INSPECTION TECHNICAL PROCEDURE

I-121

PIPING SYSTEM CONSTRUCTION INSPECTION

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Revision 0

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INSPECTION TECHNICAL PROCEDURE I-121, REV. 0
PIPING SYSTEM CONSTRUCTION INSPECTION

1.0 PURPOSE

This procedure provides guidance for assessing the Contractor's activities for construction of important-to-safety piping and tank systems. Important-to-safety piping systems, support structures, and tanks are designed to withstand the forces of normal and abnormal operations and anticipated transients. To ensure the performance objectives are met, the Contractor has committed to construct the important-to-safety piping systems, support structures, and tanks in accordance with committed standards. These standards are referenced in the programs and related documents that incorporate the Contractor's construction plans. These include the Safety Requirements Document (SRD), the Quality Assurance Manual (QAM), and the Integrated Safety Management Plan (ISMP).

This inspection procedure assesses the adequacy and effectiveness of the following:

- Piping system, piping system support structure, and tank construction implementing procedures
- Piping system, piping system support structure, and tank construction activities
- Training and qualification of personnel
- Records.

2.0 OBJECTIVES

This procedure verifies the Contractor has developed and implemented effective programs for (1) implementing commitments regarding the construction of piping systems, support structures, and tanks; (2) managing and providing oversight to ensure construction of piping systems, support structures, tanks, and related quality control, have been adequately addressed by specifications, drawings, and procedures; (3) managing and providing oversight to ensure the as-constructed conditions of piping systems, support structures, and tanks are in accordance with the design; and (4) recording important-to-safety piping system and tank construction activities.

This procedure is used as a component of a complete construction inspection program. This and other inspection procedures will be used on an ongoing basis, as needed, to provide assurance that construction activities are being conducted as required by authorization basis commitments and Contractor procedures. Although it is expected that during the construction phase, a significant portion of this inspection procedure will be accomplished at least once for each major Contractor/subcontractor involved with the activities addressed by this procedure, it is not expected the entire procedure will be completed during any one inspection and/or every time the inspection procedure is used.

3.0 INSPECTION REQUIREMENTS

3.1 Adequacy and Effectiveness of Construction Implementing Procedures

3.1.1 The inspector should verify all Contractor/subcontractors with construction responsibilities in the area of important-to-safety piping systems, support structures, and tanks have approved procedures describing administrative controls and work processes implementing the design requirements. (QAM, Policy Q-05.1, Sections 3.1.1 and 3.3; ISMP, Table 1-3, item 5; and SRD, Safety Criterion (SC) 4.1-2 and 7.3-5)

3.1.2 The inspector should verify procedures prescribe adequate methods of quality control (QC) inspection to ensure that the as-built condition of piping systems, support structures, and tanks meets specified engineering requirements and drawings. As part of the assessment of the QC inspection procedures, ensure the procedures include or reference appropriate quantitative or qualitative acceptance criteria for determining the prescribed activities have been accomplished satisfactorily. (QAM, Policy Q-05.1, Section 3.5.1; ISMP, Table 1-3, items 5 and 8; and SRD, SC 4.1-2 and 7.3-7)

3.1.3 The inspector should verify procedures require equipment used for process monitoring or data collection is calibrated and maintained. (QAM, Policy Q-12.1, Sections 3.1.2 and 3.2; ISMP, Table 1-3, items 5 and 8; and SRD, SC 7.3-5 and 7.3-7)

3.1.4 The inspector should verify the Contractor has established procedures for ensuring craft and QC inspection personnel performing quality related piping system, support structure and tank installation, and testing activities are qualified to perform their assigned work. (QAM, Policy Q-02.2, Section 3.3.2; and ISMP, Table 1-3, item 2)

3.2 Adequacy and Effectiveness of Construction Activities

The inspector should verify piping system and tank construction work is being accomplished under controlled conditions using approved instructions, procedures, and checklists prepared at a level of detail based on the importance and complexity of the work process being performed. (QAM, Policy Q-05.1, Section 3.1.1; SRD, SC 4.1-2, 4.2-2, 4.2-3, 4.2-4 and 7.3-5; and ISMP, Table 1-3, item 5)

3.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

The inspector should verify craft, testing, and Quality Assurance (QA)/QC personnel involved in the performance of piping system and tank construction and inspection activities are qualified to perform their job functions. (QAM, Policy Q-02.2, Sections 3.2.2, 3.3.1 and 3.3.3; and SRD, SC 7.3-3)

3.4 Adequacy and Effectiveness of Records

The inspector should verify records of as-built piping system and tank installation and testing are as specified, reviewed by the Contractor for accuracy and assurance the recorded information meets project requirements, approved, and stored and maintained sufficient to support technical and contractual requirements. (QAM, Policy Q-17.1, Sections 3.1.2, 3.3.1, and 3.6.1; SRD, SC 4.0-3, 4.1-2 and 7.3-4; and ISMP, Table 1-3, item 4)

4.0 INSPECTION GUIDANCE

For each of the inspection elements, the inspector should: (1) obtain a copy of the Contractor's procedures and the related industry codes and standards committed to by the Contractor; (2) become familiar with the contents of the procedures and standards; and (3) assess whether the procedures and implementation of the procedures adequately conform to the applicable commitments.

