INSPECTION PROCEDURE 75001 ATTACHMENT 02

CONTAINMENT AND CONTAINMENT PENETRATIONS

Effective Date: April 1, 2026

PROGRAM APPLICABILITY: IMC 2573

75001.02-01 INSPECTION OBJECTIVE

To verify that safety-related (SR) and non-safety-related, safety-significant (NSRSS) containment systems, structures, and components (SSCs) can perform their required safety functions (RSFs).

75001.02-02 INSPECTION REQUIREMENTS

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 containment SSCs. Inspection guidance for this portion of the inspection is provided in inspection procedure (IP) 75001, Appendix A.

02.02 SSC Inspection Samples:

Verify the as-built containment SSCs meet the design requirements in the ASME code, design specifications, the design report, and the safety analysis report (SAR).

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

Verify the inspections, tests, and analyses (ITA) are performed and that the acceptance criteria (AC) in the combined license (COL) are met.

02.04 Operational Program Inspections:

Inspect implementation of the containment leak rate testing operational program, if applicable.

75001.02-03 INSPECTION GUIDANCE

General Guidance

The purpose of this IP is to provide insights into the quality and performance of work being performed in the inspection area for containment SSCs. 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 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 reference 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, "Inspection of 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 in a particular attribute.

03.02 SSC Inspection Samples

a. Materials Purchase and Receipt Inspection

Purchase orders should explicitly state the type of quality documentation required (e.g., Certified Material Test Report (CMTR) or Certificate of Compliance) in accordance with

the design requirements. If a CMTR was required, the inspector should verify that chemical and physical test results, including heat treatment as applicable, comply with the material specification required by the design documents. Typical attributes included in receipt inspections are:

- Plate material or containment penetration assemblies are in conformance with purchase specification
- Marking/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
- Evidence of damage
- Cleanliness at time of receipt
- Surface protection, closures and packaging and storage requirements
- Disposition of non-conforming items

b. Material Storage and Handling

Welding consumables such as coated electrodes, bare weld rod and spools, and inserts require special handling and storage considerations because these materials are melted during the welding process and become part of the welded joint. Welding material storage procedures should contain, consistent with applicable code, requirements for environmental cleanliness and moisture control as contaminants like dirt, grease, and moisture can cause weld defects such as lack of fusion, porosity, and cracking due to hydrogen embrittlement.

Plate material, prefabricated containment penetrations and penetration materials and valves are often stored outside, exposed to the elements in lay-down areas located around the construction site. The surface to be welded should be reasonably smooth, and free of rust, scale, oil, grease, and other deleterious foreign materials, including moisture. Stainless steel components should be stored separately from carbon steel components as contact with carbon steel can contaminate the stainless steel and cause surface rust to appear. Likewise, contact with carbon steel chains should be avoided when rigging to lift stainless components. Any tape used on stainless steel material and components should be certified as containing low halides as these are known to promote cracking.

Typical considerations for inspecting adequacy of storage areas are as follows:

- Improper storage classification.
- Protective mechanisms at the time of site receipt and initial storage (e.g., functionality and adequacy of devices)
- Adequacy of dunnage for plate material, containment penetration assembly components, and major prefabricated assemblies during storage.

- Continued adequacy of end caps for containment penetration assemblies' protective coverings for weld preparation areas.

- Weather protection such as canvas or plastic coverings. (In many cases, the original protective covering was adequate, but inattention to damage and normal "wear and tear" led to substandard or unacceptable protective provisions.)

- Sites near salt water should receive special attention to ensure that protective storage measures consider potential chloride contamination damage form salt or saltwater intrusion.

- Storage areas located on sandy soil or near sandy beaches require special attention to avoid the entry of wind-driven sand particles into plate material and containment penetration assemblies and assembly components.

- Inadequate or illegible material identification (damaged by handling and/or environment).

