vents of the VCC.

Documents Reviewed: Procedure RA/2/1100/006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks," Revision 0; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

Category: Radiological **Topic:** Radioactive Materials

Reference: 10 CFR 72.104(a)

Requirement: During normal operations and anticipated occurrences, the annual dose equivalent to any real individual who is located beyond the controlled area must not exceed 25 mrem to the whole body.

Finding: This requirement was achieved. Licensee Calculation 32-5052738-00, page 25 demonstrated that the dose requirement was achieved by analyzing the Phase III (maximum number of loaded casks) dose contours. The planned dose rates attributed to the ISFSI at the controlled area boundary were extrapolated and documented in Calculation 32-5055544-01. The three points at the Exclusion Area Boundary were estimated to provide a dose rate of 0.85 mrem/yr (entrance), 0.79 mrem/yr (Crepe Myrtle Road, and 0.03 mrem/yr (Security Practice Range) based on the Phase III data.. These dose rates are added to the plant generated dose rates which are captured in the Annual Radioactive Effluent Release Report.

Documents Reviewed: Calculation 32-5052738-00, "Determination of Dose Contours for Catawba Nuclear Station ISFSI Project," Dated 9 December 2004; Calculation 32-5055544-01, "Determination of Dose Rates at 50 Locations for the Catawba Nuclear Station ISFSI Project," Dated 14 January 2005; Report "2006 Annual Radioactive Effluent Release Report," For the period of January 1, 2006 through December 31, 2006

Category: Radiological **Topic:** Unloading Operations - Gas Monitoring

Reference: FSAR 1015, Section 8.3

Requirement: During the unloading process, the licensee must monitor the helium removed from the canister for fission products. Fission products present in the removed gas could produce a significant radiological hazard.

Finding: This requirement was achieved. Procedure MP/0/A/7650/183, Step 11.7.1 (B) required Radiation Protection personnel to be available for monitoring the activity of vented gases during the unloading activity. Enclosure 5.3 of Procedure RA/0/1100/018 directed gamma and neutron surveys to be taken when the vent and drain ports were removed and required that gas samples be obtained from the TSC for fission products.

Based on the inspectors questioning, the licensee generated item 5 to PIP C-07-01860 to evaluate the current sampling methodology used for potential high temperature gas sample stream (>400 degrees F) during a TSC unloading scenario to ensure sample equipment was appropriate for the high temperatures that could be encountered and procedural controls were sufficient.

Sampling the canister internals for fission products during the unloading process was demonstrated in the ISFSI storage building using a canister mockup and the spare VDS system. Sampling was performed in accordance with Section 12.27 of Procedure

TT/0/A/9100/099 and Enclosure 5.3 of Procedure RA/0/1100/018 and considered the potential of a high temperature gas stream during the sampling process.

The sample rig contained a 100 ml sample bomb which was fully instrumented for gas pressure, flow, and temperature. The radiation protection practices included the use of a HEPA unit to limit airborne activity, temporary shielding to limit exposure, neutron dose monitoring and contamination control measures.

Documents Reviewed: Procedure RA/0/1100/018, "Radiation Protection Controls for Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision 0; Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies from NAC-UMS Casks," Revision 0; PIP C-07-01860

Category: Records **Topic:** Cask Records (#1)

Reference: 10 CFR 72.212(b)(8)

Requirement: The licensee shall accurately maintain the records provided by the cask supplier for each cask that shows, in addition to the information provided by the cask vendor, the following: (a) the name and address of the cask vendor, (b) the listing of the spent fuel stored in the cask and (c) any maintenance performed on the cask. This record must include sufficient information to furnish documentary evidence that any testing and maintenance of the cask has been conducted under an NRC approved QA plan.

Finding: These requirements were met. Section 14.0 of the 72.212 report addressed the three specific record requirements of 72.212(b)(8). The name and address of the vendor was properly recorded. No maintenance had been performed on any of the casks, therefore no such records existed. The licensee planned to control any future maintenance records on the casks in accordance with procedure NSD 702, Document Control. Lastly, the licensee planned to maintain and control the listing of spent fuel stored in each cask using their MANTIS database, a nuclear material accountability database. The inspector verified that the MANTIS database is subject to proper QA controls and is maintained current through document control.

Documents Reviewed: "Catawba Nuclear Station Independent Spent Fuel Storage Installation 10 CFR 72.212 Evaluation NAC-UMS Universal Storage System," Revision DRAFT

Category: Records **Topic:** Cask Records (#2)

Reference: 10 CFR 72.234(d)(2) & (d)(3)

Requirement: A list of records required for each cask is provided in 10 CFR 72.234(d)(2). The certificate holder is required by 10 CFR 72.234(d)(3) to provide an original of these records to the user

Finding: This requirement was met. The licensee's receipt inspection process ensured that all records required by 72.234(d)(2) were received from the vendors. These records were then transmitted to document control for storage. The Certificates of Conformance records reviewed by the inspector contained all the required information.

Documents Reviewed: Receiving Inspection Report 85133 for Purchase Order DP 2613, Dated March 29, 2007; Certificates of Conformance for TSC's 25, 30, and 47 and for VCC's 29, 34, and 42

Category: Records **Topic:** Maintaining a Copy of the CoC and Documents

Reference: 10 CFR 72.212(b)(7)

Requirement: The general licensee shall maintain a copy of the CoC and documents referenced in the certificate.

Finding: This requirement was met. The licensee maintains current copies of the CoC, Technical Specifications, and the FSAR in document control. These documents were QA controlled using NSD 702. The inspector verified that the current revisions were available in document control for the following documents:

Certificate of Compliance 1015, Amendment 4
Technical Specifications, Amendment 4
FSAR, Revision 6A

Documents Reviewed: Catawba Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," DRAFT; Nuclear System Directive 702, "Document Control," Revision 19

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 met. The inspector reviewed the referenced letter dated September 13, 2006 and verified that the licensee notified the NRC within 90 days of their intent to store spent nuclear fuel under a general license using the NAC-UMS Storage System in accordance with approved CoC 1015.

Documents Reviewed: Letter to NRC Document Control Desk from Duke Power Company, dated September 13, 2006 (ADAMS Accession Number ML062640531)

Category: Records **Topic:** Record Retention for 72.212 Analysis

Reference: 10 CFR 72.212(b)(2)(ii)

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: There is reasonable assurance this requirement will be met. There is no licensee procedure that specifically contains a requirement to maintain the 72.212 analysis document. This document has been approved and Section 8.0 states that "a copy of record will be retained per NSD 701 until spent fuel is no longer stored under the general license issued under 72.210."

Documents Reviewed: CNS 10CFR72.212 Evaluation NAC-UMS Universal Storage System, "CATAWBA Nuclear Station Independent Spent Fuel Storage Installation 10CFR72.212 Evaluation NAC-UMS Universal Storage System," Revision 0, Dated May 30, 2007; Nuclear System Directive 701, "Records Management," Revision 6
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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: There is reasonable assurance this requirement will be met. Step 12.10 of the proposed revision to Procedure MP/0/A/7650/181 stated: "Notify Regulatory Compliance, directly and via PIP, that cask loading is completed and notification to NRC within 30 days is required." This step further required that the name of the person notified was documented along with the date and time of notification. The PIP will be entered into the Catawba Corrective Action process and will receive Management attention.