The SRD, SC 4.2-2, refers to the American Society of Mechanical Engineers (ASME) Standard B31.3, "Process Piping," 1996 Edition, as the Code governing process piping system design and construction. The ASME Boiler and Pressure Vessel Code (B&PV) Section VIII, "Rules for Construction of Pressure Vessels," provides the requirements for tank construction. The structural steel construction of piping system or tank supports, which are not attached by weld to the pipe or tank, are governed by the SRD, SC 4.1-2, which refers to American Nuclear Society (ANS)/American Institute for Steel Construction (AISC) Standard N690-94, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities," which references the American Welding Society (AWS) Standard D1.1-1996, "Structural Welding Code." ASME B31.3 refers to ASME B&PV Code, Section IX, as the Code governing pipe welding and ASME, Section VIII, references Section IX as the Code governing tank welding.

This procedure assumes that inspection technical procedures I-114, "Structural Steel Inspection," and I-115, "Structural Steel Welding Inspection," have not been completed to assess the Contractor's programs for installing and welding steel structures. If these procedures have been accomplished for the piping and tank system Contractor, the inspector may choose to not perform the sections of this procedure that assess the Contractor's implementation of AWS Standard D1.1 requirements.

Suggested sample selections are included in the sections below. The inspector can follow the suggestions or choose samples more appropriate for the inspection due to construction progress, completion of Contractor's QA/QC reviews, or inspector experience. The inspector should use judgement in determining sample selection, focusing on examination of the most important aspects of the particular activity being inspected. The intent is to establish a high level of assurance that the end product meets requirements.

4.1 Adequacy and Effectiveness of Construction Implementing Procedures

4.1.1 The inspector should review the implementing procedures for important-to-safety pipe, pipe support, and tank construction provided by the Contractor. Verify the procedures have been approved and specify the work processes and management controls for the major construction activities. The major construction activities are listed in Sections 4.1.1.1 through 4.1.1.11, below. The inspector should ensure the Contractor's procedures adequately address each of the major construction activities and the requirements, as applicable, of AISC Standard N690-94, ASME B31.3, and ASME B&PV Sections VIII, and IX.

4.1.1.1 Receiving

The inspector should select a sample of procurement documents (specifications and drawings) that address at least five different types of important-to-safety piping system components (e.g., pipe, motor operated valves, check valves, solenoid valves, tank shell material). Verify these documents specify the following:

- The shape, size, dimension, and material type and grade. Material should conform to the approved design requirements and specifications.
- Required Certificates of Conformance, Certified Mill Test Reports, or certified report of tests made by the fabricator or qualified testing laboratory have been provided.

4.1.1.2 Storage

The inspector should ensure the construction procedures for important-to-safety piping systems and/or the procurement documents reviewed for Section 4.1.1.1 above require the following:

- The quality of the material received to be maintained by including provisions for access control of the storage area.
- The identity of material in storage to be maintained by including provisions for an adequate marking system.
- Protection from the environment and weather, as appropriate. Pipe material and support structural steel should be protected from corrosion.
- Segregation of nonconforming material.

4.1.1.3 Fit-up and Alignment

The inspector should ensure the construction procedures for important-to-safety piping and support steel structures require the following:

- Fit-up tolerances for length, depth, and straightness of structural members and anchor base plate bolt holes. (AISC Standard N690-94, Section Q1.23.11)

- Limits for spacing between pipe and supports. (Design Drawings)

- Support base plate elevation and degree of levelness. (AISC Standard N690-94, Section Q1.25.5)

- Piping elevation and degree of levelness/slope. (Design Drawings)

- Alignment of piping weld edges conforms to the criteria of ASME B31.3, Chapter V, Article 328.4.3.

- Calibration of layout instruments and measuring tapes. NOTE: Calibration and control measures are not required for rulers, tape measures, levels, and other such coarse measurement devices that provide adequate accuracy as received from the manufactures. (QAM Policy Q-12.1)

4.1.1.4 Edge Finish

The inspector should ensure the construction procedures for important-to-safety pipe welding implement ASME B31.3, Chapter V, requirements regarding: preparation for welding (Article 328.4); cleaning (Article 328.4.1); and alignment (Article 328.4.3).

