INSPECTION PROCEDURE 75001 ATTACHMENT 09

LOAD AND FUEL HANDLING EQUIPMENT

Effective Date: April 1, 2026

PROGRAM APPLICABILITY: IMC 2573

75001.09-01 INSPECTION OBJECTIVES

To verify that safety-related (SR) and non-safety-related, safety-significant (NSRSS) load handling, fuel handling and fuel storage systems and components can perform their required safety functions (RSFs).

75001.09-02 INSPECTION REQUIREMENTS

The inspectors shall complete the required inspection samples that are necessary and sufficient to establish with reasonable assurance that the following requirements are being met:

02.01 Vertical Slice Inspection of Quality Assurance:

Verify the licensee, manufacturer, or project vendor is effectively implementing its quality assurance (QA) and quality control (QC) requirements, in accordance with the quality assurance program (QAP) for activities associated with SR and NSRSS load and fuel handling systems and components. Inspection guidance for this inspection is provided in inspection procedure (IP) 75001, Appendix A.

02.02 SSC Inspection Samples

Verify the SR and NSRSS as-built load and fuel handling systems and components are designed and constructed in accordance with the applicable codes and standards, design requirements, and the SAR.

Verify testing activities for the SR and NSRSS as-built load and fuel handling systems and components conform to applicable codes and standards, design requirements, the SAR, and the licensee's testing requirements.

02.03 Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). Only applicable for construction under a combined license (COL).

Verify the inspections, tests, and analysis (ITA), for ITAAC related to load and fuel handling systems and components are performed and that the acceptance criteria (AC) in the COL are met.

02.04 Operational Programs

Verify the SR and NSRSS as-built electrical systems and components are appropriately qualified to perform their required safety functions (RSFs), as required, for a harsh environment, seismic conditions, and functional qualification.

75001.06-03 INSPECTION GUIDANCE

General Guidance

The purpose of this inspection procedure is to provide insights into the quality of work being performed in the inspection area for load and fuel handling systems and components. These insights will support the Advanced Reactor Construction Oversight Program's (ARCOP) continual assessment process described in Inspection Manual Chapter (IMC) 2572, "Assessment of Advanced Reactor Construction Projects."

The specific components selected for inspection, and the depth and breadth of each inspection may vary widely between inspections and will depend on the structure, system, and component's (SSCs) risk significance for the design, the timing and location of the inspection, and the construction activities completed or in progress at the time of inspection.

Each inspection using this IP will constitute at least one inspection sample, regardless of how many sections are implemented during the inspection. As described in IMC 2572 and IMC 2573, "Inspection of the Advanced Power Reactor 'Quality of Reactor Plant Construction' Strategic Performance Area," the number of inspection samples needed to complete inspections in the inspection area are determined by the specified range of inspection samples listed in the project-specific inspection scoping matrices and on the results of the continual assessment process.

This IP is used for various advanced reactor designs and is scalable and flexible. Completion of every section/step of this IP is not expected or required for individual inspections or to complete the baseline inspection program for a project. Inspectors should perform the inspection activities in the following sections of this IP, as available.

In addition to the guidance below, inspectors may refer to the supplemental inspection guidance in Attachment 1 of this IP and other IPs as necessary to aid in completing the inspections in this procedure.

Inspection samples shall be selected in accordance with the ARCOP project-specific inspection scoping matrices, as described in IMC 2573.

Specific Guidance

03.01 Quality Assurance Implementation

The inspectors should refer to IP 75001, "Manufacturing and Construction Quality for Advanced Power Reactor Structures, Systems, and Components," and IP 75001, Appendix A, "Implementation of the Quality Assurance Program," for additional inspection guidance. The inspectors should select a sample of QA attributes to inspect during each inspection based on the scope and content of the planned inspection, the prior completed samples, and indication of potential issues for a particular attribute.

03.02 SSC Inspection Samples

For purposes of this procedure, load and fuel handling equipment may include the following components.

