

NRC INSPECTION MANUAL

SPLB

INSPECTION PROCEDURE 50095

SPENT FUEL STORAGE RACKS

PROGRAM APPLICABILITY: 2512

SALP FUNCTIONAL AREA: MECHANICAL COMPONENTS (SCMECHC)

50095-01 INSPECTION OBJECTIVES

01.01 To determine whether the technical requirements detailed or referenced in the facility Safety Analysis Report (SAR) associated with spent fuel storage racks have been adequately addressed in the construction/installation specification, drawings, and work procedures.

01.02 To determine by direct observation and independent evaluation of work, whether the licensee's work control system is functioning properly and whether the installation of spent fuel storage racks is in compliance with NRC requirements, licensee commitments, and applicable codes.

01.03 To review a sample of records associated with the installation of spent fuel storage racks to determine whether the licensee is adequately preparing, reviewing, and monitoring a system of quality records.

50095-02 INSPECTION REQUIREMENTS

02.01 Review of Implementing Procedures, Specifications, and Instructions. Determine whether specifications, drawings, work instructions and inspection procedures have been established that will ensure the technical adequacy of the following activities pertaining to spent fuel storage racks. Determine whether these documents comply with NRC requirements and licensee commitments.

- a. Procurement Documents. Review the design and purchase specifications and drawings to ensure that specific technical requirements and commitments contained in the SAR have been translated into vendor purchase documents. Verify the following:
 1. Structural, welding, and neutron absorption materials are appropriately specified and adequately described.
 2. The required design and fabrication codes have been invoked (AWS, ASME, AISC).
 3. Critical dimensions and tolerances are specified (fuel box center-to-center, seismic restraint clearance, etc.).

4. Special design or fabrication requirements are specified with respect to neutron absorbing materials such as weight-percent boron, homogeneity, chemistry, blackness tests, and special vents as required.
- b. Receipt Inspection Procedures/Instructions. Verify that receiving inspection instructions require the following:
 1. inspection for damage
 2. conformance to purchase specifications (including any special requirements)
 3. proper identification and verification
 4. material test reports (MTRs)
 5. necessary supplier/vendor documentation
- c. Storage Procedures. Verify that site storage procedures provide for the following:
 1. proper identification
 2. proper handling
 3. cleanliness preservation
 4. protection from adverse weather and other physical damage
 5. storage surveillance requirements
- d. Installation Procedures/Instructions. Verify that work procedures provide adequate instructions for the following (if applicable):
 1. welding and NDE procedure qualification requirements
 2. control of rigging and handling to prevent damage to new racks or existing structures
 3. removal or modification of existing rack structures
 4. proper location and orientation
 5. dimensional checks for levelness, alignment, clearances, and restraints installation
 6. final clearance check for using dummy fuel element or other go/no-go gages
 7. installation of corrosion test specimens in the spent fuel pool (if specified)
- e. Determine whether the licensee has an established audit program.
- f. Determine whether the licensee has an established program for ensuring that site engineering, craft, nondestructive examination (NDE), and inspection personnel involved in the installation of spent fuel storage racks are qualified to perform their assigned work.

02.02 Observation of Activities

- a. Visually examine the new spent fuel storage racks before installation. Verify that requirements are being met in the following areas:
 1. Receipt inspection procedures are being followed.
 2. Site storage procedures are adequate.
 3. Configuration of spent fuel racks is as specified in assembly drawings.
 4. Structural welds are in conformance with welding requirements.
 5. Racks are free of obvious defects such as cracks, dents, missing parts, or evidence of shipping damage.
 6. Nonconformance items have been properly identified/documentated and corrective action has been taken or initiated.

