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NRC Regional ISFSI Inspections

Taiwan ISFSI Workshop
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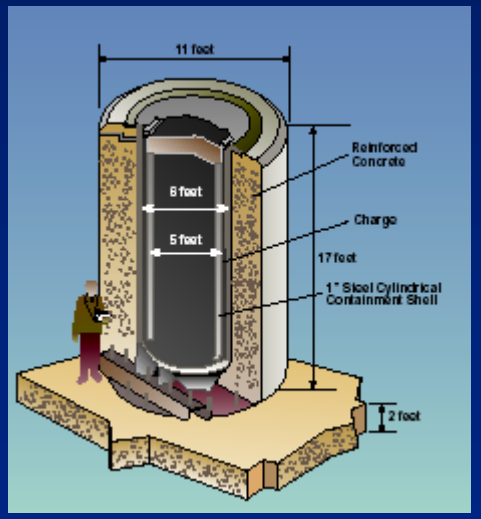
Outline

- ISFSI Locations in US
- NRC Regional Boundaries
- Role of Headquarters and Regions During ISFSI Inspections
- Regional Inspection Focus
- Inspection Preparation
- Inspection Databases
- Industry Lessons Learned



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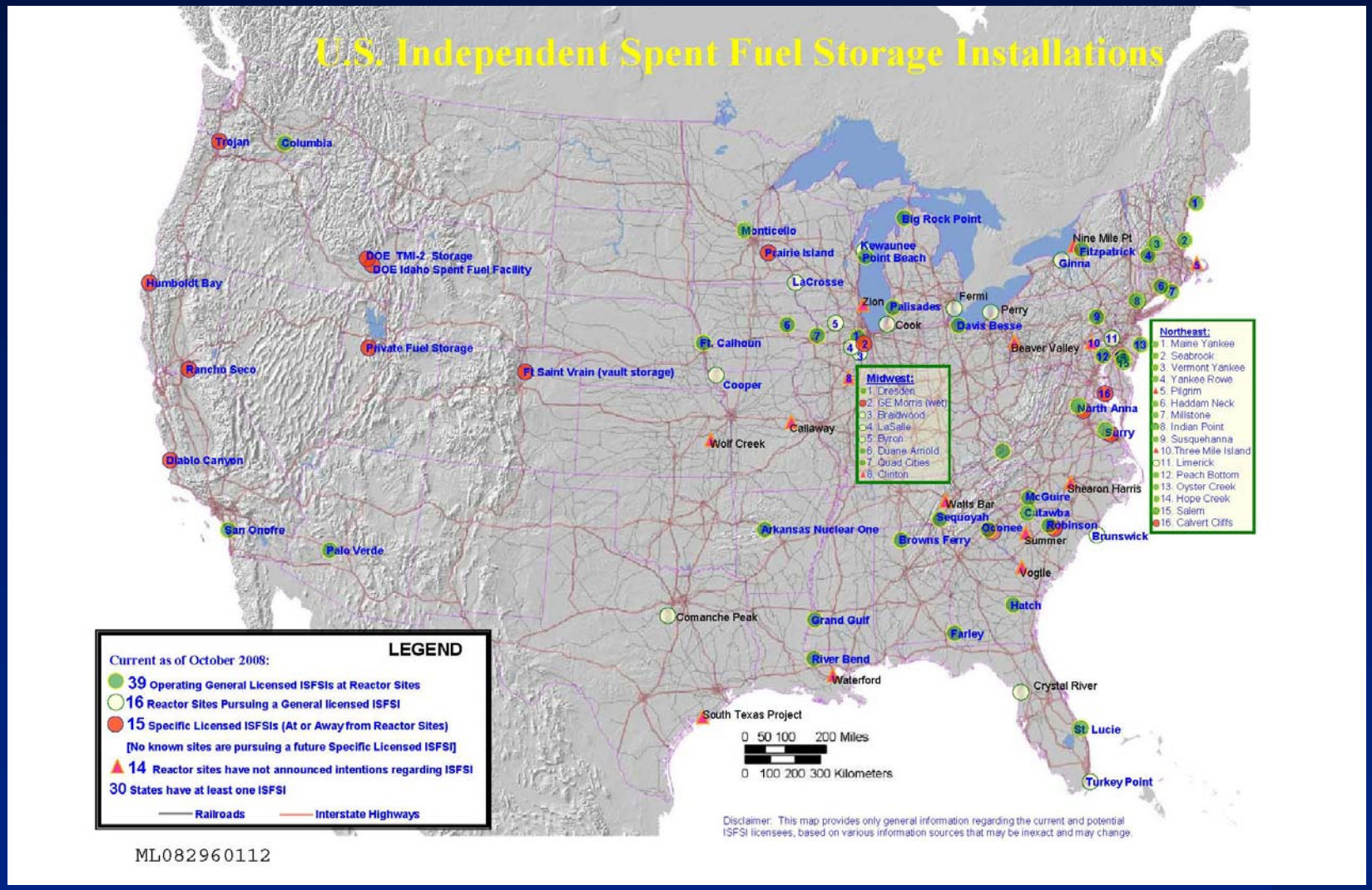
ISFSI Locations in US