- New fuel dry storage racks or containers that will contain the new reactor fuel in dry storage within the new fuel storage area.
- Spent fuel storage racks or containers that will contain the spent fuel at the facility.
- Light load handling equipment (related to fuel loading, core shuffling, or fuel removal) includes the fuel handling and refueling system which consist of equipment and structures used for conducting fueling, refueling, and fuel removal operations.
- Heavy load handling systems consist of equipment which lift loads whose weight is greater than the combined weight of a single spent fuel assembly and its handling device. This equipment would be used for activities such as reactor disassembly, spent fuel cask handling, and movement of critical parts of the reactor or support components. These cranes are generally seismically qualified and are in the vicinity of the reactor or refuel floor. Heavy load handling systems not within the vicinity of reactor fuel (e.g., cranes in outlying buildings) are not within the scope of this IP.
- Other fuel handling equipment such as transfer machinery used to transport irradiated fuel from one plant location to another. Examples may include trolley systems, rail systems, and/or other plant equipment.

a. Fuel Rack or Container Installation

Verify the following attributes:

- Fuel Rack and containers are fabricated using the proper material (base metal and neutron absorbing material) as described in the design documents and manufacturer's specifications.
- Fuel Rack and containers are properly supported and/or restrained in accordance with design documents.
- Installation requirements have been met such as proper location, orientation, alignment, spacing, placement, dimensions, tolerances, and quantity.
- A seismic stress analysis for the safe shutdown earthquake and a stress analysis for the fuel rack and container design loads should be complete and have been reviewed and approved by the licensee prior to installation.
- Use of specially trained and qualified personnel and equipment when required to meet manufacturers' instructions.
- Appropriate drawings and work procedures are available to installation personnel. Installation requirements, construction drawings, specifications, and work procedures are of the latest approved revision.

b. Fuel Handling and Heavy Load Handling Equipment Installation

Verify the following attributes:

- Load handling equipment has been fabricated using the proper materials and techniques as described in the construction code and design documents.
- Equipment installation is in accordance with design drawings, design specification, and licensee procedures.
- Equipment maximum load is adequate for its use and has been analyzed by the licensee. If appropriate, review the load limit set points for compliance with design requirements.
- Equipment purchase specifications requirements conform to the commitments described in the licensing bases. Storage and installation are in accordance with established site procedures.
- If the Crane has been designed to be single failure proof, verify the design meets a methodology previously approved by the NRC, such as NUREG-0554 or ASME NOG-1.
- Equipment complies with seismic design criteria.
- Use of specially trained personnel and equipment when required to meet manufacturers' instructions and regulatory requirements.
- Installation requirements, construction drawings, specifications, and work procedures contain the latest revisions and are available to craft personnel.
- Structural and/or fabrication welding is completed in accordance with applicable welding codes, standards, manufacturer's installation requirements, qualified welding procedures and the licensee's QA program requirements related to the control of special processes. See IP 75001.WELD for additional information.
- For non-single failure proof cranes, verify that mechanical stops or electrical interlocks are installed to prevent interaction with safety related equipment or confirm that load drop evaluations meet requirements per NUREG-0612.

c. Post Installation Activities

Verify the equipment is properly protected and maintained considering the following attributes, as applicable:

- Periodic inspections are being performed in accordance with established guidance described in NUREG-0612.
- Protection is provided as required against adverse temperature, humidity, flooding, and foreign materials such as dirt, dust, and construction debris.
- Lubrication, rotation, and electrical resistance checks are being performed.
- Records are being maintained as to the status of installed components.

- Appropriate stamps, tags, markings, etc. are in use to prevent missing the required inspections and tests, and the prevention of inadvertent operation.

- If applicable, ensure that fuel storage area floor drains are free from obstruction and are protected from foreign material being trapped in the drain during installation, fabrication, and post installation.

d. Testing and Verification

Refer to Attachment 1 of this IP for inspection information related to construction testing.

03.03 ITAAC Verification

Review the licensee's plan for completion of applicable ITAAC associated with the work activities being inspected. Review the activities that the licensee intends to credit for future ITAAC closure. For example, if the licensee intends to rely on a specific quality control (QC) observation during the installation of an SSC, then the inspector should review a sample of these QC observations to determine whether the activity was performed in accordance with applicable quality and technical requirements.