Documents Reviewed: Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies into NAC-UMS Casks," 000 Markup

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Category: SFP Criticality **Topic:** Compliance with 10CFR50.68

Reference: RIS 2005-05

Requirement: Subcriticality in the spent fuel pool must be maintained without credit for soluble boron in compliance with 10 CFR 50.68. However, Part 72 allows credit for boron in the spent fuel pool during loading, unloading and handling operations. Review the licensee's criticality analysis or other documentation demonstrating compliance with 10 CFR 50.68 during canister loading.

Finding: This requirement was demonstrated to have been met by the licensee in Calculation CNC-1553.12-00-0016, which demonstrated compliance with 10CFR 50.68(b) by maintaining a k-effective below 1.0 (subcritical) for 5 wt % PWR fuel if flooded with unborated water.

Documents Reviewed: NRC Regulatory Issue Summary 2005-05, "Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installations," Dated March 23, 2005; PIP C-05-02903, "NRC RIS 2005-05 describes potential issues regarding criticality requirements for the spent fuel pool and spent fuel casks during cask loading," ;Calculation CNC-1553.12-00-0016, "NAC Calculation for UMS Transfer Cask Criticality Evaluation for 5 wt % PWR Fuel in Unborated Water," Dated 8 August, 2006

Category: Slings **Topic:** Rigging Practices

Reference: ASME B30.9, Sect 9-6.10.4

Requirement: Rigging activities should be performed safely and in a manner consistent with the rigging practices of ASME B30.9.

Finding: This requirement was implemented. All lifts at the Catawba station required a lift plan. Each lift plan was developed using the Lift Plan Checklist contained in the Duke Energy Rigger's Handbook. The checklist included: load weights and crane capacity; size and type of lifting hardware; lifting hardware inspection; hitch types and angles; attachment points for center of gravity; communications with the crane operator; and the load travel path. These rigging practices were consistent with the requirements of ASME B30.9.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Duke Riggers Handbook; Catawba Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

Category: Slings **Topic:** Sling Identification

Reference: ASME B30.9, Sect 9-6.7.1

Requirement: Each sling shall be marked to show name or trademark of manufacture, manufactures code or stock number, rated load for the type of hitch used and the angle upon which it is based, core material and cover material, if different from core material.

Finding: This requirement was achieved. Several of the slings that were planned to be used to perform the dry fuel loading operations were visually inspected by the inspector. The slings which were visually examined contained the manufactures name, rated loads based on the type of sling configuration and type of material.

Documents Reviewed: None

Category: Slings **Topic:** Sling Inspections - Annual

Reference: ASME B30.9, Sect 9-6.9.1 & 3.

Requirement: Prior to use, all new, altered, modified or repaired slings shall be inspected. A complete inspection for damage to the sling shall be periodically performed, not to exceed 1 year. Written records of the most recent inspection shall be maintained and shall include the condition of the sling.

Finding: This requirement was implemented. The Duke Energy Rigger’s Handbook required initial inspection of all rigging hardware prior to initial use and frequent inspections of synthetic slings before, during and after use. The inspection and removal from service criteria was consistent with ASME B30.9 for Kevlar and synthetic slings.

However, the Rigger’s Handbook did not require a documented inspection of synthetic slings every 12 months. In response, the licensee revised Procedure PT/0/A/4150/041 to require an annual inspection of the cask lift rig sets, which included the slings. The inspection criteria provided in Section 12.8 of Procedure PT/0/A/4150/041 instructed the user to look for signs of defects, deformation, corrosion and signs of wear without listing all the specific criteria included in ASME B30.9 which would cause a sling to be removed from service. Procedure PT/0/A/4150/041 did however list ANSI B30.9 as a reference that may be needed to perform the procedure.

Using both the Rigger’s Handbook and Procedure PT/0/A/4150/041, the licensee could meet the requirements of ASME B30.9 for annual inspection of the synthetic slings.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Duke Rigger's Handbook

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Category: Slings **Topic:** Sling Inspections (Frequent)

Reference: ASME B30.9, Sect 9-6.9.2

Requirement: A visual inspection for damage shall be performed each day or shift the sling is used.

Finding: This requirement was achieved. All referenced documents include statements to inspect rigging prior to and after each use. These inspections were confirmed to be undocumented (as allowed per ASME code) and performed by the riggers in the field. Riggers use the Duke Power "Rigger's Handbook" inspection checklist on slings prior and after each use.

Documents Reviewed: Catawba Lifting Program, Rigger's Handbook, Catawba Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; Catawba Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies into NAC-UMS Casks," DRAFT

Category: Slings **Topic:** Sling Protection - Sharp Edges

Reference: ASME B30.9, Sect 9-6.10.4

Requirement: Sharp edges in contact with the sling should be padded with material of sufficient strength to protect the sling.

Finding: This requirement was met. Training and information contained in the rigger's handbook included requirements for protection to the slings when handling sharp edges while rigging. Specifically, "if in contact with rigging, rough or sharp corners or edges shall be surfaced, padded or machined smooth to prevent damage to rigging"

Spot check interviews by the inspector confirmed that riggers were aware of sharp edge precautions and how to properly protect the sling from cuts and damage.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Duke Rigger's Handbook

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Category: Slings **Topic:** Sling Rated Load

Reference: ASME B30.9, Sect 9-6.5.2 & 9-6.5.5

Requirement: The rated load of the sling shall be determined based on size, hitch type, and angle in accordance with manufacture information or Table 24 and Figure 23 of ASME B30.9.

Finding: This requirement was achieved. The synthetic round slings that were used for the majority of the heavy lifts had the sling capacities stamped on the slings. Additionally, the riggers handbook include provisions for calculating sling loading based on various sling configurations (ex. Various angles and rigging orientations, static and dynamic, etc.).

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Duke Rigger's Handbook

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Category: Slings **Topic:** Sling Temperature Limits

Reference: ASME B30.9, Sect 9-6.8.1

Requirement: Slings shall not be used in contact with objects that exceed the temperature limit of the sling.

Finding: This requirement was achieved. During the loading process, the transfer cask and canister will be immersed in the spent fuel pool. This will keep the temperature of the canister below the maximum temperature rating of the twin path slings used to lower the loaded canister into the concrete canister. The upper temperature limit specified for using a normal twin path sling is 180 degrees F. The maximum temperature of the canister lid during the loading phase was calculated to be 176 degrees as documented in

Calculation EA790-3206.

To provide adequate margin during a potential canister unloading evolution the licensee decided to purchase new twin path slings that were rated up to a temperature of 300 degrees. The licensee had submitted a change request to Procedure MP/0/A/7650/183 that specified that the "Sparkeater" slings rated to 300 degrees F were to be used to lift the canister during the unloading operations.