- b. Observe work activities in progress or completed work on the racks of the spent fuel pool. Verify the following:
 1. Specially trained personnel and special equipment or tools are available and utilized, where required, to meet manufacturer/vendor instructions and licensee/contractor requirements.
 2. Latest revisions of approved drawings, specifications, and procedures are available for use at the installation site.
 3. Proper rack location and orientation are checked against drawings.
 4. Seismic restraints are in place and gapped.
 5. No apparent damage to racks or spent fuel pool occurs during installation.
 6. Required installation welds and specified NDE are performed.
 7. Required bolting, shimming, and torquing of fasteners are performed in accordance with approved procedures.
 8. QC inspection is adequate.
 9. Corrosion test specimens are installed properly.

02.03 Review of Records. Verify the following:

- a. Vendor/shop fabrication records, including material certification records, are complete.
- b. Receipt inspection and storage surveillance records are complete.
- c. Sample several installation records in each of the following areas for completeness:
 1. leveling, alignment, and tolerances
 2. restraint installation
 3. dummy fuel element test for adequate clearance

4. certification of materials such as weight-percent boron homogeneity, and chemistry for special and construction steels
5. weld identification and weld material traceability as required
- d. Check for proper handling and disposition of nonconformance reports.
- e. Personnel certification or qualification records are complete.
- f. Review at least one licensee/contractor audit report (shop/vendor or site installation) pertaining to this inspection area and determine whether:
 1. The required audit has been performed in areas established in the audit plan.
 2. Audit findings have been reported in sufficient detail to permit a meaningful assessment by those responsible for corrective action.
 3. The licensee/contractor has taken proper followup action on those matters in need of correction.

50095-03 INSPECTION GUIDANCE

General Guidance. Before performing this inspection, applicable sections of the SAR, SER, and other related licensee submittals are to be reviewed to determine licensee commitments relative to the installation of spent fuel storage racks. The inspector(s) then utilize these commitments during the review of the licensee's implementing procedures, specifications, drawings, work procedures, and QA/QC implementing procedures. Some of this review can be completed during inspection preparation if arrangements are made in advance to have selected documents sent to the region.

Findings from this inspection activity are to address each element inspected as being satisfactory, unresolved and requiring resolution, or in violation and requiring correction. When significant inadequacies are identified in specifications or procedures indicating weakness within the preparing technical organization, the inspector is to so inform cognizant regional supervision. The issue is to be addressed at the appropriate level of licensee management.

There are three types of activities pertaining to spent fuel storage rack work:

- a. new spent fuel storage racks and supports--no fuel or water in the fuel pool, no radiation
- b. repair of existing spent fuel storage racks and supports--fuel and water in the fuel pool, radiation hazard present
- c. new fuel racks and supports for expansion of existing fuel storage facilities--a radiation hazard may exist

The selection of inspection requirements in the above areas shall be guided by the feasibility of performing the inspection without exposing the inspectors unnecessarily to radiation. Use judgment, especially during the inspection of repair work on existing spent fuel storage racks where high radiation may exist.

Consider performance of this inspection procedure when the licensee has scheduled work in any of the above three categories and the licensee has a Category 3 rating in the Quality

Programs and Administrative Controls functional area for the most recent SALP assessment.

03.01 Specific Guidance

- a. Inspection Requirement 02.01. Although section 02.01 may be started as early as 3 months before installation, it must be started before work is 10% complete and must be completed before work is 100% complete.
- b. Inspection Requirement 02.01a. Depending on plant status, there may be other commitments and technical requirements to be considered during this review.
- c. Inspection Requirements 02.01a.4 and 02.03c.4. The neutron blackness test is sometimes required to verify the presence of neutron absorbing materials in the walls of the fuel box cells. The test may consist of traversing the fuel box cell walls sandwiched between a neutron source and neutron detector.