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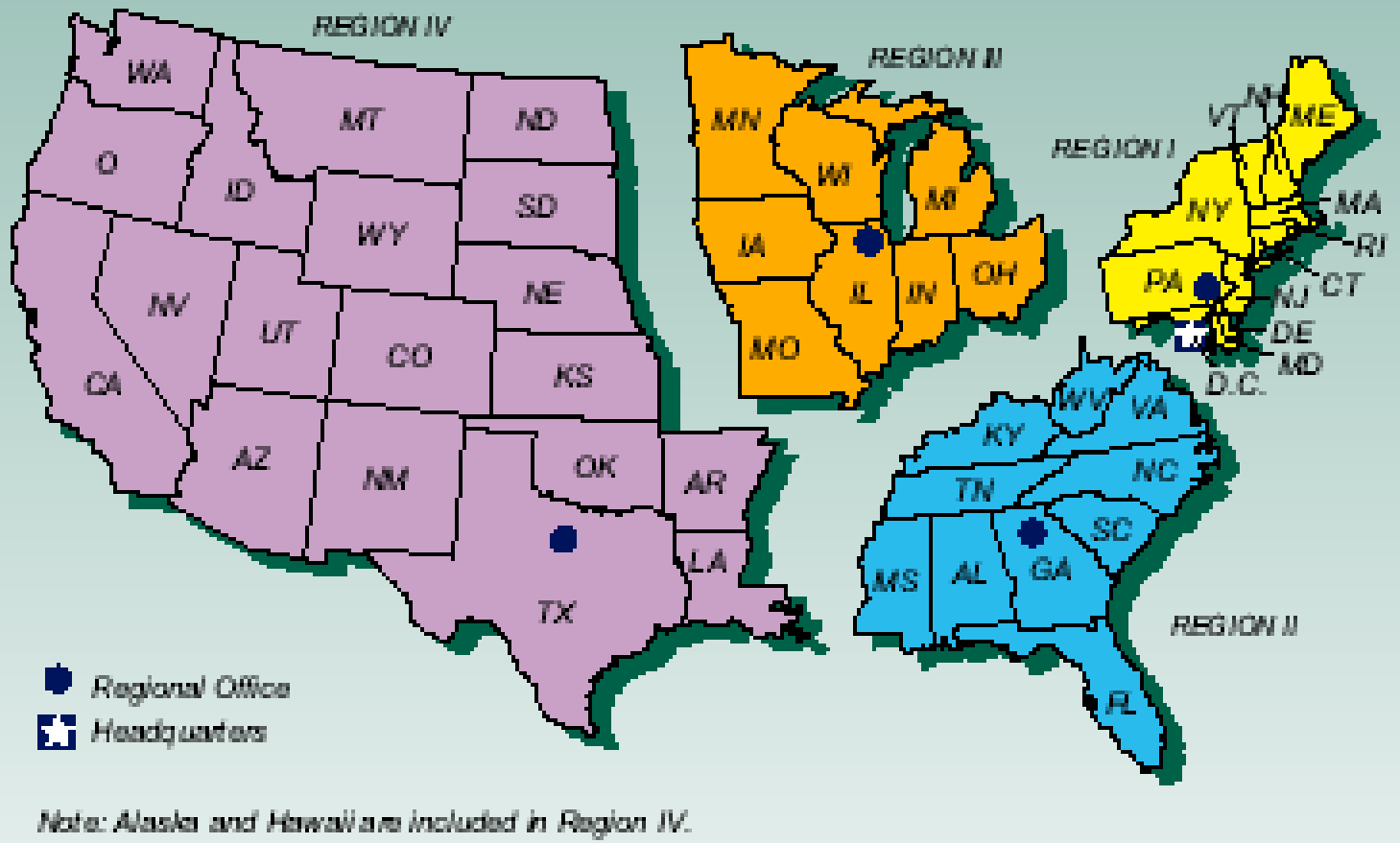
NRC Regions