Documents Reviewed: Duke Rigger's Handbook; Catawba Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2; Catawba Procedure MP/0/A/7650/181, "Loading Spent Fuel Assemblies into NAC-UMS Casks," DRAFT; Calculation EA790-3206, "Thermal Analyses for UMS Transfer Cask/Canister for PWR Fuel," Revision 6; Procedure MP/0/A/7650/183, "Unloading Spent Fuel Assemblies From NAC-UMS Casks," Revision 000

Category: Slings **Topic:** Sling Training

Reference: ASME B30.9, Sect 9-6.1

Requirement: Sling users shall be trained in the selection, inspection, cautions to personnel, effects of environment and rigging practices.

Finding: This requirement was achieved. Duke Energy had established a lifting program training course that included training for riggers and crane operators. Table 3.2-1 of the Duke Lifting Program listed five training programs by task. The listed tasks were rigger assistant, supervisor rigger, limited scope rigging task, riggers for common lifts and advanced riggers for complex lifts. Riggers and advanced riggers must be evaluated before certification. The individuals are required to be entered into a rigging database upon certification as a rigger or advanced rigger.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12

Category: Slings **Topic:** Synthetic Round Sling Removal from Service

Reference: ASME B30.9, Sect 9-6.9.4

Requirement: A synthetic round sling shall be removed from service if any of the following conditions are present: a) missing or illegible sling identification; b) acid or caustic burns; c) heat damage; d) holes, tears, cuts abrasive wear or snags that expose the core yarns; e) broken or damaged core yarns; f) weld splatter that exposes core yarns; g) round slings that are knotted; h) discoloration and brittle or stiff areas which may mean chemical or ultraviolet/sunlight damage; or i) fittings that are pitted, corroded, cracked, bent, twisted, gouged or broken.

Finding: The intent of this requirement was achieved. The licensee program required that the rigger perform a visual inspection of the slings prior to and after each use. The riggers were trained to use the requirements of the rigger's handbook to perform the inspection. Page 44 of the rigger's handbook listed items for the riggers to inspect, including that the tell-tales were visible, observe the entire length of the outer cover for cuts, tears, holes or punctures. Additionally, the rigger was instructed to inspect for signs of damage including corrosion, cracks, breaks, distortion, heat or chemical damage and exposed load bearing yarn. If defects were observed, the instructions were to remove the sling from service.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Duke Rigger's Handbook

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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 test load 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, Sect 6.2, 6.5)

Finding: This requirement was implemented. The licensee used a Hercu-Link assembly which consisted of a chain hoist mounted to a special lifting bracket to lower the canister into the concrete cask. The Ingersoll-Rand Hercu-Link chain hoist and lift pin assembly were load tested by Ingersoll-Rand on March 17, 2004. The hoist was rated at 110,000 pounds and was load tested to 137,500 pounds (125% of the rating). This met the requirements of ANSI B30.16, Section 16-2.2.2 (b).

The lift pin assembly had a maximum service load of 75,467 pounds and was load tested to 113,200 pounds (150% of the maximum service load). This met the requirements of ANSI N14.6, Section 6.2. The NAC-UMS FSAR Table 3.2-1, PWR Class 2, provided a weight of 72,900 pounds for a fully loaded canister when lifted with the Hercu-Link hoist. Therefore, the maximum service load of 75,467 pounds was adequate to support this lift.

Following the load testing, liquid penetrant testing was performed on the lift pin assembly and magnetic particle testing was performed on the hook in accordance with ANSI N14.6, Section 6.5. No relevant indications were identified. The Hercu-Link chain hoist had no load bearing welds.

NAC Calculation 12418-2006 provided a structural analysis of the Hercu-Link system. For a non-critical lift, ANSI N14.6 required a factor of safety of 3 against the material yield strength and a factor of 5 against the ultimate material strength. The calculation included a dynamic load factor of 10%. The calculation concluded that the minimum safety factor against yield is 4 (which is greater than the required value of 3) and the minimum safety factor against the ultimate strength is 5.9 (which exceeds the minimum requirement of 5). Therefore it was concluded that the hoist components, lift pin and the canister lid satisfied the design stress requirements of ANSI N14.6.

Documents Reviewed: NAC International Purchase Order #03-0438, Dated December 22, 2003; Ingersoll-Rand Procedure 382-30556, "Procedures For Qualifying," Revision A; NAC Calculation 12418-2006, "Structural Analysis of the Chain Hoist Components for Transfer Operations," Revision 1
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Category: Special Lifting Devices **Topic:** Load-Bearing Pins

Reference: ANSI N14.6, Section 4.2.4.

Requirement: Load-bearing pins, extension links, and adapters used to connect mating members of special lifting devices shall be designed on the basis of the criteria established in 4.2.1 Stress Design Factors.

Finding: This requirement was implemented. Calculation 1085-02 presented the structural analysis for the Long Lift Adaptor (also known as the TN-32A Lifting Beam) and its pins. Since no redundancy was provided in the Long Lift Adaptor, safety factors of 6 for yield stress and 10 for ultimate stress were required. In order to achieve the stress safety factors, the maximum allowable loading for the support plates and pins was 110,000 pounds. The ANSYS model demonstrated that the ultimate stress on the support plates was 100,030 pounds and the yield stress was 74,940 pounds. The model also demonstrated that the ultimate stress on the pins was 105,467 pounds and the yield stress was 63,280 pounds. All stresses were within allowable limits.

Calculation CNC-1126.01-00-0001 presented the structural analysis for the Long Lift Adaptor Extension and its pins. Since no redundancy was provided in the Long Lift Adaptor Extension, safety factors of 6 for yield stress and 10 for ultimate stress were required. The calculation included the total loading on the Long Lift Adaptor Extension. The total load was comprised of the Long Lift Adaptor (1,765 pounds), Long Lift Adaptor Extension (1,000 pounds), lift yoke (7,635 pounds), and the transfer cask (210,000 pounds). The total static load was 220,400 pounds, to which a 10% dynamic loading (22,040 pounds) was added. This brought the total load to 242,440 pounds, which was rounded up to 250,000 pounds. The ANSYS model demonstrated that the safety factors of 6 on yield stress and 10 on ultimate stress required by ANSI N14.6 and NUREG 0612 were achieved.

The ANSYS model and referenced calculations demonstrated that stress design factors of the special lifting device connecting members were above the minimum requirements established in ANSI N14.6 and NUREG 0612.

The Long Lift Adaptor was load tested on February 24, 2000 by Hi Tech Manufacturing. The Long Lift Adaptor Extension was load tested on April 26, 2007 by Columbiana Hi Tech, LLC. The Adaptor and Adaptor Extension were both rated for 115 tons or 230,000 pounds static. A 15% dynamic loading factor was added bringing the total loading to 264,500 pounds. The Adaptor and Adaptor Extension were both load tested to 386,240 pounds (168%) for 11 minutes. Following load testing the Adaptor and Adaptor Extension were disassembled for NDE. All side plates and bolts were subjected to magnetic particle testing (MT) and the pins were subjected to liquid penetrant testing (PT). No relevant indications were identified.