4.1.1.5 Anchor bolts, Embedded Weldments and Plate Anchors

The inspector should determine whether inspection technical procedure I-113, "Structural Concrete Inspection," has recently been performed at the site. If not, review the construction procedures to determine if anchor bolts, embedded weldments, and anchor plates are in accordance with those procedures. In addition, the inspector should assess whether the Contractor's procedures adequately address the following:

- The minimum edge distance for bolts, studs, or bars with shear loading (ACI Standard 349, Appendix B – Steel Embedments, Section B.5.1.2.1)

- Expansion anchor testing (ACI Standard 349, Appendix B – Steel Embedments, Section B.7.4).

4.1.1.6 Bolted Connections

The inspector should ensure the construction procedures for important-to-safety pipe and supports require the following:

- For support base plates, maximum and minimum edge distance for slotted, oversize and standard bolt holes. (AISC Standard N690-94, Sections Q1.16.5.1-3 and Q1.16.6)

- For support base plates, maximum and minimum hole size for standard, oversize, short slotted, and long slotted holes for bolted connections. (AISC Standard N690-94, Section Q1.23.7)

- For support base plates, minimum spacing requirements for bolt holes. (AISC Standard N690-94, Section Q1.16.4)

- For support bolting installations, requirements for minimum thread engagement, threaded connection locking devices, and piping movement. (ASME B31.3, Chapter IV, Article 321.1.5) (ASME B31.3, Chapter IV, Article 321)

- For flanged joints in piping systems, bolts should extend through the nut so they are at least flush; although only one complete thread below flush engagement is acceptable. (ASME B31.1, Chapter V, Article 335.2)

- Calibration of torque wrenches.

4.1.1.7 Pipe and Tank Support Welded Connections

The inspector should determine whether the inspection technical procedure I-115, "Structural Steel Welding," has recently been performed at the site for the Contractor who will be performing the welding on structural steel for pipe and tank supports. If not, review the construction procedures for that welding in accordance with that procedure. In addition, the inspector should assess whether the Contractor's procedures adequately address:

- Identification of welders and weld operators. (AISC Standard N690-94, Section Q1.7.4)

- Weld procedure qualification. (AISC Standard N690-94, Section Q1.17 which references AWS Standard D1.1-96)

- Control of welding material. (AISC Standard N690-94, Section Q1.17 which references AWS Standard D1.1-96)

4.1.1.8 Qualification of Pipe and Tank Welding Procedure Specifications (WPS)

The inspector should determine whether the construction procedures for welding important-to-safety pipe and tank material implement the following requirements:

- WPSs shall be qualified in conformance with ASME Section IX, Article II.

- Welding positions qualified by a WPS (flat, horizontal, vertical, and overhead) are in accordance with ASME Section IX, Article II, paragraph QW-203.

- The written WPS specifies all of the applicable essential variables referenced in paragraph QW-200.1(b) of ASME Section IX, Article II. The specific value of

these WPS variables must be obtained from the Procedure Qualification Record (PQR) which serves as a written confirmation record of a successful WPS qualification (ASME Section IX, Article II, paragraph QW-200.2(d)).

- The WPS must be re-qualified when changes to the PQR essential variables are beyond those listed in Tables QW-252 through QW-256 of ASME Section IX, Article II.

- Welded test assemblies for WPS qualification shall be prepared for testing in accordance with ASME Section IX, Article II, paragraphs QW-202 and 210.

- Acceptable qualification welds must meet the following ASME Section IX, Article II criteria: visual inspection requirements (paragraph QW-302.1); radiographic test requirements (paragraph QW-302.2); and mechanical testing requirements (paragraph QW-302.4).

4.1.1.9 Qualification of Pipe and Tank Welding Personnel

The inspector should determine whether the construction procedures for welding important-to-safety pipe and tank material address the following requirements:

- Welders using welding processes covered by ASME, Section IX must have been qualified by the applicable test described in Section IX, paragraph QW-304.

- Welders not engaged in a given welding process for which the welder is qualified for a period of six months, or if the essential variables of the process are changed beyond that allowed by Section IX Tables QW-252 through 256, must be re-qualified in accordance with Section IX, paragraphs QW-320 and QW-322.

- The welding position a welder is qualified for shall be in conformance with Section IX, Tables QW-352 through QW-357.

4.1.1.10 Tolerances for Material Physical Dimensions

The inspector should ensure the construction procedures for important-to-safety support structures require tolerances for the following:

- Length of structural materials (e.g., girders) (AISC Standard N690-94, Section Q1.23.11.1)

- Depth or width of structural materials (e.g., girders) (AISC Standard N690-94, Section Q1.23.11.2)

- Straightness of structural members (AISC Standard N690-94, Section Q1.23.11.7).