Note: Alaska and Hawaii are included in Region IV.

Role of HQ and Regions

- HQ–Spent Fuel Storage & Transportation
  - Licensing
  - Vendor inspections
  - Support regional inspections
- Regions
  - ISFSI Inspections
    - Pre-operational
    - Routine operational
    - Physical Security
  - Event response and reactive inspections

Regional Inspection Focus

- Focus on risk significant activities
- Pre-operational and initial cask loading
  - Largest inspection effort (team inspection)
  - Inspect licensee demonstrations and program changes
  - Source of majority of inspection findings
- Routine operational inspections
  - Focus on performance, program changes and emergent issues
- Reactive inspections

Inspection Preparation

- Inspector resources:
  - Inspection Procedures (IP)
  - 10 CFR Part 72
  - Certificate of Compliance (CoC)
  - Site-specific license
  - Technical Specifications
  - Safety Evaluation Report (SER)
  - Final Safety Analysis Report (FSAR)
  - Recent licensee inspection reports
  - Industry events & NRC generic communication
  - Licensee Documents

Inspection Databases

- 10 CFR Part 72 Requirements
  - General License Requirements
  - Site Specific Requirements
  - Some overlap between two databases
- Concrete Construction Requirements
  - ISFSI and Concrete Overpacks
  - American Concrete Institute (ACI) 349 for Important-To-Safety Concrete
  - ACI 318 for Not-Important-To-Safety Concrete
  - Considerable overlap between the two databases
  - Includes applicable requirements from American Society for Testing and Materials (ASTM)

Inspection Databases

- Overhead Cranes
  - Single-Failure-Proof cranes
  - Non-Single-Failure-Proof cranes
  - NUREG 0612 requirements for heavy loads and cranes
  - NUREG 0554 requirements for single-failure-proof cranes
  - ANSI N14.6 requirements for special lifting devices
  - ASME B30.2 requirements for overhead cranes
  - ASME B30.9 requirements for slings

Inspection Databases

- Welding and Non-Destructive Examinations
  - Includes welding processes that will be used on the cask (Shielded Metal Arc Weld-SMAW; Gas Metal Arc Weld – GMAW and Gas Tungsten Arc Weld – GTAW)
  - Includes NDE that will be used (Visual Test – VT; Dye Penetrant Test – PT; Helium leak test; Hydrostatic test)
  - Includes welding variables and personnel qualifications