Documents Reviewed:
Transnuclear Calculation 1085-02, Lifting Beam For TN-32A Cask", dated June 2, 1999.
Catawba Calculation CNC-1126.01-00-0001, "Fuel Handling Long Lift Adaptor Extension Tool", dated April 11, 2007
Columbiana Hi Tech, LLC Certificate of Conformance, dated April 26, 2007
Hi Tech Manufacturing Proof/Load Test Certification, dated February 24, 2000

Category: <u>Special Lifting Devices</u> **Topic:** <u>Transporter Special Lifting Device Requirements</u>

Reference: NUREG 0612, Sect 5.1.1 (4)

Requirement: Special lifting devices should satisfy the guidelines of ANSI N14.6 "Standard for Special Lifting Devices for Shipping Containers Weighting 10,000 lbs or More for Nuclear Materials."

Finding: The intent of this requirement was achieved for both the header beam and lift links used on the transporter at Catawba to move the concrete canister loaded with fuel. Catawba prepared a design calculation for the fabrication of the transporter including the header beam and lift links for use at McGuire. This design calculation specified a bounding payload of 180 tons and specified allowable stresses for the upper structure (including the header beam and lift links) in accordance with the requirements of ANSI N14.6, Section 4.2.1.1. This section of ANSI N14.6 specified among other things that the special lifting device be capable of lifting three times the combined weight of the container without generating a combined shear stress or maximum tensile stress at any point in excess of the corresponding minimum tensile yield strength of the materials and be capable of lifting five times the weight without exceeding the ultimate tensile strength of the materials. Fabrication of the header beam, lift links and link pins for the Catawba transporter was specified to meet the requirements specified in Report 8703-303-M, which included the allowable design stresses specified by ANSI N14.6.

The maximum weight of the concrete cask including loaded canister used at Catawba was documented as 314,600 pounds (157.3 tons) in Table 3.2-1 of the NAC-UMS FSAR. On April 13, 2007 a load test of 125% of the rated load of 180 tons was conducted at Lift Systems, Inc. of the header beam, lift links and link pins. The load test and post-load weld inspections were determined to be satisfactory. Although ANSI N14.6 specified a load test of 150% of the rated load, the staff has historically accepted a load test of 125% of the header beam for a transporter along with the stress factors mentioned in the paragraph above. Based on the actual load used at Catawba, the load test of 227 tons equated to a 144% load test of the Catawba lifting equipment.

Documents Reviewed: Report 8708-303-M, "Spent Fuel Storage Cask Transporter," Revision 1; Lift Systems, Inc. Certificate of Load Test, Dated April 13, 2007

Category: <u>Special Lifting Devices</u> **Topic:** <u>Yoke Annual Testing</u>

Reference: ANSI N14.6, Sect 7.3.1; Sect 6.3.1

Requirement: Annually, not to exceed 14 months, the yoke shall be subjected to a test load equal to 300% of the maximum service load if a single component failure on the yoke could result in an uncontrolled lowering of the load. If the design for handling the load incorporates a single-failure proof concept, then each path in the dual-load-path device shall be tested to 150% of the load instead of the 300%. After sustaining the load for a period of not less than 10 minutes, critical areas, including major load bearing welds, shall be subject to visual inspection for defects and all components shall be inspected for permanent deformation. 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. Annual inspections of the lift yoke and lift yoke extension were completed on March 12, 2007, under Work Order #01706131 and Procedure PT/0/A/4150/041. The licensee elected to perform dimensional testing, visual inspection and nondestructive testing of major load-carrying welds and critical areas, in lieu of load testing. Paint was removed from all areas subjected to nondestructive testing and was re-applied upon completion of testing.

The lift yoke was inspected under Procedure PT/0/A/4150/041, Section 12.6 and Enclosure 13.3. The nondestructive examinations included: a) Liquid Penetrant Testing (PT) of the interior diameter of the crane hook pin hole bearing surfaces; b) PT testing of the vertical shear sections at the edges of the strongback weldment tabs; c) PT testing of the bearing surface on the palm of each J-Hook; d) PT testing of the bearing surfaces on the J-Hook slots; and e) Magnetic Particle Testing (MT) of the shank hook. No relevant indications were identified. The visual inspection included all load bearing welds and critical areas of the lift yoke. No defects, deformation, cracks, signs of wear, or damage were identified.

The lift yoke extension was inspected under Procedure PT/0/A/4150/041, Section 12.2 and Enclosure 13.1. The nondestructive examinations included: a) Ultrasonic Testing (UT) of the upper and lower pins; b) PT testing of the interior diameter of the upper and lower pin hole bearing surfaces; c) and MT testing of the upper and lower shaft full penetration butt welds. No relevant indications were identified. The visual inspection included all load bearing welds and critical areas of the lift yoke extension. No defects, deformation, cracks, signs of wear, or damage were identified.

Documents Reviewed: PT/0/A/4150/041, "Annual Inspection of ISFSI Lifting Devices," Revision 2 (Completed Date 3/15/07); Work Order #01706131 released for work on January 30, 2007

Category: Special Lifting Devices **Topic:** Yoke Initial Acceptance Testing

Reference: ANSI N14.6, Sect 7.3.1; Sect 6.2.1; Sect 6.5

Requirement: Prior to initial use, the yoke shall be subjected to a test load equal to 300% of the maximum service load if a single component failure on the yoke could result in an uncontrolled lowering of the load. If the design for handling the load incorporates a single-failure proof concept, then each path in the dual-load-path device shall be tested to 150% of the load instead of the 300%. 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 achieved. The licensee provided data showing that the lift yoke and transfer cask trunnions had been tested at the same time. The transfer cask primary trunnions and lift yoke were tested to 704,565 pounds on September 24, 2002 in accordance with Paragraph 4.1 of Procedure 01-020-LT. A test bridge was installed on top of the transfer cask, spanning the diameter. Hydraulic rams were then placed on top of the bridge. The lifting yoke was suspended above the hydraulic rams while the lifting yoke arms were engaged with the primary trunnions. The hydraulic rams were then extended to transfer the weight of the lifting yoke from the crane to the rams. Hydraulic pressure, equivalent to a load of 704,565 pounds, was then applied to the rams. The upward force against the lifting yoke was transmitted to the primary trunnions through the lifting yoke arms. The proof load was maintained for 11 minutes and, while still under load, the primary trunnions were visually inspected. No damage or cracking was identified. Following load testing, the lift yoke was visually inspected for evidence of cracking, galling, and permanent deformation.

Documents Reviewed: Hi Tech Manufacturing Procedure 01-020-LT, "Load Test Procedure," Revision 1; Hi Tech Manufacturing Proof/Load Test Certification, Dated September 30, 2002; NAC-UMS FSAR 1015, Revision 3

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

Reference: ANSI N14.6, Sect 6.3.6

Requirement: The yoke shall be visually inspected by operating personnel for indications of damage prior to each use.