03.04 Operational Program Inspections

Verify the SR and NSRSS as-built load and fuel handling systems and components are appropriately qualified to perform their required safety functions (RSFs), as required by design specifications, qualification reports, and the SAR. This may include harsh environments, seismic conditions, and functional qualifications.

The inspectors should refer to IP 75001.QUAL, "Qualification of Mechanical, Electrical, and Instrumentation and Control (I&C) Components," for additional inspection guidance for environmental, seismic and the functional qualification. This should include review of qualification data packages (e.g., seismic test reports, environmental qualification data, interface requirements such as conduit seals, drip loops, T-drains).

Seismic qualifications of equipment are grouped into three general categories: (1) analysis, (2) tests, and/or (3) qualify by combination of tests and analysis. One of these methods may be adequate to verify the ability of the equipment to meet the seismic qualification requirements.

Inspectors should confirm that equipment is installed in configurations bounded by qualification testing and that any changes in location, mounting, interface, or storage do not invalidate the qualification.

75001.09-04 RESOURCE ESTIMATE

Resource estimates for this procedure are expected to vary based on design and project-specific variables. Refer to the project-specific scoping matrix for a given project for a more precise resource estimate.

75001.09-05 PROCEDURE COMPLETION

Completion of this IP is based on 1) completing the minimum required inspection samples identified in the site-specific inspection scoping matrix and 2) an assessment pursuant to IMC 2572 that there is reasonable assurance that the activities for load and fuel handling equipment are being accomplished with quality in accordance with the licensing basis requirements.

75001.09-06 REFERENCES

ANS 57.1, “Design Requirements for Light Water Reactor Fuel Handling Systems”

ANSI B30.10, “Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings”

ANSI B30.11, “Monorails and Underhung Cranes”

ANSI N210-76, “Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations”

ANSI/ANS 57.3, “Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants”

ANSI-N 14.6, “Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (5 ton) or More for Nuclear Materials”

ASME B&PV Code Section III

ASME NOG-1, “Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)”

ANSI B30.2, “Overhead and Gantry Cranes”

ASME B30.9, “Slings”

ASME B30.16, “Overhead Underhung and Stationary Hoists”

AWS D1.1, “Structural Welding Code”

AWS D14.1, “Specification for Welding Industrial and Mill Cranes”

CMAA-70, “Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes”

NUREG-0554, “Single-Failure-Proof Cranes for Nuclear Power Plants”

NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants (Microfiche location 6411/280)”

NUREG-0800, “Standard Review Plan 9.1.2, New and Spent Fuel Storage”

NUREG-0800, “Standard Review Plan 9.1.4, Light Load Handling System (Related to Refueling)”

NUREG-0800, “Standard Review Plan 9.1.5, Overhead Heavy Load Handling Systems”

RG 1.124, “Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports (Rev. 1, ML003739380)”

RG 1.13, “Spent Fuel Storage Facility Design Basis”

RG 1.130, “Service Limits and Loading Combinations for Class 1 Plate-and-Shell-Type Component Supports (Rev. 1, ML003740123)”

RG 1.29, “Seismic Design Classification”

RG 1.54, “Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants”

RG 1.84, “Design and Fabrication Code Case Acceptability, ASME Section III, Division 1”

END

List of Attachments:

Attachment 1: Supplemental Inspection Guidance
Attachment 2: Revision History for IP 75001.09

Attachment 1: Supplemental Inspection Guidance

The purpose of this attachment is to provide guidance for inspection of fuel and load handling equipment per Section 02.02 of the main body of this IP. Some of the sections and guidance in this attachment may not apply to all facilities. ITAAC are only applicable to facilities constructed under a COL. Inspectors may consider:

a. Fuel Rack and Container Installation

Fuel rack and container installation should not distort the rack/container geometry or have any detrimental impact on rack/container mechanical integrity (over stress, exposure to contamination, etc.). Handling and rigging of the racks/containers should be carefully planned and effectively implemented. Installation rigging points on the racks/containers should be inspected for localized damage. Dimensional and visual checks should be made to ensure no distortion prior to and post installation. Distortion could impact a smooth fuel assembly fit into the racks/containers. Dummy fuel assembly loading into rack/container storage areas should be used to identify any anomalies or non-conforming conditions. The racks/containers should comply with the installation requirements including dimensional clearances and leveling criteria.