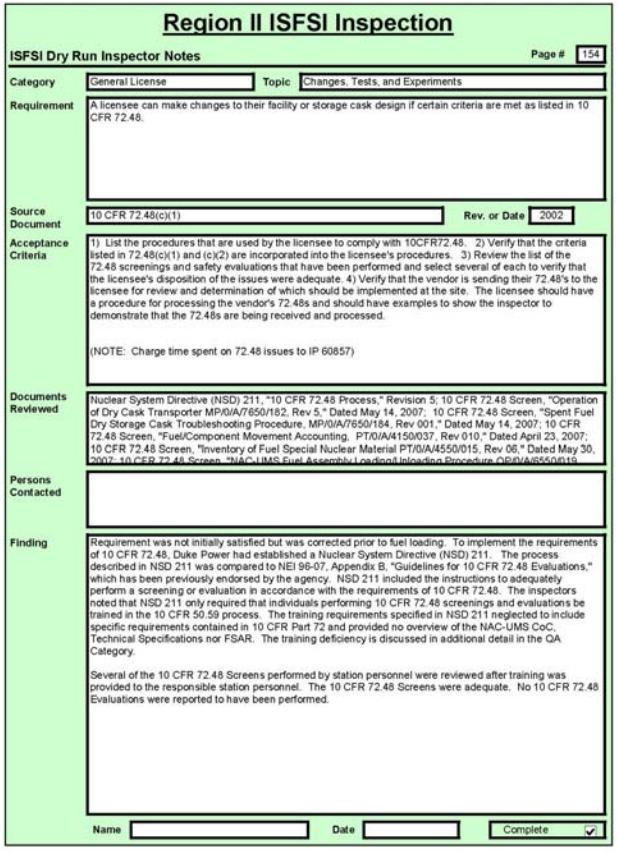
Inspection Databases

- Site and Cask Specific Requirements
  - Taken from the Certificate of Compliance (CoC); Technical Specifications and the FSAR for general licensees
  - Taken from the License, Technical Specifications and the FSAR for site specific licensees
  - Vendor Cask Databases developed for:
    - Holtec
    - NUHOMS
    - NAC UMS
- Databases must be updated prior to next use when the governing requirements change

Inspection Databases

- Databases include inspections of:
  - Cask loading activities
  - Cask unloading activities
  - Fuel selection
  - Programs
    - Fire Protection
    - Safety Reviews
    - Quality Assurance
    - Emergency Planning
    - Corrective Actions
    - Radiation Protection
    - Records
    - Security
    - Training

Inspection Databases
Inspector Datasheets

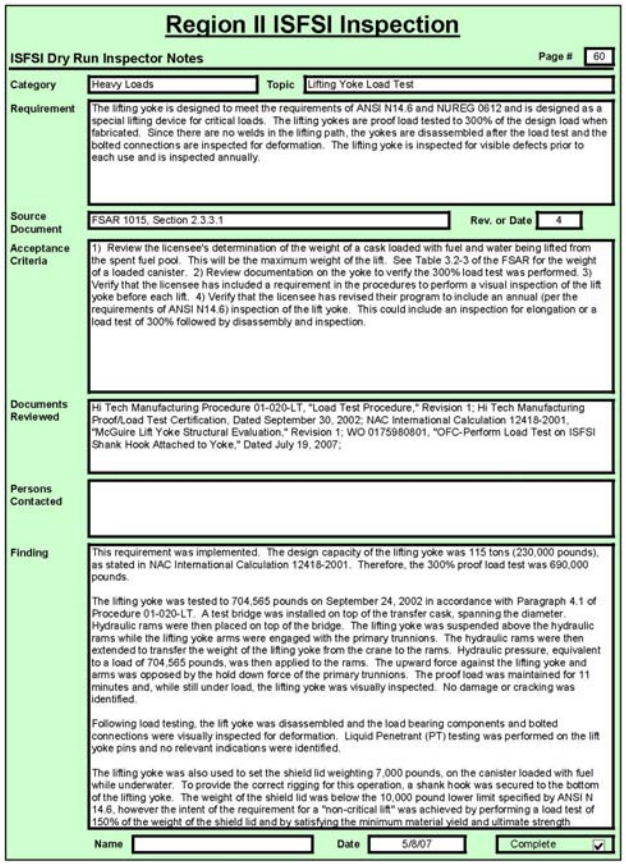


Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 154

Category	General License
Topic	Changes, Tests, and Experiments
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.
Source Document	10 CFR 72.48(c)(1)
Rev. or Date	2002
Acceptance Criteria	1) List the procedures that are used by the licensee to comply with 10CFR72.48. 2) Verify that the criteria listed in 72.48(c)(1) and (c)(2) are incorporated into the licensee's procedures. 3) Review the list of the 72.48 screenings and safety evaluations that have been performed and select several of each to verify that the licensee's disposition of the issues were adequate. 4) Verify that the vendor is sending their 72.48's to the licensee for review and determination of which should be implemented at the site. The licensee should have a procedure for processing the vendor's 72.48s and should have examples to show the inspector to demonstrate that the 72.48s are being received and processed. (NOTE: Charge time spent on 72.48 issues to IP 60857)
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
Persons Contacted	
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.