Finding: This requirement was achieved. Both the Duke Lifting Program and Procedure TT/0/A/9100/099 included provisions for performing visual inspections to the yoke prior to each use. The inspector interviewed maintenance personnel and observed various lifts during the dry run demonstration, which indicated that the visual inspection requirements for the yoke before each lift were being properly followed.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12; Catawba Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 2

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

Reference: ANSI N14.6, Sect 6.3.2

Requirement: The initial testing requirements for the yoke, specified in ANSI N14.6, Section 6.2.1 shall be repeated prior to use following any major maintenance or alteration. Major maintenance or alteration is defined as repair or design change in which load bearing members are subject to heat above 300 degree F.

Finding: This requirement was achieved. The lifting program included provisions for load testing after major maintenance or alterations of lifting equipment, including the lift yoke.

Documents Reviewed: Duke Energy Carolinas Lifting Program, Revision 12

Category: Special Lifting Devices **Topic:** Yoke Static/Dynamic Load Criteria

Reference: NUREG 0612, Sect 5.1.1(4); ANSI N14.6 Sect 4.2.1.1

Requirement: The stress design factors stated in ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device.

Finding: This requirement was implemented. Section 5.1.1 of Calculation 12418-2001 presented the ANSYS Model used in the structural analysis for the lift yoke. The model included a static loading of 115 tons for the transfer cask, plus a static loading of 2 tons for the crane hook, plus a 10% dynamic loading. The total weight modeled was 115 + 2 + 11.7 = 128.7 tons.

Since no redundancy was provided in the lift yoke, safety factors of 6 for yield stress and 10 for ultimate stress were required. The model demonstrated that the safety factor on yield stress was 14.74 and the safety factor on ultimate stress was 16.96. The stress design factors, including static and dynamic forces, were above the minimum requirements established in ANSI N14.6 and NUREG 0612.

Documents Reviewed: NAC International Calculation 12418-2001, "McQuire Lift Yoke Structural Evaluation", dated February 12, 2002

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. Section 6.1 of Procedure TT/0/A/9100/099 limited operation of refueling and dry cask storage equipment to qualified maintenance personnel and to trainees under their direct supervision. The Learning Management System (LMS) database was accessible from any network computer, thus enabling the job supervisor to immediately determine a person's qualifications and certifications.

Documents Reviewed: Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002

Category: Training **Topic:** Health Requirement for Certified Personnel

Reference: 10 CFR 72.194

Requirement: The physical condition and the general health of personnel certified for the operation of equipment and controls that are important to safety must not be such as might cause operational errors that could endanger other in plant personnel or the public health and safety. Any condition that might cause impaired judgment or motor coordination must be considered in the selection of personnel for activities that are important to safety. These conditions need not categorically disqualify a person if appropriate provisions are made to accommodate such defect.

Finding: This requirement was implemented. The personnel assigned to operate the ISFSI equipment had received physical examinations within the past year. The physical examinations included audiometric, pulmonary function testing, vision testing, urinalysis, blood work, blood pressure and pulse, EKG beginning at age 42, chest x-ray for those employees in the asbestos or arsenic surveillance programs, and a physical exam of eyes, ears, nose and throat, heart, lungs and reflexes. All personnel had been cleared by the physician to perform the ISFSI work.

Documents Reviewed: Form 399187, "Medical Questionnaire For Clearance Exam", Revision 11; Form 399190, "Nurse's Exam For Clearance", Revision 11; Form 398996, "Physician's Exam For Clearance", Revision 11

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Category: Training **Topic:** NRC 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. Catawba licensed operators provided oversight for dry fuel storage operations and the non-licensed operators monitored storage cask temperatures once the casks were loaded. ISFSI specific training for operators was classified as Emergent Issues Training and was incorporated into the Licensed Operator Requalification (LOR) program. The training consisted of classroom instruction under Lesson Plan OP-CN-EI-ISFSI, which was completed on March 13, 2007. The instruction provided an overview of the NAC storage system design including the SAR, SER and Certificate of Compliance. The instruction also covered the basic steps involved in fuel loading, transportation, and storage cask temperature monitoring. During the inspection, interviews with a Work Control Center Senior Reactor Operator and a non-licensed operator indicated that the training was effective.

Catawba maintenance personnel performed the dry fuel storage operations. Completion of basic maintenance certification under Employee Training and Qualification Standard, ETQS 3101.0, was a prerequisite for ISFSI training. The ISFSI-specific training for maintenance personnel included:

Classroom Instruction, TTN675, "Fuel Initial Training"
Classroom Instruction, CNMD-93, "UMS NAC Dry Cask Storage"
OJT Training, CN-MECH-OT-0175-R01 - "Operate the Overhead Fuel Building Cranes"
OJT Training, CN-MECH-OT-0176-R01 - "Operate All Fuel Component Handling Tools"
OJT Training, CN-MECH-OT-0178-R01 - "Operate the Spent Fuel Pool Manipulator Crane"
OJT Training, CN-MECH-OT-2184-R00 - "Operation of Dry Cask Transporter"
OJT Training, CN-MECH-BT-NAC Dry Cask - R00 - "NAC UMS Dry Cask"

The ISFSI tasks not covered in the above training were rolled-up into Task CN-MECH-BT-NAC Dry Cask. Under this task, loading procedure TT/0/A/9100/099 was presented in the classroom and was performed in the field during the pre-operational testing.

Catawba radiation protection personnel provided the radiological controls for dry fuel storage operations. Completion of the Catawba basic radiation protection technician certification was a prerequisite for ISFSI training. The skills and knowledge required for basic certification included:

CO-RP-0001, "Taking Counting and Recording Surveys"
CO-RP-0002, "Use of Alpha and Beta/Gamma Smear Counters"
CO-RP-0003, "Posting and RCZ Construction"
CO-RP-0004, "Control and Storage of Radioactive Materials"
CO-RP-0005, "Monitor and Coach Workers Entering/Exiting RCA/RCZs"

The ISFSI-specific training for radiation protection personnel included classroom instruction under Lesson Plan RP-MC-RFT-264. Under this lesson plan, radiation protection loading procedure RA-2-1100-006 was presented in the classroom and was performed in the field during pre-operational testing.

Prior to initial fuel loading, all ISFSI-specific training had been approved by station management. The Learning Management System (LMS) database had been updated to indicate completion of required training for all personnel performing dry fuel storage activities.

Documents Reviewed: Employee Training and Qualification Standard, ETQS 3101.0, "Maintenance Training and Qualification", Revision 10; Lesson Plan OP-CN-EI-ISFSI, "Independent Spent Fuel Storage Installation", Revision 00
Lesson Plan CNMD-93, "Dry Cask Storage," Revision Draft; Lesson Plan RP-MC-RFT-264, "NAC-UMS Dry Cask Storage", Revision 00; Procedure PT/0/A/4600/031, "NAC-UMS Cask Surveillance", Revision 000; Procedure TT/0/A/9100/099, "NAC-UMS Spent Fuel Cask Dry Run Procedure", Revision 002;
Procedure RA-2-1100-006, "Unit 2 Controls and Surveillance for Loading Spent Fuel Assemblies into NAC-UMS Casks", Revision 000; Task CO-MECH-BT-NAC, "NAC Dry Cask"

Category: Training **Topic:** Training Program

Reference: CoC 1015, Tech Spec A.5.1

Requirement: A training program shall be developed under the general licensee's systematic approach to training (SAT). Training modules shall include comprehensive instructions for the operations and maintenance of the cask and ISFSI.