4.1.1.11 Nondestructive Examination

The inspector should determine whether the inspection technical procedure I-120, "Nondestructive Testing," has recently been performed at the site. If not, review the construction procedures for structural steel in accordance with that procedure.

Nondestructive examination procedures must be provided for any examination of piping system welds and the procedures must conform to the requirements of ASME B31.3, Chapter VI, Article 343. The inspector should examine the procedures for visual inspection, liquid penetrant inspection, magnetic particle inspection, ultrasonic inspection, and radiographic inspection and verify the procedures conform to the applicable requirements. The intent of these inspections is not to repeat procedure I-120, rather to ensure the special requirements of ASME B31.3 are satisfied.

In addition, the inspector should assess whether the Contractor's procedures adequately address the following:

- Minimum examination of welds (AISC Standard N690-94, Section Q1.26.2 for support welds; and ASME B31.3, Chapter V, Article 341.4 for piping system welds)

- Inspection sampling for full-penetration and partial-penetration welds (AISC Standard N690-94, Sections Q1.26.2.1 and Q1.26.2.2 for support welds; and ASME B31.3, Chapter V, Article 341.4 for piping system welds).

4.1.2 The inspector should review the QC construction inspection procedures for important-to-safety piping, tanks, and supports provided by the Contractor. Verify the procedures are approved and provide adequate QC inspections and inspection methods to ensure the major construction activities are completed in accordance with drawing and procedure requirements and include or reference appropriate quantitative or qualitative acceptance criteria. The major construction activities are listed in Sections 4.1.2.1 through 4.1.2.11, below, with guidance on the activities that should be in the Contractor's QC procedures.

NOTE: Section 4.1.2 and 4.1.3 should be performed together.

4.1.2.1 Receiving

The inspector should verify the QC inspection procedures for important-to-safety steel piping and support material are adequate to ensure:

- Material received meets the design specification (shape, size, dimension, and material type and grade).

- The Certificate of Conformance, Certified Mill Test Report, or certified report of test made by the fabricator or a qualified testing laboratory is provided as required by the procurement document.

4.1.2.2 Storage

The inspector should verify the QC inspection procedures for important-to-safety steel structures ensure the following:

- Access is controlled to the storage area
- A marking system is used to maintain the identity of material in storage
- Material is protected from the environment and weather, as appropriate
- Nonconforming material is segregated.

4.1.2.3 Fit-up and Alignment

The inspector should verify the QC inspection procedures for important-to-safety piping and support steel structures ensure the following:

- Fit-up tolerances for length, depth, and straightness are not exceeded. The procedures should reference AISC Standard N690-94, Section Q1.23.11, for acceptance criteria, as appropriate.
- Limits for contact bearing for column compression joints are not exceeded. The procedures should reference AISC Standard N690-94, Section Q1.25.4, for acceptance criteria.
- Tolerance for base plate elevation and degree of levelness is not exceeded. The procedures should reference AISC Standard N690-94, Section Q1.25.5 for acceptance criteria.
- Pipe supports are located as required by design requirements.
- Pipe and component elevations and slopes are in accordance with design requirements.
- Pipe weld root openings conform to the requirements of the WPS.
- Layout instruments and tapes are calibrated. Acceptance criteria should be in accordance with engineering specifications and drawing.

4.1.2.4 Edge Finish

The inspector should verify the QC inspection procedures for important-to-safety piping and support steel ensure the following:

- The edges have the required finish. The procedures should contain or reference the criteria of AISC Standard N690-94, Section Q1.21.3 for support steel

acceptance criteria and ASME B31.3, Chapter V, paragraph 328.4.2 for piping material, as appropriate.

- The finish of any support steel thermal cut edges is within the acceptance criteria. The procedures should reference AISC Standard N690-94, Section Q1.23.3.1 for support steel acceptance criteria and ASME B31.1, Chapter V, Article 328.4.2 for piping acceptance criteria.

4.1.2.5 Anchor Bolts, Embedded Weldments, and Plate Anchors

The applicable section of the inspection procedure I-113, "Structural Concrete Inspection," should be followed. The QC procedure should reference ACI Standard 349-97 for acceptance criteria, as appropriate.

4.1.2.6 Bolted Connections

The inspector should verify the QC inspection procedures for important-to-safety pipe and support structures ensure the following:

- For support base plates, maximum and minimum edge distance for slotted, oversize, and standard bolt holes are not exceeded. The procedures should reference AISC Standard N690-94, Sections Q1.16.5.1-3 and Q1.16.6 for acceptance criteria, as appropriate.