Some swelling problems within the storage tubes have been encountered with racks utilizing neutron poisons. There are two types of poison plates commonly being used in spent fuel racks. These are:

1. B₄C in an aluminum matrix (Boral) clad with aluminum and encapsulated in stainless steel
2. B₄C dispersed in an organic resin matrix and encapsulated in stainless steel

With the first type of poison plates, the swelling is thought to be caused by water leaking through defective welds in the stainless steel encapsulation and reacting with unpassivated aluminum. Hydrogen is liberated in this reaction which has been known to cause pressure buildup and swelling. The interim "fix" has been to drill vent holes near the top of the stainless steel encapsulation to allow hydrogen gas to escape. However, some spent fuel rack manufacturers are depending on their NDE program to assure leak-tight welds.

With the second type of poison plates, the organic matrix off-gases when irradiated with gamma rays from the spent fuel causing a pressure buildup within the encapsulation. The "fix" for this type of poison plate has been to drill vent holes near the tip of the stainless steel encapsulation similar to the "fix" noted above.

As noted, there have been problems encountered with these two types of poison materials; there may be other types and designs. In any event, be particularly watchful for conditions or mechanisms that could result in unexpected loss of poison effectiveness at any time during the useful life of the storage racks by ensuring that surveillances of neutron absorbing materials in the walls of the fuel box cells are performed as committed to by the licensee.

- d. Inspection Requirement 02.01d.1. This procedure does not include in its scope detailed welding and NDE inspection requirements by NRC; nor does it prescribe inspection coverage of the licensee's radiological protection measures that may be appropriate if spent fuel racks are being installed after plant operation. Assistance to perform NRC inspections in these areas shall be considered during the region's preinspection planning and assistance provided as necessary.
- e. Inspection Requirements 02.01d.6 and 02.03c. The levelness and proper clearance of the final installation are commonly checked using a dummy fuel element and dynamometer. The dummy element is lowered into the fuel cell and the drag is noted on the dynamometer during removal of the element. It is important to have the spent fuel pool water level at its normal height before

performing the final dimensional checks if vent holes are not drilled for storage racks using Boral in their poison plates. Swelling in this type of rack has been found in as little as 3 days after installation with the water level at its normal height.

- f. Inspection Requirements 02.01d.7 and 02.02b.9. Corrosion test specimens are required only if neutron poison materials are installed and the licensee agreed to install test specimens.
- g. Inspection Requirement 02.01e. Does the audit plan cover safety-related work and control functions in the area of spent fuel storage rack installation? Does the audit plan specify frequency of the audit and procedures on how to conduct the audit?
- h. Inspection Requirement 02.02a.2. Check such items as protective covers, storage supports, preservatives if used, cleanliness, proper identification, and performance of surveillance requirements.
- i. Inspection Requirements 02.02a.4 and 02.02b.6. Inspectors who may not be experienced in welding and NGE can check for obvious visual defects such as weld cracks and lack of weld filler. Detailed weld inspection is to be performed by NRC welding and NDE specialists.
- j. Inspection Requirement 02.02b.4. The seismic restraints are normally provided with a gap between the restraints and spent fuel pool wall to allow thermal growth.
- k. Inspection Requirement 02.02b.7. Check an appropriate sample of bolts and fasteners.
- l. Inspection Requirement 02.03a. Cross check selected material certifications against the appropriate material specification and the materials stated in the application/SER or other licensee submittals.

50095-04 REFERENCES

ANS 57.2, "Design Objectives for Light Water Reactors Spent Fuel Storage Facilities at Nuclear Power Facilities."

Regulatory Guide 1.13, "Spent Fuel Storage Facilities Design Basis," December 1975.

Regulatory Guide 1.29, "Seismic Design Classification," September 1978.

Regulatory Guide 1.38, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage and Handling of Items for Water-Cooled Nuclear Power Plants," May 1977.

Regulatory Guide 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants," September 1977.

Regulatory Guide 1.58, "Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel," September 1980.

Regulatory Guide 1.88, "Collection, Storage and Maintenance of Nuclear Power Plant Quality Assurance Records," October 1976.

SAR and SER Chapters 1, 3, 9, and 17, including pertinent codes and standards referenced in these chapters.

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