

NRC Meeting on ASME Section XI IWE General Visual Examination

January 19, 2023



AGENDA

- ASME Section XI IWE General Visual Examinations
 - History
 - Examination Requirements
 - Interpretations
- Operating Experience and Unintended Consequences
- Regulatory Requirements
 - Bases for NCVs?
- Summary of Industry Position

Problem Statement

Licensees have been performing the ASME XI IWE Containment General Visual Examination in compliance with 10 CFR 50.55a and ASME Section XI requirements for nearly 3 decades without having to remove insulation from containment penetration piping to make those surfaces accessible for visual examination. These inspections have been successfully performed over this extensive time period, maintaining the integrity of containment, with no detrimental adverse operating experience. The NRC has recently issued violations for not removing insulation from penetrations for these general visual examinations with no clear regulatory bases.

ASME Section XI IWE General Visual Examinations



■ History

- The requirements of Section XI, Subsection IWE were initially imposed by 10 CFR 50.55a (61 FRN 41303) in 1996. This rule required compliance with the 1992 Edition with the 1992 Addenda, with conditions specified in 10 CFR 50.55a(b)(2).
- The 1992 Edition with the 1992 Addenda, Category E-A, Item E1.11 required a general visual examination prior to each 10 CFR 50, Appendix J Type A Test on “**Accessible Surface Areas**” – essentially codifying 10 CFR 50, Appendix J, V.A. examination requirements
- Based on industry benchmarking, licensees have not removed containment insulation to perform the 10 CFR 50, Appendix J, V.A. examinations, or the IWE general visual examinations required by Table IWE-2500-1, Examination Category E-A, Item E1.11

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■ NRC Endorsed Examination Requirements (2019 Edition)

- **IWE-1220** specifies exemptions from examination requirements, including *“inaccessible portions of containment...”*
- **IWE-1231** addresses accessible surface areas and requires, in part, that *“surface areas identified in IWE-1240”* shall remain accessible for visual examination.

Note: 10 CFR 50.55a(g)(4) exempts licensees from the accessibility provisions of IWE-1231, acknowledging the limitations of the original plant design, geometry, and materials. NRC confirmed this exception in the 1996 rule making. This exemption also applies to IWE-1232(a) and (b), except for repair/replacement activities performed after initial plant construction.

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■ NRC Endorsed Examination Requirements (2019 Edition)

- **IWE-1232(c)** defines inaccessible surface areas as those where “*visual access by line of sight from permanent vantage points is obstructed by permanent plant structures, equipment, or components, provided these surface areas do not require examination in accordance with the inspection plan or IWE-1240*”.
- **IWE-1241** identifies surface areas that require examination in accordance with Table IWE-2500-1, Examination Category E-C.

Note: For surface areas (including insulated surface areas) that are subject to accelerated aging and degradation described in IWE-1241, IWE-1232(c) imposes a requirement that is more stringent than that required for the General Visual Examination. If an insulated surface area is subject to conditions described in IWE-1241, insulation must be removed to the extent necessary to make the surface area accessible for the VT-1 visual examinations required by Examination Category E-C.

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- **NRC Endorsed Examination Requirements (2019 Edition)**
 - **IWE-2310(d)** requires that “*Visual examinations shall be performed, either directly or remotely, by line of sight from floors, platforms, walkways, ladders, or other permanent vantage points, **unless temporary access is required by the inspection plan.***”

Note: IWE-2310(d) has remained essentially unchanged since the 2000 Addenda.

Examples where temporary access, such as removing insulation, may be required by the inspection plan for visual examinations.

- *VT-1 examination of pressure retaining bolted connections (Category E-G)*
- *VT-1 examination of containment surfaces (Category E-C)*
- *VT-3 examination of submerged areas and BWR vent systems (Category E-A)*
- *General visual examination of leak chase channel system closures (Category E-A)*
- *Examination of inaccessible areas in support of IWE-2500(d) evaluations*

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■ NRC Endorsed Examination Requirements (2019 Edition)

- **IWE-2311** requires that general visual examinations be performed *“to determine the general condition of containment surfaces and detect evidence of degradation.”*
- **IWE-2500(d)** requires that an engineering evaluation be performed to determine the acceptability of an inaccessible area ***“When conditions exist in accessible areas that could indicate the presence of, or result in, degradation in an inaccessible area.”***

Note: If adverse conditions are detected on surface areas adjacent to insulated surfaces, the requirement of IWE-2500(d) is applicable and an engineering evaluation is required to determine the acceptability of the insulated surfaces. Removal of insulation would likely be required for this evaluation.