- For support base plates, required hole size for standard, oversize, short slotted, and long slotted holes for bolted connections is not exceeded. The procedures should reference AISC Standard N690-94, Section Q1.23.7 for acceptance criteria, as appropriate.

- For support base plates, minimum bolt hole spacing requirements are not compromised. The procedures should reference AISC Standard N690-94, Section Q1.16.4 for acceptance criteria, as appropriate.

- For support to pipe bolting installations, requirements for minimum thread engagement, threaded connection locking devices (ASME B31.3, Chapter IV, Article 321.1.5), and piping movement (ASME B31.3, Chapter IV, Article 321) are implemented.

- For flanged joints in piping systems, bolts should extend through the nut so that they are at least flush. (ASME B31.3, Chapter V, Article 335.2)

- Torque wrenches are calibrated.

4.1.2.7 Welded Connections

Determine whether the inspection procedure I-115, "Structural Steel Welding," has recently been performed at the site. If not, the inspector should review the construction

procedures for pipe and tank support structures in accordance with that procedure. In addition, the inspector should assess whether the Contractor's QC procedures adequately address the following:

- Identification of welders and weld operators. The procedure should reference AISC Standard N690-94, Section Q1.7.4 for acceptance criteria, as appropriate.

- For pipe and tank welds, the procedure should implement the requirements of ASME B31.3, Chapter V, Article 328.5.1, regarding welder identification symbols, marking of welds, rules for tack welding, and welding environmental conditions.

- Weld procedure qualification. The procedure should reference AWS Standard D.1.1-96. Section 4 (support welding) and ASME Section IX, Article II (pipe and tank welding) for acceptance criteria, as appropriate.

- Control of welding material. The procedure should reference AWS Standard D1.1-96, Section 5.3.1.4 and Section 5.3.2 for acceptance criteria, as appropriate.

4.1.2.8 Qualification of Pipe and Tank Welding Procedure Specifications (WPS)

The inspector should determine whether the QC inspection procedures for welding important-to-safety pipe, tank, and support structures are adequate to ensure the following:

- WPSs are qualified in conformance with AWS Standard D1.1, Section 4, Part B, for support welding and ASME, Section IX, Article II, for pipe and tank welding.

- Welding positions (flat, horizontal, vertical, and overhead) are qualified by a WPS. The procedure should reference Table 4.1 of AWS Standard D1.1 for acceptance criteria (AWS D1.1-96, Section 4.3) for support welding. The procedure should ensure ASME, Section IX, Article II, paragraph QW-203, for pipe and tank welding is implemented.

- The type and number of qualification tests required to qualify a WPS for a given thickness, diameter, or both is specified. The procedure should ensure, for pipe support welds, Table 4.2, 4.3, or 4.4, as appropriate, for joint type for acceptance criteria (AWS D1.1-96, Section 4.4) and ASME, Section IX, Article II, paragraph QW-202, for pipe and tank welds is implemented.

- A written WPS is prepared that specifies all the applicable essential variables referenced in Section 4.7 of AWS Standard D1.1 (for support welds) and ASME, Section IX, Article II, paragraph QW-200.1, for pipe and tank welds. The specific values for these WPS variables shall be obtained from the procedure qualification record (PQR), which serves as a written confirmation record of a successful WPS qualification (AWS D1.1-96, Section 4.6) for support welds, and ASME Section IX, Article II, paragraph QW-200.2(d) for pipe and tank welds.

- The WPS are re-qualified when significant changes are made to the PQR essential variables. The procedure should ensure Table 4.5 or 4.6 of AWS Standard D1.1 for acceptance criteria (AWS D1.1-96, Section 4.7) for support welds, and ASME Section IX, Article II, Tables QW-252 through 256 for pipe and tank welds are implemented.

- Welded test assemblies for WPS qualification are prepared for testing in accordance with AWS Standard D1.1, Section 4.8 (AWS D1.1-96, Section 4.8) for support welding and ASME Section IX, Article II, paragraphs QW-202 and 210 for pipe and tank welds.

- Qualification welds are acceptable. The procedures should specify the following acceptance criteria:

  - The visual inspection requirements in Section 4.8.1 (AWS D1.1-96, Section 4.8.1) for support welds and ASME Section IX, Article III, paragraph QW-302.1 for pipe and tank welding

  - The UT or RT requirements of Section 6, Part C (AWS D1.1-96, Section 4.8.2.2) for support welds, and ASME Section IX, Article III, paragraph QW-302.2 for pipe and tank welding

  - The mechanical testing requirements of Sections 4.8.3.3, 4.8.3.5, and 4.8.4.1, as applicable, for support welding (AWS D1.1-96, Section 4.8.3.3, 4.8.3.5 and 4.8.4.1), and ASME Section IX, Article III, paragraph QW-302.4 for pipe and tank welding.