Confirm that work instructions for installation and storage contain appropriate guidance and are implemented in accordance with programmatic requirements. For example, prior to installation lifts, craft should perform pre-job briefs and inspect rigging equipment pursuant to site administrative controls and appropriate ANSI standards. Spread lift rigs should be utilized as recommended by the vendor.

Depending on the licensee's design basis, racks/containers should have a vendor provided confirmatory dynamic and stress analysis. The licensee should have reviewed and accepted that these analyses and installation instructions were consistent with the analyzed design. The licensee should have a seismic stress analysis available to review such as described in RG 1.29, Seismic Design Classification for Nuclear Power Plants. The inspector should reference the licensing bases for specific guidance.

For seismic components, the inspector should pay particular attention to the traceability of material and equipment to ensure the use of specified parts and components. The inspector should ensure that required identification of the item is maintained by part number, bolting grading, serial number, or other appropriate means, either on the item or on records traceable to the item, and that any required markings are on the item. In the case of critical fasteners, compliance with the applicable material specification (e.g. purchase order and vendor identification) should be verified by required markings on bolts and nuts and certified material test reports or certificates of conformance as required by the applicable procurement drawings and specifications and/or by the applicable codes. In the case of vendor-supplied equipment assemblies containing fasteners, samples should be inspected to verify compliance with approved vendor drawings, design and code specifications, and other information.

Field observations may include independent measurement/observation, or alternatively, observation of licensee/contractor inspections.

Review the manufacturer's instructions for installation of the racks/containers. Determine if they specify that personnel with special training should be utilized for the installation. If so, determine if specially trained personnel are being utilized to meet the specification.

Height of the racks/containers relative to the pool water (or other cooling media) depth should be confirmed for required coverage. Flow paths around the racks/containers and the clearance between the walls and the racks/containers, and between racks/containers shall be in accordance with installation requirements. The licensee's fuel storage and handling analyses will provide sufficient detail to determine required parameters to maintain a coolable spent fuel storage and transport configuration. If applicable, ensure that fuel storage area floor drains are installed and free from obstruction and are protected from foreign material being trapped in the drain during installation.

QA items that the inspector should pay particular attention to include the following: quality control hold points, quality of QA records, QA record management, and field changes are properly controlled. The inspector should review the licensee's procurement packages for equipment inspected under this procedure.

b. Fuel Light Load Handling and Heavy Load Handling Systems Installation Guidance

Fuel Light Load Handling Systems

The fuel light load handling systems shall conform to applicable requirements specified in the design and licensing basis.

Verify allowable crane movement has been analyzed by the licensee. Tests of movement and verification of limitations shall be conducted on all possible load paths.

Other installation requirements, such as coatings, orientation, alignment, dimensional tolerances, and other mounting requirements should be verified.

The rails for the fuel-moving equipment should be checked for dimensional acceptability; the successful transport of fuel is in the alignment and smoothness of operation of the machine-to-rail interface.

Distance between rails and the level of the rail should be checked. The rails should be parallel along their length. Centerline distance between rails and the wheels of carts shall meet drawing tolerances. Lift cabling installation, installation requirements and method of attachment/adjustment are potential critical points for inspection. Hydraulic equipment should be checked for leak tightness and smooth operation.

Verify adequate precautions are taken to prevent damage during placement/mounting. For example, prior to installation lifts, pre-job briefs should take place, and rigging equipment should be inspected per site administrative controls and appropriate ANSI standards. Spread lift rigs should be utilized as recommended by the vendor and other documentation.