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■ ASME Section XI Interpretations

ASME Interpretation XI-1-10-02 was issued in 2009, clarifying requirements of IWE-1232(c), as follows:

Question: Is it a requirement of IWE-1232(c) that permanent (e.g., welded or mechanically connected) plant structures, equipment, or components be disassembled or removed in order to make surface areas accessible for visual examination, provided the examination areas do not require examination in accordance with the inspection plan or IWE-1240?

Reply: No.

Note: This interpretation provided examples of what a licensee might consider to be permanent but did not define what constitutes “permanent” plant structures, equipment, or components. Insulation is a design feature and therefore permanent.

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■ ASME Section XI Interpretations

ASME Interpretation XI-1-13-25 was issued in 2013, further clarifying requirements of IWE-1232(c), as follows:

Question (1): Is it a requirement of IWE-1230 that containment surface covered by thermal insulation be considered accessible for general visual examination in accordance with Table IWE-2500-1, Examination Category E-A?

Reply(1): No.

Question(2): Is it a requirement of IWE-1230 that containment surface covered by thermal insulation be considered accessible for augmented examination in accordance with Table IWE-2500-1, Examination Category E-C, if these surfaces are subject to accelerated degradation and aging?

Reply(2): Yes.

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■ ASME Code Revisions

- ASME recently approved a revision to IWE-1232(c) and (d) [ASME *Record* #20-2064] to clarify requirements for insulation removal (consistent with Interpretation #XI-1-13-25).
- Record #20-2064 did not receive a single negative vote during deliberations by the Section XI Working Group on Containment, the Section XI Subgroup on Water-Cooled Systems, and the Section XI Standards Committee.

Note: The NRC has members on each of these committees, and any of these members could have voted against this action at any of these committee meetings to convey NRC concerns with the proposed code change (and Interpretation #XI-1-13-25).

Operating Experience and Unintended Consequences



- Benchmarking of plants in the U.S. has determined that insulation is not normally removed from containment penetrations for the performance of IWE general visual examinations. This practice is consistent with industry practice not to remove this insulation for the performance of 10 CFR 50, Appendix J, V.A. containment general inspections.
- A review of operating experience has not identified the existence of containment penetration degradation that would have been detected during the IWE general visual examinations if insulation had been removed.
- Based on a review of the different containment designs currently in service in the U.S., it is estimated that at least 1/3 of the operating units contain process piping penetrations that are insulated. Insulation removal is estimated to cost over \$500k per unit for each inspection interval.

Operating Experience and Unintended Consequences



- Although degradation of some containment bellows has been identified at some U.S. plants, the bellows assemblies are typically obstructed from visual examination by protective covers and would not be accessible for general visual examination even if insulation is removed. The condition of containment penetration bellows is monitored by the performance of Type A and B Tests in accordance with 10 CFR 50, Appendix J.
- Insulation performs a design feature and in many cases protection of the penetration. Repeated removal for inspection, when no susceptibility to degradation exists and no signs of degradation are evident, could have the unintended adverse effect of degrading the insulation protective features.
- Until 2022, not a single U.S. plant had been cited for not removing containment penetration insulation for the IWE general visual examinations, even though the requirements of Subsection IWE have been in place since the late 1990s.

Regulatory Requirement

- **10 CFR 50.55a(b)(2)(ix)(A)** requires that licensees provide the following information in the ISI Summary Report required by IWA-6000 when conditions exist in accessible areas that could indicate the presence of or could result in degradation to such inaccessible areas [IWE-2500(d)].
 - *(i) A description of the type and estimated extent of degradation, and the conditions that led to the degradation;*
 - *(ii) An evaluation of each area, and the result of the evaluation; and*
 - *(iii) A description of necessary corrective actions.*

Notes:

1. *Application of this condition and the IWE-2500(d) requirement ensures that an appropriate level of rigor is applied when evaluating the acceptability of containment surfaces that are considered inaccessible for visual examination. Any leakage, rust, or staining emanating from or extending into an inaccessible area of containment must be evaluated by the owner, and the results of those evaluations must be submitted to the NRC following each refueling outage.*
2. *10 CFR 50.55a(b)(2)(ix) imposes conditions on the use of Subsection IWE to address NRC concerns with the ASME Code requirements for metal containment examination. However, the NRC has not issued a condition related to removal of insulation for containment visual examinations, even though there are conditions specified in § 50.55a(b)(2)(xxvii) that require insulation removal for Class 1, 2, and 3 components.*

Recent Finding and Violation

- Green Finding and Non-cited Violation for *“failure to perform general visual examinations specified in...(ASME) Section XI, Subsection IWE, Table IWE-2500-1, “Examination Category E-A, Containment Surfaces.” Specifically, the licensee failed to perform general visual examinations of the accessible surfaces...in accordance with IWE Table-2500-1 (E-A) to determine the general condition and detect evidence of degradation.”*
 - *Inspection Report (IR) noted “[t]he inspectors inquired why insulation was not removed prior to these examinations”*
- Agree – general visual exams required for Category E-A surfaces that are accessible, do not agree components with insulation are considered accessible for this exam
- What is the regulatory basis for the position that Category E-A surfaces that have insulation are considered accessible or that insulation is required to be removed to perform this specific exam?