4.1.2.9 Qualification of Pipe and Tank Welding Personnel

The inspector should determine whether the QC inspection procedures for welding important-to-safety pipe, tank, and support structures are adequate to ensure the following:

- Welders, welding operators, and tack welders using welding processes covered by AWS Standard D1.1 are qualified by the applicable test described in AWS D1.1, Section 4, Part C (AWS D1.1-96, Section 4.1.2) for support welding and ASME Section IX, Article III, paragraph QW-304, for pipe and tank welding.

- Welders or weld operators not engaged in a given welding process, for which they are qualified, for a period exceeding six months are re-qualified prior to engaging in the welding process. (AWS D1.1-96, Section 4.1.3.1 for support welding and ASME Section IX, Article III, paragraph QW-322, for pipe and tank welds).

- The welding position a welder is qualified for should be in conformance with Table 4.8 of AWS Standard D1.1 for support welding (AWS D1.1-96, Section 4.18.1.1) and ASME Section IX, Article III, Tables QW-352 through 357, for pipe and tank welds.

- The type and number of qualification tests required for welders or welding operators shall conform to Table 4.9 of AWS Standard D1.1 for support welds (AWS D1.1-96, Section 4.19.1) and ASME Section IX, Article III, paragraph QW-302, for pipe and tank welding.

- Welders, welding operators, and tack welders that are qualified for a given process shall be required to re-qualify, if an essential variable for the process is changed beyond the limitations shown in Table 4.10 of AWS Standard D1.1 (AWS D1.1-96, Section 4.22.) for support welds and ASME Section IX, Article III, Tables QW-352 through 357, for pipe and tank welds.

- The acceptance criteria for welder and welding operator qualification shall be in conformance with Section 4.30 of AWS Standard D1.1 (AWS D1.1-96, Section 4.30) for support welding and ASME Section IX, Article III, paragraph QW-304, for pipe and tank welding.

4.1.2.10 Tolerances for Material Physical Dimensions

The inspector should verify the QC inspection procedures for important-to-safety pipe, tank, and support structures ensure the following:

- Support materials (e.g. girders) are the required lengths. The procedure should reference AISC Standard N690-94, Section Q1.23.11.1 and AWS Standard D1.1-96 for acceptance criteria, as appropriate.

- Support materials (e.g. girders) are the required depths. The procedure should reference the appropriate material specification (e.g. ASTM Standards A6, A36, etc.) for acceptance criteria.

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- Support members are straight within the allowed tolerance. The procedure should reference ASTM Standard A6 and AISC Standard N690-94, Section Q1.23.11.7 for acceptance criteria, as appropriate.

- Pipe and tank material, whose ends have been prepared by machining to achieve joint preparation or alignment requirements, shall not be less than the specified minimum wall thickness specified by the material ASTM standard, B31.3, Section 328.4.

- Flanged faces and bolt holes shall conform to the requirements of ASME B31.3, Section 335.1.1.c.

4.1.2.11 Nondestructive Examination

The inspector should determine whether the construction inspection procedure I-120, "Nondestructive Testing," has recently been performed at the site. If not, review the construction procedures for important-to-safety pipe, tank, and support structures in

accordance with that procedure. In addition, the inspector should assess whether the Contractor's QC procedures adequately addresses the following:

- The minimum visual examination of support weld length. The procedure should reference AISC Standard N690-94, Section Q1.26.2 for acceptance criteria, as appropriate.
- Required inspection sampling for support full-penetration and partial-penetration welds. The procedure should reference AISC Standard N690-94, Sections Q1.26.2.1 and Q1.26.2.2 for acceptance criteria, as appropriate.

- The pipe and tank examination procedures should specify the extent of examinations required and conform to the requirements of ASME B31.3, Chapter VI, paragraph 341.4 and provide criteria for progressive sampling consistent with paragraph 341.3.4. The acceptance criteria for welds should conform to Table 341.3.2.

- The pipe and tank construction procedures should specify requirements for in-process examination which conforms to ASME B31.3, Chapter VI, paragraph 344.7.

4.1.3 When determining the adequacy of the QC procedures per Section 4.1.2 of this procedure, also determine whether the procedures require that test equipment or instruments used for process monitoring or data collection identified in Sections 4.1.2.1, 4.1.2.3, 4.1.2.6, 4.1.2.8, 4.1.2.10, and 4.1.2.11 are calibrated and maintained. The calibration standards should be traceable to industry recognized criteria (for example, the National Bureau of Standards, **Not Committed**).

4.1.4 Review the procedures establishing the requirements for the qualification of craft and inspection personnel and determine whether the procedures conform to the requirements of QAM, Policy Q-02.2 Section 3.3.3 .