Finding: This requirement was implemented. All dry cask storage training programs were developed using the systematic approach to training (SAT) process. The licensee performed a job and task analysis for the ISFSI operation and determined that the majority of the skills and knowledge needed for performance of the ISFSI tasks were contained in existing qualification programs. Specialized tasks not previously trained were identified and incorporated into the training guides and lesson plans.

Documents Reviewed: Employee Training and Qualification Standard, ETQS 3101.0, "Maintenance Training and Qualification", Revision 10; Lesson Plan OP-CN-EI-ISFSI, "Independent Spent Fuel Storage Installation", Revision 00; Lesson Plan CNMD-93, "Dry Cask Storage," Revision Draft ; Lesson Plan RP-MC-RFT-264, "NAC-UMS Dry Cask Storage", Revision 00.

Category: Welding Materials **Topic:** Minimum Delta Ferrite Content

Reference: ASME Section III, Article NB-2433; Reg Guide 1.31

Requirement: A delta ferrite determination must be made for A-No.8 consumable inserts, bare electrode, rod, or wire filler metal. Exceptions: 1) A-No.8 metal used for weld metal cladding; 2) SFA-5.4 and SFA-5.9 metal; 3) Type 16-8-2 metal. The minimum acceptable delta ferrite content is 5 FN and it must be stated in the certification records.

Finding: This requirement was implemented. The cut lengths of weld wire purchased under PO

#CN65156 were SFA 5.9 Class ER 308/308L. The ARCOS Certification of Tests stated the delta ferrite content was 8 FN. The spool of weld wire purchased under PO #MN89904 was SFA 5.9 Class ER 308. The ARCOS Certification of Tests stated the delta ferrite content was 7 FN.

Documents Reviewed: ARCOS Industries, LLC Certification of Tests for Purchase Order #CN65156 (Catawba)
ARCOS Industries, LLC Certification of Tests for Purchase Order #MN89904 (McGuire)

Category: Welding Personnel Quals **Topic:** Qualification Expiration

Reference: ASME Section IX, Part QW-322.1

Requirement: The performance qualification of a welder or welding operator, for any process, shall expire when he has not welded with that process for six months or more.

Finding: This requirement was implemented. Whenever welding material was drawn from stores under a Welding Material Issue Slip, the welding supervisor updated the welder activity database and assigned a new expiration date six months into the future. The database printout dated 04/04/2007 indicated that all welders and welding operators assigned to the ISFSI project had performed manual or machine GTAW welding within the past 6 months.

Documents Reviewed: Computer Printout of Welder Activity, dated April 4, 2007; Welding Material Issue Slips, dated April 4, 2007

Category: Welding Personnel Quals **Topic:** Welder Performance Qualification (WPQ)

Reference: ASME Section IX, Parts QW-301.4, 356, 452.1, 6

Requirement: The record of welder performance qualification (WPQ) tests shall include the essential variables listed in QW-350, the type of test and test results, and the ranges qualified in accordance with QW-452. The essential variables for manual GTAW welding are: (1) Backing; (2) Base metal P-number; (3) Filler metal F number; (4) Consumable inserts; (5) Filler metal form; (6) Maximum weld deposit thickness; (7) Welding positions; (8) Welding progression; (9) inert gas backing; and (10) Current type and polarity. Two side bend tests are required for groove weld test coupons 3/8 inch thick or greater. Groove weld tests qualify fillet welds.

Finding: This requirement was implemented. The performance qualification tests for manual GTAW were welded in accordance with welding procedure specification (WPS) GTSM0801-01. The performance qualification tests contained all of the essential variables for manual GTAW required by the referenced ASME code sections.

Documents Reviewed: Welder Performance Qualification Records

Category: Welding Personnel Quals **Topic:** Welder Performance Qualification Test (WPQ)

Reference: ASME Section IX, Part QW-301.2

Requirement: The welder performance qualification test shall be welded in accordance with a qualified welding procedure specification (WPS), unless preheat or post weld heat treatment is specified.

Finding: This requirement was implemented. At the time of the inspection, four welders were qualified to make closure welds on the NAC-UMS canister. Three were qualified for both manual and machine GTAW. The fourth was qualified for machine GTAW only.

The performance qualification tests for machine GTAW were welded in accordance with welding procedure specification (WPS) GTOO0808-01 without preheat or post weld heat treatment. The Radiographic Testing (RT) method of NDE was used and the welds were satisfactory.

The performance qualification tests for manual GTAW were welded in accordance with welding procedure specification (WPS) GTSM0808-01 without preheat or post weld heat treatment. The Radiographic Testing (RT) method of NDE was used and the welds were satisfactory.

Documents Reviewed: Welder Performance Qualification Records

Category: Welding Personnel Quals **Topic:** Welding Operator Performance Qualification

Reference: ASME Section IX, Parts QW-301.4, 361.2, 452.1, 6

Requirement: The record of welding operator performance qualification (WOPQ) tests shall include the essential variables listed in QW-360, the type of test and test results, and the ranges qualified in accordance with QW-452. The essential variables for machine welding are: (1) welding process; (2) direct or remote visual control; (3) automatic arc voltage control (GTAW); (4) automatic joint tracking; (5) position qualified; (6) consumable inserts; (7) backing; and (8) single or multiple passes per side. Two side bend tests are required for groove weld test coupons 3/8 inch thick or greater. Groove weld tests qualify fillet welds.

Finding: This requirement was implemented. The performance qualification tests for machine GTAW were welded in accordance with welding procedure specification (WPS) GTOO0808-01. The performance qualification tests contained all of the essential variables for machine GTAW required by the referenced ASME code sections.

Documents Reviewed: Welder Performance Qualification Records

Category: Welding Procedures **Topic:** GTAW Essential Variables

Reference: ASME Section IX, Part QW-256

Requirement: The welding procedure specification for Gas Tungsten Arc Welding (GTAW) shall describe the following essential variables: (1) Base metal thickness range; (2) Base metal P number; (3) Filler metal F number; (4) Filler metal A number; (5) Filler metal product form (flux, metal, powder); (6) Maximum weld deposit thickness; (7) Minimum preheat temperature; (8) PWHT conditions; (9) Shielding gas mixture; and (10) Trailing Shielding gas mixture and flow rate.

Finding: This requirement was implemented. The welding procedure specifications for both manual and machine GTAW contained all of the essential variables required by ASME Section IX, Part QW-256.