- Storage of stainless steel pipe on cribbage, dunnage, or packing material treated with fire retardants may expose the piping to excessive halides.

- Fire-retardant coatings applied to structural steel may have high halide content. Adjacent stainless-steel materials and components should be protected to avoid cross-contamination.

c. Installation and Welding

Welding and non-destructive examination (NDE) inspection activities should confirm that the activities conform to the requirements of American Society of Mechanical Engineers (ASME) Section IX and Section V respectively. The inspectors should refer to IP 75001.WELD, "Inspection of the Welding and Nondestructive Examination Programs," for additional specific inspection guidance on welding and NDE.

As available, the welds selected for inspection should represent various stages of the welding process (e.g., weld joint preparation, fit-up, root pass, final pass), various weld processes (e.g., shielded metal-arc welding (SMAW), gas tungsten-arc welding (GTAW), gas metal-arc welding (GMAW)), and various material types and pipe size (generally those materials designated in the applicable edition of the ASME Boiler and Pressure Vessel Code, Section IX). Emphasis should also be given to welds that, because of their location, are difficult to accomplish.

Verify that the procedures are properly qualified in accordance with the codes and standards specified in the design documents. For those welds selected, verify that the welder(s) is properly qualified for the piping material, electrode / process, and position and that the welder's identity is recorded via stamping the weld or by other means such as documentation.

The welding process is generally controlled by a traveler which will specify the steps in completing the weldment, materials to be used, and will also document quality control inspections and step completion. Verify that welding procedures, detailed drawings and instructions, and weld data sheets, if applicable, are at the workstation or readily available. Material traceability has been a significant issue at some construction sites in

the past. The inspector should verify that the containment plate material and the containment penetration assemblies and/or materials and welding consumables are of the specified type and grade and are adequately and uniquely identified (such as by heat number) in the traveler or accompanying documentation.

The inspector should verify the following:

- The containment liner plate sections are being installed at the proper location in the plant in accordance with approved drawings. If a plate joint fit-up is specified, verify the installation is within the tolerance provided in the specification. Inspection should include verification that plate-to-plate gap and overall structure requirements are following drawing and code requirements.

- Weld joint geometry is as specified in the drawings and surfaces to be welded have been prepared, cleaned, and inspected in accordance with applicable procedures.

- NDE such as visual inspection (VT), magnetic particle (MT) or liquid penetrant (PT) examination of the surfaces to be welded has been performed and found acceptable in accordance with the specified code.

- Components to be welded are assembled and held in place within specified gap and alignment tolerances and that alignment is within limits allowed by the drawings or code. Ensure cold springing during installation is in accordance with allowance provided in the approved procedures, or by engineering evaluation and analysis.

- Tack welds and temporary attachments such as bridging bars or fit-up clips have been performed by qualified welders, in accordance with qualified welding procedure specifications.

- Gas purging, if specified, is used in accordance with the applicable procedure and that protection is provided to shield the welding operation from adverse environmental conditions.

- Preheat and interpass temperature, if specified, is maintained in accordance with applicable procedure requirements.

- Welding equipment, including power cables and gas lines, are in good condition and that ammeters and voltmeters used for automatic welding have been calibrated in accordance with applicable procedure requirements.

- Procedures specify appropriate holding and baking temperatures and out-of-oven exposure time for each class of coated electrode. Procedures for maintaining welding consumable cleanliness and limiting electrode moisture pickup are strictly adhered to.

- Procedures for weld rod control maintain identification after the welding materials are issued to the welder and are strictly adhered to. Rod stubs are controlled and disposed of in accordance with the procedures.

- Interpass cleaning, grinding (especially starts and stops) and back-gouging, if necessary, are conducted in accordance with the applicable procedure.

- Temporary attachments, arc strikes, and weld splatter are removed and inspected in accordance with specified procedures.