4.2 Adequacy and Effectiveness of Construction Activities

Prior to performing work observation inspections in the field, the inspector should review the procedures and industry standards which apply to the work that will be observed to ensure familiarity with the requirements and acceptance criteria pertinent to the planned observations. During field observations, the inspector should carry a copy of the sections of the drawings, procedures, and industry standards pertinent to the planned observations and verify work is being accomplished using procedures of the proper revision.

The inspector should select three representative important-to-safety piping runs/tanks for inspection and ensure the pipe, supports, and tanks are constructed and located in accordance with the design specifications, drawings, and tolerances. The samples selected should ensure a piping system in each of the major buildings (Pretreatment, Low-Activity Waste, and High-Level Waste) is examined.

The major individual construction activities for pipe, tank, and support structures are listed in Sections 4.2.1 through 4.2.11, below, with guidance for inspection of each of these activities. The inspector should ensure that the Contractor is adequately implementing the construction procedure for each of these activities.

During the field observations, the inspector should interview and obtain the names of a sample of the craft and QC personnel performing the observed activities to assess whether their knowledge of the job and procedures is satisfactory. The sample size will be determined by the number of Contractor personnel performing the activity, but not less than three or more than six of each discipline (craft and QC personnel). Information on these same personnel will be used pursuant to Section 4.3, below, to determine the adequacy of their experience and training.

4.2.1 Receiving

Select four receiving inspection reports which include piping, tank, support, and piping system components (i.e., pumps, motor operated valves, check valves, or solenoid operated valves) and verify the following:

- Material received meets the design specification and procurement document requirements including shape, size, dimension, and material type and grade.

- Certified mill test report or certified report of test made by the fabricator or a qualified testing laboratory is provided as required by procurement documents.

4.2.2 Storage

Select two receiving reports for support structural material (e.g., girders, plate, weld filler metal, fasteners, expansion anchors), piping material, components, and tank material. For each report independently verify the following:

- Access to the storage area is controlled.

- Material is identified with a marking system. The system is effective with legible marking (tags are easily read and not subject to weather) to identify material.

- Protection from environment and weather is provided, as appropriate. Materials are not subject to deleterious dust, rain, grease, corrosion, etc.

- Nonconforming material is segregated, as necessary.

4.2.3 Fit-up and Alignment

The inspector should verify the following:

- Fit-up tolerances conform to procedure or drawing requirements.
- Clearances conform to procedure or drawing requirements.
- Layout instruments and tapes are calibrated. Equipment and instruments used for in-process monitoring and inspection should be calibrated to standards traceable to industry recognized criteria (e.g. the National Bureau of Standards, **Not Committed**). NOTE: Calibration and control measures are not required for rulers, tape measures, levels, and other such coarse measurement devices that provide adequate accuracy as received from the manufactures. (QAM Policy Q-12.1)

4.2.4 Edge Finish

The inspector should verify the following:

- Weld preparation edges have the required finish, spacing, and configuration.
- Thermal cut edges have the required finish.
- Flange faces have the required finish.

4.2.5 Anchor Bolts, Embedded Weldments, and Plate Anchors

For any anchor bolt installations in the selected piping runs, verify the following:

- For support base plates, maximum and minimum edge distance for slotted, oversize, and standard bolt holes is not exceeded.
- For support base plates, required hole size for standard, oversize, short slotted, and long slotted holes for bolted connections is not exceeded.
- For support base plates, minimum bolt hole spacing requirements are not exceeded.

4.2.6 Bolted Connections

For any bolted connections in the selected piping runs, the inspector should verify the following attributes, as applicable, conform to established requirements:

- Maximum and minimum edge distance for slotted, oversize, and standard bolt holes.
- Bolt hole size for standard, oversize, short slotted, and long slotted holes for bolted connections.
- Minimum bolt hole spacing requirements.

- For support to pipe bolting installations, requirements for minimum thread engagement, threaded connection locking devices, and piping movement.

- For flanged joints in piping systems, bolts should extend through the nut so they are at least flush; although only one complete thread below flush engagement is acceptable.

- Torque wrenches are calibrated as required by the construction specification.

4.2.7 Welded Connections

The inspector should examine a sample of the welded connections in the three piping runs/tanks selected for examination. The sample of welded connections should include in process welding. The inspector should verify the following:

- A number, letter, or symbol identifies the welders and weld operators and the identifier is used to identify the work.

- The weld procedures are qualified in accordance with requirements.

- Welding material is controlled in accordance with requirements.