Documents Reviewed: Welding Procedure Specification (WPS) GTOO0808-01, "Mechanized GTAW", Revision 3; Welding Procedure Specification (WPS) GTSM0808-01, "GTAW, SMAW or Combination", Revision 6

Category: Welding Procedures **Topic:** GTAW Non Essential Variables (1-14)

Reference: ASME Section IX, Part QW-256

Requirement: The welding procedure specification for Gas Tungsten Arc Welding (GTAW) must describe the following non-essential variables: (1) Joint design; (2) Backing; (3) Backing material; (4) Root spacing; (5) Retainers; (6) Filler metal size; (7) Consumable inserts; (8) Filler metal SFA specification number; (9) Filler metal AWS classification number; (10) Welding positions; (11) Welding progression; (12) Trailing Shielding gas composition and flow rate; (13) Pulsing current; (14) Current type and polarity;

Finding: This requirement was implemented. The welding procedure specifications for both manual and machine GTAW contained all of the non essential variables required by ASME Section IX, Part QW-256.

Documents Reviewed: Welding Procedure Specification (WPS) GTOO0808-01, "Mechanized GTAW", Revision 3; Welding Procedure Specification (WPS) GTSM0808-01, "GTAW, SMAW or Combination", Revision 6

Category: Welding Procedures **Topic:** GTAW Non Essential Variables (15-27)

Reference: ASME Section IX, Part QW-256

Requirement: The welding procedure specification for Gas Tungsten Arc Welding (GTAW) must also describe the following non-essential variables: (15) Amperage range; (16) Voltage range; (17) Tungsten size; (18) String or weave bead; (19) Orifice or gas cup size; (20) Method of initial and interpass cleaning; (21) Method of back gouging; (22) Oscillation width; (23) Multiple or single pass per side; (24) Multiple or single electrodes; (25) Electrode spacing; (26) Travel mode and speed; and (27) Peening.

Finding: This requirement was implemented. The welding procedure specifications for both manual and machine GTAW contained all of the non essential variables required by ASME Section IX, Part QW-256.

Documents Reviewed: Welding Procedure Specification (WPS) GTOO0808-01, "Mechanized GTAW", Revision 3; Welding Procedure Specification (WPS) GTSM0808-01, "GTAW, SMAW or Combination", Revision 6

Category: Welding Procedures **Topic:** GTAW Supplementary Essential Variables

Reference: ASME Section IX, Part QW-256

Requirement: The welding procedure specification for Gas Tungsten Arc Welding (GTAW) must describe the following supplementary essential variables, when required: (1) Base metal group number; (2) Base metal thickness range; (3) Welding positions; (4) Maximum interpass temperature; (5) PWHT conditions; (6) Current type and polarity); (7) Multiple or single pass per side; and (8) Multiple or single electrodes.

Finding: This requirement was implemented. The welding procedure specifications for both manual and machine GTAW contained all of the supplementary essential variables required by ASME Section IX, Part QW-256.

Documents Reviewed: Welding Procedure Specification (WPS) GTOO0808-01, "Mechanized GTAW", Revision 3; Welding Procedure Specification (WPS) GTSM0808-01, "GTAW, SMAW or Combination", Revision 6

Category: <u>Welding Procedures</u> **Topic:** <u>Procedure Qualification Record (PQR)</u>

Reference: ASME Section IX, Part QW-200.2

Requirement: Each manufacturer or contractor shall prepare a Procedure Qualification Record (PQR) for each procedure. The completed PQR shall document all essential and, when required, all supplementary essential variables of QW-250 through QW-280 for each welding process used during the welding of the test coupon. Non essential variables may be documented at the contractor's option. The PQR shall be certified accurate by the manufacturer or contractor.

Finding: This requirement was implemented. Procedure Qualification Record No. L-104D documented successful welding of the test coupons using the Machine GTAW process and WPS GTOO0808-01. ASME Section IX side bend destructive testing performed on the 4 test coupons indicated the weld strengths were acceptable.

Procedure Qualification Record No. L-110D documented successful welding of the test coupons using the Manual GTAW process and WPS GTSM0808-01. ASME Section IX face bend and root bend destructive testing performed on the 4 test coupons indicated the weld strengths were acceptable.

Both PQRs contained all of the essential variables, the applicable supplementary essential variables, and the majority of the non-essential variables. The statements in the PQRs were certified accurate by the testing laboratory and by Duke Power Company.

Documents Reviewed: Procedure Qualification Record No. L-104D, dated January 11, 1990
Procedure Qualification Record No. L-110D, dated February 11, 1991

Category: <u>Welding Procedures</u> **Topic:** <u>Tack Welds</u>

Reference: ASME Section III, Article NB-4231.1

Requirement: Tack welds used to secure alignment shall either be removed completely when they have served their purpose, or their stopping and starting ends shall be properly prepared by grinding or other suitable means so that they may be satisfactorily incorporated into the final weld. When tack welds are to become part of the finished weld, they shall be visually examined and defective tack welds shall be removed.

Finding: This requirement was implemented. The licensee was using Procedure NDE-60 for inspection of tack welds made on dry fuel storage canisters. The requirements for tack welds contained in Section 7.1 of Procedure NDE-60 were consistent with ASME Section III, Article NB-4231.1. During the demonstration, the first 3 shield lid tack welds indicated off-center starts, late wire feed, and abrupt downslopes. The ends of these three tack welds were ground out for incorporation into the root pass. The remaining 5 shield lid tack welds did not require grinding prior to incorporation into the root pass.

Documents Reviewed: Procedure NDE-60, "Visual Examination of Welds and Brazed Joints", Revision 010

Category: Welding Procedures **Topic:** Weld Repairs - Base Metal Defects

Reference: ASME Section III, Article NB-4132

Requirement: Weld repairs exceeding in depth the lesser of 3/8 inch (10 mm) or 10 percent of the section thickness, shall be documented on a report which shall include a chart which shows the location and size of the prepared cavity, the welding material identification, the welding procedure, the heat treatment, and the examination results of the weld repair.

Finding: This requirement was implemented. The licensee was using Procedure NIPM QAL-16 for inspection of repairs made to closure welds on the dry fuel storage canisters. Section 5.11.4 of Procedure NIPM QAL-16 provided requirements for weld repairs exceeding in depth the lesser of 3/8 inch (10 mm) or 10 percent of the section thickness. The weld repair documentation required by this section of the procedure was consistent with ASME Section III, Article NB-4132.

Documents Reviewed: Nuclear Program Inspection Manual NIPM QAL-16, "Inspection of ASME Section XI Field Piping Welds", Revision 26

Category: Welding Procedures **Topic:** Weld Repairs - Surface Defects

Reference: ASME Section III, Article NB-4452; NB-2538.c

Requirement: Surface defects may be removed by grinding or machining without weldout provided the minimum section thickness is maintained, the depression is blended and liquid penetrant testing is performed to ensure the defect is removed.

Areas ground to remove oxide scale or other mechanically caused impressions for appearance or to facilitate proper ultrasonic testing need not be examined by the magnetic particle or liquid penetrant test method.