Power sources/supplies to components should be consistent with the licensing and design basis. The breaker for the component should not have other intermittent, permanent, or temporary loads that can overload the supply breaker. For additional electrical installation guidance, reference IPs 75001.06, "Electrical Systems, Components, and Cables."

If present for the reactor type, the jib crane has a maximum load rating. This crane as well as all cranes should be clearly marked with their maximum rating. The licensee shall verify that the crane is capable of this maximum load. The jib crane may get used as a

general lift apparatus and its load limit can unintentionally be exceeded. Administrative controls should be used to limit the crane's use. Fuel handling cranes and platforms typically have a maximum load rating. There shall be a vendor provided analysis on this topic.

Fuel handling tools should be sampled for compliance with drawing dimensional tolerance.

Review the licensing basis to determine if the licensee is committed to NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants." If so, verify that the crane meets the NUREG-0554 single failure proof guidelines.

Depending on the licensing basis, some cranes may be designed to Seismic Category 1 requirements as described in RG 1.29. Some cranes may be designed to Seismic Category II.

Review the manufacturer's instructions for installation and first operation of the cranes and light load handling equipment. Determine if they specify that personnel with special training should be utilized for the installation. If so, determine if specially trained personnel are being utilized to meet the specification.

Installation requirements, construction drawings, specifications, and work procedures are of the latest approved revision.

QA items of particular interest include verification of QC hold points, QA record quality and retention requirements, QA records management, and review of field changes to confirm that they do not deviate from the approved design. The inspector should review the licensee's procurement packages for purchased equipment inspected under this inspection procedure.

If welding is required for component installation, select a sample of welds for review. Through direct observations and/or record reviews, confirm the applicable attributes listed in IP 75001.WELD have been met.

Inspectors performing this inspection should be familiar with the applicable industry code requirements such as the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section IX, Welding and Brazing Qualifications. (NOTE: ASME Section IX is only a qualification code, the code requirements for fabrication using welding techniques are contained in the appropriate construction code, such as ASME Section III or ASME NOG-1). The inspector should also be familiar with the other requirements from the licensing basis (P/FSAR, DCD), other welding related design information, applicable process procedures, QA program requirements, and commitments. The inspector should be familiar with general welding practices and specific welding techniques. Additionally, the inspector should be competent in nondestructive testing techniques such as, visual examination, Magnetic Particle, Liquid Penetrant, Radiographic, and Ultrasonic.

The inspector should consider efficiencies gained by performing this inspection along with other welding activities since these may be the same craft personnel, procedures, welders, etc.

Records shall provide traceability of the welding activity such as welding procedures used, identification of welders, material certification, inspections performed and results, inspectors, and qualification records for procedures and personnel. These records shall be retained and stored in accordance with QA requirements.

Overhead Heavy Load Handling Systems (OHLHS)

Based on review of design specifications, industry codes, drawings, engineering calculations, station procedures, and field observations, verify:

The OHLHS is seismically qualified, where applicable, and that the as-installed equipment including anchorage is seismically bounded by the tested or analyzed conditions.

The OHLHS meets one of three safety guidelines for load drops as described in Standard Review Plan 9.1.5, Overhead Heavy Load Handling System.

Procedural controls have been established for the design, operation, testing, maintenance, and inspection of the OHLHS consistent with section 5.1.1 of NUREG-0612 and SRP 9.1.5.

Load testing of the OHLHS cranes main and auxiliary hoists is satisfactory, meet applicable Code and ITAAC requirements, and bound the expected load weights. Pre-operational inspection and testing of overhead cranes is typically governed by ASME NOG-1. Tests shall include operational testing with 100 percent load to demonstrate function and speed controls for bridge, trolley, and hoist drives and proper functioning of limit switches, locking and safety devices. A rated load test is performed with a 125 percent load.

Testing is completed satisfactorily to confirm that the uncontrolled lowering of a heavy load is prevented. Testing meets applicable Code and ITAAC requirements and bounds the expected load weights. The crane braking subsystem should be clearly understood prior to testing. Dynamic and Emergency braking pretest shall verify proper operation prior to the application of loads. For highly reliable/single failure proof cranes, Section 8 of NUREG-0554 provides additional testing guidance.