Name | Date | Complete ☑



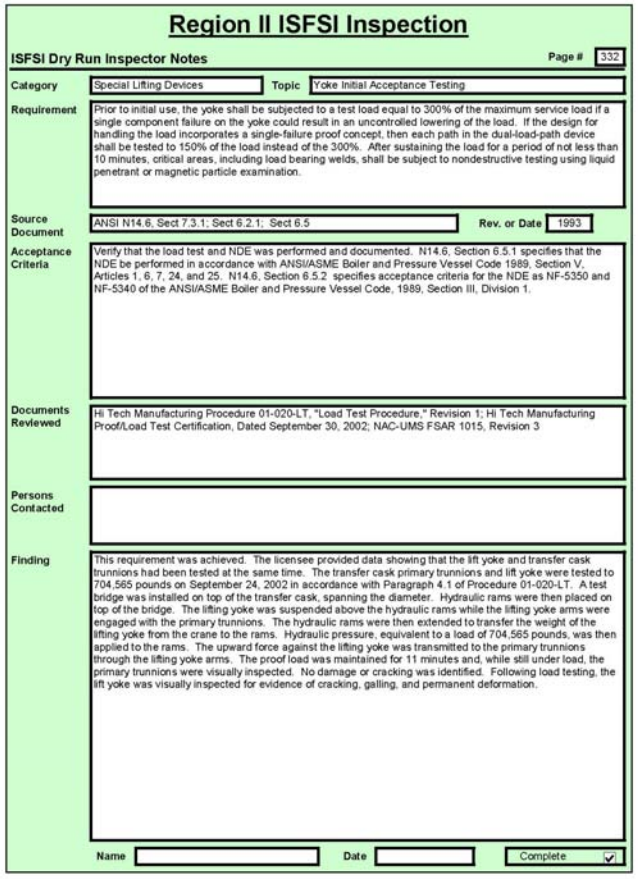
Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 60

Category	Heavy Loads
Topic	Lifting Yoke Load Test
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.
Source Document	FSAR 1015, Section 2.3.3.1
Rev. or Date	4
Acceptance Criteria	1) Review the licensee's determination of the weight of a cask loaded with fuel and water being lifted from the spent fuel pool. This will be the maximum weight of the lift. See Table 3.2-3 of the FSAR for the weight of a loaded canister. 2) Review documentation on the yoke to verify the 300% load test was performed. 3) Verify that the licensee has included a requirement in the procedures to perform a visual inspection of the lift yoke before each lift. 4) Verify that the licensee has revised their program to include an annual (per the requirements of ANSI N14.6) inspection of the lift yoke. This could include an inspection for elongation or a load test of 300% followed by disassembly and inspection.
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;
Persons Contacted	
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