- Minor weld material removal such as by light grinding and rewelding is generally permissible during the welding process. Repairs performed after the weld is completed and as a result of final visual or other NDE method that find the weld unacceptable shall be accomplished in accordance with approved repair procedures and shall be documented. Any repairs or modifications to ASME Code-stamped components shall be properly documented in the applicable Code data report as required by ASME Sections III and XI.

- The welding process pre-heat and interpass temperatures do not damage degradable materials (e.g., cable or instrumentation lines) inside containment penetrations.

d. Guidance for Post-Weld Heat Treatment (PWHT)

The need for PWHT is generally determined by the material type and thickness. For example, carbon steel, low alloy piping such as ASME SA106 typically requires PWHT when the thickness is 1-1/2 inches or greater when ASME is the applicable code however, PWHT is required when the thickness is greater than ¾ inches when B31.1 is the applicable code.

The PWHT procedure shall be in accordance with the applicable code and specify essential parameters such as number and placement of thermocouples, heat up and cool down rate, and soak time and temperature. The PWHT documentation should support that these variables were controlled throughout the process. Typically, chart recorders are used to demonstrate that the heat treatment operation was successfully completed.

Often, Charpy impact qualification is required for weldments requiring PWHT. It is essential that the inspector verify that both the base metal and weld material were properly qualified in accordance with the applicable code for PWHT. Governing codes generally require that final NDE of the weld joint be performed after PWHT.

e. Guidance for Nondestructive Examination

The inspector should verify the following:

- The sample should contain a range of NDE methods such as PT, MT, ultrasonic (UT), and radiography (RT).

- The NDE procedure is in accordance with the applicable code as specified in the design specification.

- The NDE is performed in strict accordance with the procedure.

Typical issues with NDE performance include:

- Inadequate cleaning of the surface for PT and MT. False indications may result if surface contaminants are present. Verify adequate dwell time for penetrant

applications and that the temperature of the weld surfaces (root, interpass and final cover) is in accordance with the procedure.

- Inadequate magnetic field due to a defective yoke. Yoke strength with appropriate calibrated weight should be demonstrated at intervals specified in the procedure. If prods are utilized, verify that the spacing and current are in accordance with the procedure. Any arc marks caused by prods must be removed.

- UT is widely recognized as one of the most sensitive NDT methods to operator performance, skill, and interpretation. Manual UT relies heavily on the operator's ability to properly set up equipment, position probes, interpret signal, and distinguish between defects and background noise. The inspector should verify that those doing UT are properly qualified by training, experience and test demonstration; verify the UT equipment complies with the procedure and that all variables important for proper exam, such as exam volume, frequency, search angle, gain/sensitivity are properly followed; and ensure relevant and non-relevant indications are dispositioned in accordance with the procedure.

- For RT, verify that isotope source strength, film type, source to film distance, and exposure times are in accordance with the procedure. Verify that image quality indicators are the correct type and thickness and that the required sensitivity and radiograph density meet the applicable code requirement.

f. Guidance for Reinforcing Steel and Concrete

See IP 75001.01, “Buildings and Structures.” These SSCs are inspected as a separate inspection sample.

g. Verify that major offsite fabricated assemblies, such as personnel airlock assemblies and equipment hatch assemblies, have been fabricated and installed in accordance with the manufacturer’s instructions and design engineering specifications. After installation and prior to testing of these assemblies, ensure that the assembly has been protected from damage and is maintained in operable condition.

h. Electrical and I&C Penetrations

Verify that electrical and I&C penetrations are installed per their specifications, reference IP 75001.06, “Electrical Systems, Components, and Cables,” and 75001.07, “Instrumentation and Control (I&C) Systems and Components.” Ensure that installed electrical and I&C penetrations have no visible damage and are ready to function in accordance with manufacturer’s instructions and design engineering specifications.

i. Coatings

Verify that the exterior of the containment is treated in accordance with design engineering specifications. Verify that any required coatings and preservatives on containment surfaces are applied in accordance with design specifications and manufacturer’s instructions.