Finding: This requirement was implemented. The licensee was using Procedure NIPM QAL-16 for inspection of weld repairs on the dry fuel storage canisters. Section 5.11.2 of Procedure NIPM QAL-16 provided requirements for removal of surface defects. The requirements contained in this section of the procedure were consistent with ASME Section III, Articles NB-4452 and NB-2538.c.

Documents Reviewed: Nuclear Program Inspection Manual NIPM QAL-16, "Inspection of ASME Section XI Field Piping Welds", Revision 26

Category: Welding/NDE **Topic:** Hydrogen Gas Monitoring

Reference: FSAR 1015, Section 3.4.1.2.2

Requirement: FSAR Section 3.4.1.2.2, under requirements for "Loading Operations," specifies that monitoring for hydrogen gas will be implemented prior to beginning welding operations and continued through the completion of the root pass of the shield lid-to-shell weld. The hydrogen detector shall be mounted so as to detect hydrogen prior to welding and continuously during welding. The system shall be capable of detecting 60% LEL of hydrogen, which equates to 2.4% hydrogen. If hydrogen is detected at or above 2.4%, stop welding and remove the hydrogen gas by flushing ambient air in the region below the shield lid. Note: FSAR Section 8.1.1.21 also discusses hydrogen monitoring.

Finding: This requirement was not implemented at the time of the initial inspection but was adequately implemented prior to fuel loading. The acceptable methods for monitoring hydrogen and the personnel responsible for the monitoring were not clearly defined in the procedure during the pre-operational demonstration.

The licensee subsequently revised Procedure MP/0/A/7650/176 to clearly define the hydrogen monitoring requirements. Step 4.3.3 of Procedure MP/0/A/7650/176 required monitoring for hydrogen during all welding, grinding or cutting operations on the shield lid after installation into the canister. Step 6.6 of Procedure MP/0/A/7650/176 required the hand held hydrogen monitoring equipment to be staged and functional prior to welding the shield lid. Step 6.9 of Procedure MP/0/A/7650/176 required the Vacuum Drying System monitor used for hydrogen detection to be visible to the welder at the welding control console. The CAUTION at the beginning of Section 11.3 clearly required welding activities to stop whenever hydrogen concentration exceeded 2.4% (60% of LEL). Enclosure 13.2 was added to Procedure MP/0/A/7650/176 to provide instructions for operating the hand held hydrogen detector.

Documents Reviewed: Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 001

Category: Welding/NDE **Topic:** Weld Exam - Progressive PT on Structural Lid

Reference: CoC 1015, Table B.3-1 & FSAR 1015, Section 1.2.1.1

Requirement: Field installed welds that are not ultrasonically inspected will be root and final surface liquid penetrant (PT) inspected and progressive (i.e., at weld thickness intervals not to exceed 0.375 inch) PT examined to ensure detection of critical weld flaws. The inspections assure weld integrity in accordance with ASME Code, Section V, Articles 5 and 6, as appropriate.

Finding: This requirement was not clearly implemented at the time of the initial inspection but was clarified prior to the initial fuel loading and found to be acceptable. Section 11.5 of Procedure MP/0/A/7650/176 required liquid penetrant testing of the "root layer" of the structural lid-to-shell weld. "Root layer" was defined as up to 2 passes, which was not consistent with the ASME code exemption granted in the NAC Certificate of Compliance. The licensee generated PIP C-07-0167 to track resolution of this discrepancy.

The licensee subsequently analyzed the structural lid weld process, materials and geometry and determined that the critical flaw size for a surface connected flaw was 0.149 inches. Based on this analysis, the licensee revised Section 11.5 of Procedure MP/0/A/7650/176 to limit the thickness of the root layer to 1/8 inch (0.125 inches) prior to performing the first liquid penetrant test. Limiting the root layer thickness to 1/8 inch ensured that flaws could not exceed critical flaw size, regardless of the number of passes.

Section 11.5 of Procedure MP/0/A/7650/176 also specified the maximum weld thickness interval of 3/8 inch (0.375 inches) between liquid penetrant tests and required liquid penetrant testing of the final weld pass.

Documents Reviewed: Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 0, Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 001

Category: Welding/NDE **Topic:** Weld Exam - PT of Lid Welds

Reference: CoC 1015, App B Table B.3-1

Requirement: Root and final surface liquid penetrant examination of the shield lid welds and drain and vent port cover welds will be performed per ASME Code Section V, Article 6 with acceptance in accordance with ASME Code, Section III, NB-5350

Finding: This requirement was not clearly implemented at the time of the initial inspection but was clarified prior to the initial fuel loading and found to be acceptable. Section 11.3 of Procedure MP/0/A/7650/176 required liquid penetrant testing of the "root layer" of the shield lid-to-shell weld. "Root layer" was defined as up to 2 passes, which was not consistent with the ASME code exemption granted in the NAC Certificate of Compliance. The licensee generated PIP C-07-0167 to track resolution of this discrepancy.

The licensee subsequently analyzed the weld process, materials and geometry for the shield lid and for the drain and vent port covers and determined that the critical flaw size for a surface connected flaw was 0.149 inches. Based on this analysis, the licensee revised Section 11.3 of Procedure MP/0/A/7650/176 to limit the thickness of the root layer to 1/8 inch (0.125 inches) prior to performing the first liquid penetrant test. Limiting the root layer thickness to 1/8 inch ensured that flaws could not exceed critical flaw size, regardless of the number of passes. Section 11.3 also required liquid penetrant testing of the final weld pass.

Section 11.4 of Procedure MP/0/A/7650/176 required liquid penetrant testing of the root layer on the drain and vent port covers. However, the root layer was not defined for these welds. The licensee revised Section 11.4 of Procedure MP/0/A/7650/176 to limit the thickness of the root layer to 1/8 inch (0.125 inches) prior to performing the first liquid penetrant test. Section 11.4 also required liquid penetrant testing of the final weld pass.

Documents Reviewed: Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 00, Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 001

Category: Welding/NDE **Topic:** Weld Integrity Record

Reference: FSAR 1015, Section 9.1.1.1

Requirement: The results of the structural lid dye penetrant examination final liquid penetrant examination, including all relevant indications, as described in ASME Code, Section V, Article 6, T-676, are recorded by video, photographic or other means to provide a retrievable record of weld integrity.

Finding: This requirement was implemented. Steps 11.5.20 and 11.5.22 of Procedure MP/0/A/7650/176 required Quality Control (QC) to perform a final NDE of the structural lid weld and to document the results in accordance with Weld Process Control. QC recorded the results of the final liquid penetrant (PT) testing of the structural lid on Weld Process Control Form MWP-18. The MWP-18 form completed during the demonstration was reviewed and found to be complete. The form included all relevant indications and met the requirement for a retrievable record of weld integrity.

Documents Reviewed: Procedure MP/0/A/7650/176, "Cask-NAC-UMS Transportable Storage Canister Welding", Revision 000
Weld Process Control Form MWP-18, Revision 9.