4.2.8 Qualification of Pipe and Tank Welding Procedure Specifications

During the inspection of the piping and tank installations, the inspector should sample welds in progress and completed welds (from pipes, tanks, and supports) and verify the welding procedures used were qualified in accordance with established procedures. The inspector should perform the verifications through the review of records. The inspector should verify, for welds in progress, that the welding was being conducted in accordance with the specified essential variables and other WPS requirements.

4.2.9 Qualification of Pipe and Tank Welding Personnel

During the inspection of piping and tank installations, the inspector should obtain the welder's markings from completed welds and from the welders performing in-process welding. In conjunction with paragraph 4.2.8, above, the inspector should verify the welders were qualified, in accordance with applicable procedures, to perform the applicable procedure used on the welds. The inspector should perform the verifications through examination of welder qualification records.

4.2.10 Tolerances for Material Physical Dimensions

For the piping/tank installations selected, the inspector should verify the following:

- The length of structural materials (e.g. support beams) conforms to drawing requirements.
- The fabrication tolerances of welded structural members conform to specified requirements.
- The depth or width of piping, tank, or structural materials (e.g. support beams) is in accordance with the material specification.
- Flanged faces and bolt hole locations are in accordance with design requirements.
- Piping and tank material thickness conforms to established requirements.
- Weld joint preparations conform to established requirements.

4.2.11 Nondestructive Examination

The inspector should examine several completed welds to verify they conform to acceptance criteria established in the Contractor's visual inspection procedures and verify records of weld nondestructive examination reflect conformance to established requirements.

4.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

During the observation of work activities (Section 4.2, above), the inspector should carry a copy of the procedures specifying the Contractor's requirements for education and experience levels, training, and certification. The inspector should interview four craft and four QA/QC personnel involved in the performance of piping and tank system construction activities, and record which job they were performing. The inspector should verify that the personnel are sufficiently knowledgeable of procedure requirements. The inspector should review the training and qualification records for those individuals to determine if they meet the requirements.

The inspector should ensure the certification and qualification records of nondestructive examination personnel conform to the requirements of ASME B31.3, Chapter VI, Article 342, and the records of welding qualification conform to ASME B31.3, Chapter V, Article 328.4. In addition, the inspector should ensure nondestructive examination records conform to the requirements of ASME B31.3, Chapter VI, Article 341.4.1.c.

4.4 Adequacy and Effectiveness of Records

In addition to the records of work performance selected during the conduct of the inspections pursuant to Sections 4.2.8 and 4.2.9, above, the inspector should select a sample of 10 records that were generated during the conduct of piping and tank material receiving, storage, fit-up and alignment, bolting, welding, and testing activities, and records of qualification for those craft and QA/QC personnel selected during the performance of Section 4.3, above. The inspector should

verify the records selected for examination were approved by proper authority and were stored and maintained in such a manner to demonstrate conformance with procedural requirements.

5.0 REFERENCES

The Contractor requirements that form the basis for this procedure are identified below:

10 CFR 830, Subpart A, "Quality Assurance Requirements," *Code of Federal Regulations*

ACI Standard 318-1995, "Building Code Requirements for Structural Concrete," American Concrete Institute, 1995.

ACI Standard 349-1997 "Standard Code Requirement for Nuclear Safety-Related Concrete Structures," American Concrete Institute, 1997.

ANS/AISC Standard N690-1994, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities," American National Standard/American Institute for Steel Construction, 1994.

ASME Standard B31.3, "Process Piping," American Society of Mechanical Engineers, 1996 Edition.

ASME Section VIII, "Rules for Construction of Pressure Vessels," American Society of Mechanical Engineers, 1995 Edition.

ASME Section IX, "Welding and Brazing Qualifications," American Society of Mechanical Engineers, 1995 Edition.

AWS Standard D1.1-1996, "Structural Welding Code," American Welding Society, 1996.

Integrated Safety Management Plan (ISMP), 24590-WTP-ISMP-ESH-01-001, Rev. 1, Bechtel National, Inc., 2002.

Quality Assurance Manual (QAM), 24590-WTP-QAM-QA-01-001, Rev. 0a, Bechtel National, Inc., 2002.

Safety Requirements Document (SRD), Volume I, 24590-WTP-SRD-ESH-01-001-01, Rev. 0, Volume 2, 24590-WTP-SRD-ESH-01-001-02, Rev 0d, Bechtel National, Inc., 2002.

6.0 LIST OF TERMS

ACI	American Concrete Institute
AISC	American Institute for Steel Construction
ANS	American Nuclear Society
ASTM	American Society for Testing and Materials

AWS	American Welding Society
ISMP	Integrated Safety Management Plan
QA	quality assurance
QAM	Quality Assurance Manual
QC	quality control
RPP	River Protection Project
WTP	Waste Treatment Plant
SC	Safety Criteria
SRD	Safety Requirements Document