Name | Date 5/8/07 | Complete ☑

Inspection Databases
Inspector Datasheets

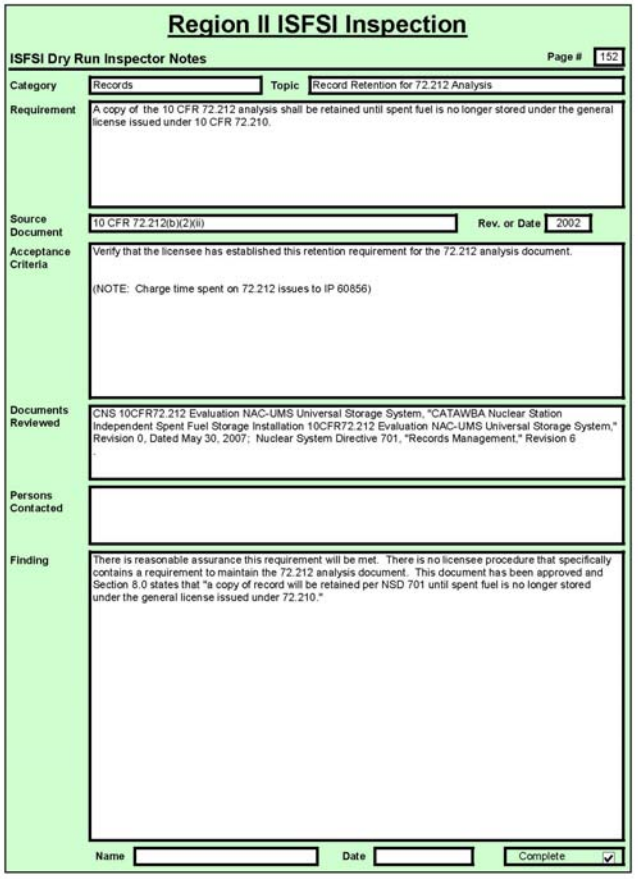


Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 332

Category	Special Lifting Devices
Topic	Yoke Initial Acceptance Testing
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.
Source Document	ANSI N14.6, Sect 7.3.1; Sect 6.2.1; Sect 6.5
Rev. or Date	1993
Acceptance Criteria	Verify that the load test and NDE was performed and documented. N14.6, Section 6.5.1 specifies that the NDE be performed in accordance with ANSI/ASME Boiler and Pressure Vessel Code 1989, Section V, Articles 1, 6, 7, 24, and 25. N14.6, Section 6.5.2 specifies acceptance criteria for the NDE as NF-5350 and NF-5340 of the ANSI/ASME Boiler and Pressure Vessel Code, 1989, Section III, Division 1.
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
Persons Contacted	
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.

Name | Date | Complete ☑



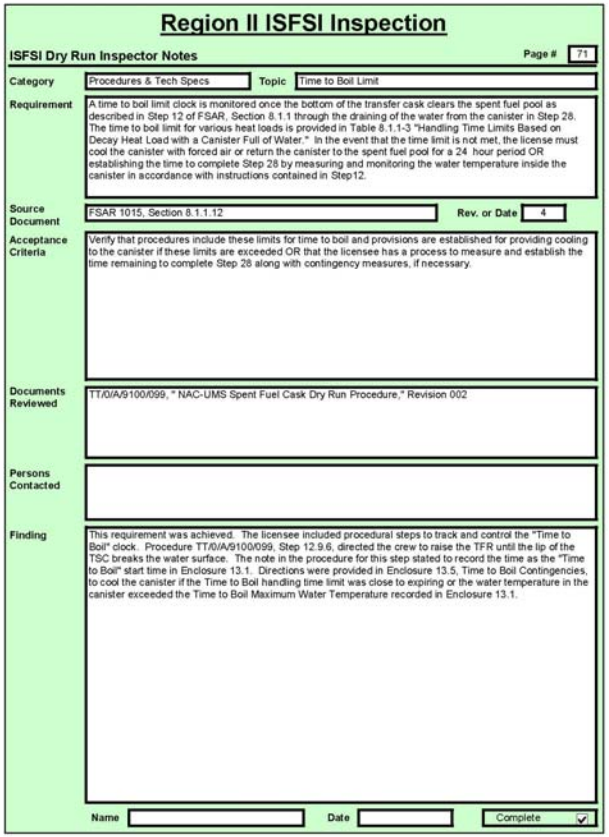
Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 152

Category	Records
Topic	Record Retention for 72.212 Analysis
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.
Source Document	10 CFR 72.212(b)(2)(ii)
Rev. or Date	2002
Acceptance Criteria	Verify that the licensee has established this retention requirement for the 72.212 analysis document. (NOTE: Charge time spent on 72.212 issues to IP 60856)
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
Persons Contacted	
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."