j. Pressure Testing

Verify that the required pressure tests have been successfully completed in accordance with the applicable codes, as specified, in the design specifications.

k. Records Review

The final documentation package for containment, up to its pressure isolation boundaries will contain, in accordance with its design basis, the necessary information and references to confirm that the fabrication met the design and Code requirements, including:

- Components and welding consumables are uniquely identified (e.g., heat number) such that the inspector can verify material composition and physical characteristics are in accordance with the design documents.
- Welding and NDE procedures and personnel are identified for each weld. NDE results indicate that acceptance criteria were met.
- As-built drawings are available and any deviations from original design are reconciled with the design documents (e.g., design report).
- Documentation indicates that all required tests (e.g., hydrostatic, pneumatic test) and examinations (e.g., alignment verifications) have met the acceptance criteria.
- Code data reports are complete and signed off by the assigned Authorized Nuclear Inspector.

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. Because ITAAC has special regulatory significance, licensees should document ITAAC closure under their QAP. This means that even if an ITAAC is for a non-safety-related SSC, the completion package and subsequent notifications on ITAAC will be controlled by the QAP.

03.04 Operational Program Inspections

Specific licensing requirements will dictate the containment leak rate testing program requirements. For example, a small modular, light water reactor design may be required to perform a hydrostatic test of its containment vessel instead of a traditional combination of Appendix J local leak rate tests (LLRT) and an integrated leak rate test (ILRT). A non-LWR design with low operating pressure using functional containment may not require any pressure tests and rely on preoperational tests to demonstrate leak tightness. Inspectors should determine the containment leakage rate testing requirements in the licensing basis for the reactor facility being inspected.

a. Guidance for an Appendix J Testing Program

Upon completion of containment construction, including all penetrations and major offsite fabricated assemblies, verify that the testing of the containment and the installed containment penetrations have been successfully completed to fulfill the requirements of 10 CFR 50, Appendix J, Type A, Type B and Type C testing requirements and as specified in the design specification. Observe the performance of the Type A, B, and C tests, if available. These reviews should examine the final test results and the technical resolution of any observed or documented anomalies. Verify that the local leakage testing procedure contains provisions which comply with the governing code (e.g., temperature requirements, test pressure, hold time, and inspection methods), and that pressure gages, recorders, and other test equipment are within the pressure range specified by the code and that calibration is current.

75001.02-04 RESOURCE ESTIMATE

Due to the variety and diversity of technologies and design bases within the scope of ARCOP, the number of inspection samples and inspection hours are identified in the site-specific inspection scoping and planning matrix in accordance with IMC 2573.

75001.02-05 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 the construction activities for mechanical systems and components are being accomplished with quality in accordance with the licensing basis requirements.

75001.02-06 REFERENCES

10 CFR 50, Appendix A, “General Design Criteria 50, Primary Containment”

10 CFR 50, Appendix J, “Primary Containment Leakage Testing for Water-Cooled Power Reactors”

10 CFR 50.55a “Codes and Standards”

ASME Section V, “Nondestructive Examination (NDE)”

ASME Section IX, “Welding, Brazing, and Fusing Qualifications”

IP 75001.WELD, “Inspection of the Welding & NDE Program”

NUREG/CR-3855, "Characterization of Nuclear Reactor Containments," June 1984

NUREG/CR-5096, "Evaluation of Seals for Mechanical Penetrations of Containment Buildings," August 1988

NUREG/CR-6154, "Experimental Results from Containment Piping Bellows Subjected to Severe Accidents," Sept. 1994

NUREG-1273, "Technical Findings and Regulatory analysis for GI II.E.4.3, “Containment Integrity Check,"” April 1988

END

List of Attachments:
Revision History for IP 75001.02

Attachment 1: Revision History for 75001.02

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	ML26057A078 04/01/26 CN 26-011	Initial Issuance.	N/A	N/A