Programmatic controls are established and in place for the inspection and use of slings and special lifting devices.

Crane rails shall be inspected for dimensional acceptability prior to setting the crane. Vendor rail installation instructions in the containment may require an understanding of rebar locations in the concrete matrix. Installation may have to be coordinated with containment welding inspections or roof closure. The rails should be consistent with associated drawings and in a common plane within tolerance.

Power sources/supplies to components should be reliable and should not have other intermittent permanent or temporary loads that can overload the supply breaker. For additional electrical installation guidance, refer to IP 75001.06.

Crane movement paths are to be clearly prescribed. Exact locations relative to crane movement position must be established such that fuel, crane, and other equipment are not damaged. Interlock position detectors for crane movement limitations should be

identified and mounted appropriately. Interlocks for load paths shall be tested. The cask handling crane shall be interlocked such that it cannot traverse over the spent fuel pool, new fuel pit, or fuel transfer canal.

Review appropriate references (below) for additional inspection details.

c. Post Installation Activities

Post-installation activities should conform to approved site procedures.

d. Construction Testing and Verifications

The inspector should determine what specific acceptance criteria are established and select those for observation that are best confirmed through direct observation. Others should be confirmed through record/data review although direct observation is the preferred method of inspection for most. For additional guidance refer to IP 75001.TEST.

Fuel Racks and Containers

Dummy (go/no-go) assembly trial insertions using the fuel handling equipment should be used to identify fuel rack installation problems. All interlocks associated with design minimum and maximum rack positions shall be tested.

Fuel racks/containers should be visually inspected for final configuration. Racks should be plumb and racks/containers should be properly spaced.

Fuel racks/containers should be visually inspected to ensure that they have been cleaned after installation and that there is no evidence of construction debris which could cause problems with insertion or removal of spent fuel.

Fuel rack support feet are not sitting on liner seams or welds.

Light Load Handling Equipment (Fuel)

The fuel handling equipment should have a visible maximum load rating. The vendor provided analysis on the adequacy of a particular load value shall be available for review. Load testing shall be completed per code requirements and in accordance with specific administrative procedures. Testing shall be completed prior to placing the equipment in service, and prior to any fuel handling.

Cabling, electrical operation of components, and hydraulics should move smoothly during testing. Other components of the handling equipment such as upenders should not vibrate or bind during operation.

Pivot fasteners should not tend to loosen themselves while in operation.

Interlock position detectors for fuel movement limits should be clearly identified and mounted appropriately. Trial movement of equipment should be accomplished on all load paths, including testing of crane safety interlocks which restrict movement of loads (e.g., Interlocks on Reactor Building crane which prevents movement of loads over spent fuel storage portion of fuel pool)

Nondestructive examination (i.e., Liquid penetrant or magnetic particle examination) of hooks prior to and/or after load testing of cranes/hoists.

Testing of crane/hoist safety interlocks which provide overload protection.

Overhead Heavy Load Equipment

The licensing basis should require specific load testing. Review those requirements prior to testing initiation. Preoperational inspection and testing of overhead cranes are typically governed by ASME NOG-1. Tests shall include operational testing with 100 percent load to demonstrate function and speed controls for bridge, trolley, and hoist drives and proper functioning of limit switches, locking and safety devices. A rated load test shall be performed with a 125 percent load.

Crane movement paths are to be clearly prescribed. Exact locations related to crane movement position must be established such that the fuel, crane, and other equipment are not damaged.

The crane braking subsystem should be clearly understood prior to testing. The dynamic and emergency braking pretests shall confirm proper operation prior to the application of loads. Section 8 of NUREG-0554 provides additional testing guidance.

Interlock position detectors for crane movement limitations should be identified and mounted appropriately. Interlocks for all load paths shall be tested.

Review appropriate references for cranes for other details of inspection (see below references).

END

Attachment 2: Revision History for IP 75001.09

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional Non-Public Information)
N/A	ML26057A074 04/01/26 CN 26-011	Initial Issuance.	N/A	N/A