Name | Date | Complete ☑

Inspection Databases
Inspector Datasheets

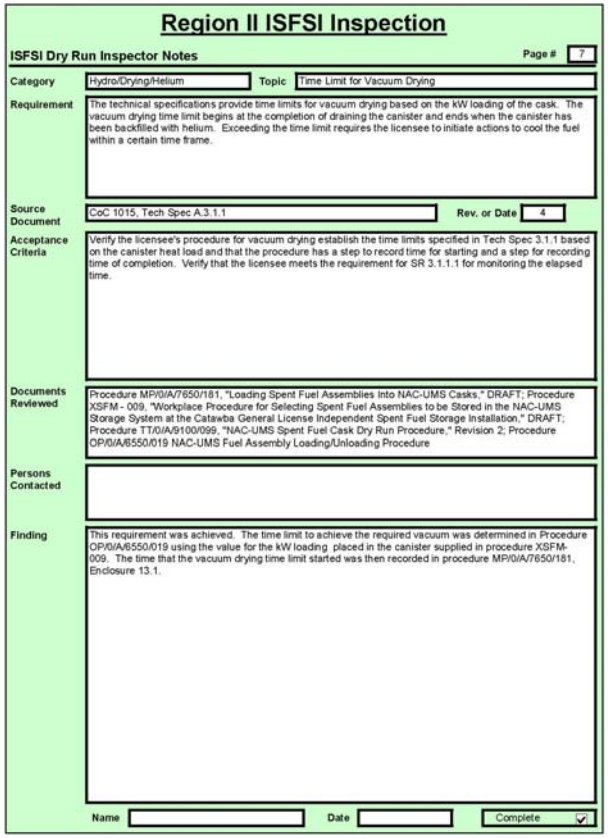


Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 71

Category	Procedures & Tech Specs
Topic	Time to Boil Limit
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.
Source Document	FSAR 1015, Section 8.1.1.12
Rev. or Date	4
Acceptance Criteria	Verify that procedures include these limits for time to boil and provisions are established for providing cooling to the canister if these limits are exceeded OR that the licensee has a process to measure and establish the time remaining to complete Step 28 along with contingency measures, if necessary.
Documents Reviewed	TT/0/A/9100/099, " NAC-UMS Spent Fuel Cask Dry Run Procedure," Revision 002
Persons Contacted	
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.

Name _____ Date _____ Complete ☑



Region II ISFSI Inspection

ISFSI Dry Run Inspector Notes Page # 7

Category	Hydro/Drying/Helium
Topic	Time Limit for Vacuum Drying
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.
Source Document	CoC 1015, Tech Spec A.3.1.1
Rev. or Date	4
Acceptance Criteria	Verify the licensee's procedure for vacuum drying establish the time limits specified in Tech Spec 3.1.1 based on the canister heat load and that the procedure has a step to record time for starting and a step for recording time of completion. Verify that the licensee meets the requirement for SR 3.1.1.1 for monitoring the elapsed time.
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
Persons Contacted	
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.

Name _____ Date _____ Complete ☑

Inspection Databases
Inspection Report

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

Inspection Databases

- Benefits:
  - Inspection attributes taken directly from the licensing requirements
  - Important inspection issues are identified during the inspection planning phase
  - Provides a thorough base of inspection criteria, which can be prioritized if necessary
  - Inspection requirements and guidance can be used by less technically qualified inspectors with good results
  - Inspections are more uniform
  - Inspection results are not solely dependent on knowledge level of the inspector

Industry Lessons Learned

- The effective licensee will utilize industry experience by:
  - Gathering experience from other utilities and vendors
  - Participate in site visits and pre-loading critiques
  - Utilizing generic communication & operating experience
- Many of the licensees do not fully understand the requirements of 10 CFR Part 72 or the cask licensing basis
- Based on the issues that occurred at one site, Regulatory Issue Summary 2006-002 was issued to heighten industry awareness

Industry Lessons Learned

- RIS 2006-22 Lessons Learned:
  - Long lead times (on the order of 5 years) are needed for ISFSI planning
  - Keep NRC regional inspection organization informed of plans and potential issues
  - For licensing issues, the Division of Spent Fuel Storage and Transportation (SFST) is the primary point of contact.

Industry Lessons Learned

- Changes that alter the sequence of cask loading operations can affect TS conditions
- Good planning can avoid the need for exemption requests
- The specific and general licensees must meet applicable requirements of 10 CFR 72.13, regardless of any expertise that is added to supplement the licensee staff

Industry Lessons Learned

- Overhead cranes should be in good working order and properly maintained in accordance with manufacturer recommendations
- Ensure that the overhead crane and supporting structure meets licensing requirements prior to beginning the dry fuel storage loading program
- Cranes should be inspected, tested and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976. [RIS 2005-25]

Industry Lessons Learned

- Utilities should allow for schedule perturbations during preoperational testing and demonstrations
- ISFSI programs should be complete and thorough. Licensees should not depend on the knowledge level of the individuals for success.
- Utility success depends on:
  - Sufficient time (realistic schedule)
  - Adequate resources
  - Strong management commitment

Industry Lessons Learned

- Vendor user groups reduce the number of repetitive errors
- Successful preoperational exercises depend on:
  - Demonstrate to maximum extent possible
  - Critique by knowledgeable individuals not directly involved with process
  - Realistic mockups
- Understand that changes under Part 72 may affect ability to transport under Part 71

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