Basis for Removing Insulation?

- Inspection report appears to conclude that removal of insulation is based on two sections of the ASME Code:
 - IWA-1500: *“Subsection IWA, Subarticle IWA-1500, “Accessibility,” stipulated, in part, that provisions for accessibility shall include considerations for sufficient space for removal and storage of insulation. The inspection accessibility provisions of IWA-1500 applied to all Section XI Subsections, including Subsection IWE for the CISI.”, and*
 - IWE-1230: *“Subsection IWE, Subarticle IWE-1230, “Accessibility for Examination,” stipulated, in part, that the openings and penetrations in Class MC containment vessels, parts, and appurtenances remain accessible for either direct or remote visual examination, from at least one side of the vessel, for the life of the plant”*

IWA-1500, Accessibility

- IWA-1500 provides design provisions to be considered for new plants in determining if a component or surface is accessible, not inspection requirements
- One such design provision is to consider the feasibility of insulation removal and storage when constructing the plant
 - Meaning this is one of the considerations when classifying a component as accessible
 - Does not state that insulation is required to be removed to make component accessible
- Other listed design provisions of this section support this conclusion
 - Another consideration for determining accessibility is inspector/examiner ability to get to the component and is there sufficient room to perform the required examination
 - The footnote states there are design conditions, other than those related to access provisions, that impact the practicality of performing inservice inspections
- IWA-1500 does not require removal of insulation to make a component accessible for the general visual examination

IWE-1230, Accessibility for Examination

- Discusses accessible surface areas (IWE-1231) and inaccessible surface areas (IWE-1232)
- IWE-1231 states a design requirement – portions of Class MC components shall remain accessible for direct or remote visual examination, from at least one side
 - Many sites were built before this ASME requirement and associated rule was promulgated
 - 10 CFR 50.55a(g)(4) addresses this issue where the design and access provisions of IWE-1231 cannot be met
 - ◆ *“Components that are classified as Class MC pressure retaining components and their integral attachments, and components that are classified as Class CC pressure retaining components and their integral attachments, must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of the ASME BPV Code and addenda that are incorporated by reference in paragraph (a)(1)(ii) of this section and the conditions listed in paragraphs (b)(2)(viii) and (ix) of this section, to the extent practical within the limitation of design, geometry, and materials of construction of the components.”*
- NRC relief from this ASME Code requirement is not required to make these surfaces accessible (ML20117L472 NRC resolution to comments 4.7 and 4.11)

IWE-1230, Accessibility for Examination (continued)



- IWE-1232 states:
 - Class MC components that made inaccessible during construction are exempt from examination while describing components that are considered inaccessible
 - Surface areas of Class MC components may be considered inaccessible if visual access by line of site from permanent vantage points is obstructed by permanent plant structures, equipment, or components (provide exams not required by ISI plan or IWE-1240)
- Insulation was installed during construction and is considered permanent plant equipment with an operational design function
- Requirement is to perform examination from permanent vantage points – requiring temporary access (e.g., scaffold) to remove insulation is inconsistent with a requirement to perform an exam from a permanent vantage point
- IWE-1230 does not impose a requirement to remove insulation for general visual examinations

Regulatory Basis for Finding

- Inspection Report states the violation is against Table IWE-2500-1(E-A), for failure to perform general visual examinations of accessible surface areas
 - Surface areas in question are enclosed in permanent insulation
 - No ASME Code or regulatory requirement to remove insulation to perform these examinations, except as may be required by IWE-2500(d)
 - ASME requirements that most appropriately apply (IWE-1232(c) and IWE-2311) consider insulated surfaces as inaccessible and do not require insulation removal for general visual examinations
- Surface areas covered by insulation are considered inaccessible for general visual examinations based on review of ASME Code and the requirements of 10 CFR 50.55a
- There is no ASME or NRC requirement to remove insulation to make the surfaces accessible for IWE-2500-1 (E-A) general visual examination

Summary of Industry Position

- Licensees have not removed containment insulation to perform the 10 CFR 50, Appendix J, V.A. examinations, or the IWE general visual examinations required by Table IWE-2500-1, Examination Category E-A, Item E1.11
- 10 CFR 50.55a(g)(4) exempts licensees from the accessibility provisions of IWE-1231, and IWE-1232(a) and (b) [except for repair/replacement activities], acknowledging the limitations of the original plant design, geometry, and materials
- Surface areas covered by insulation are considered inaccessible for general visual examinations based on review of ASME Code and the requirements of 10 CFR 50.55a
- There is no ASME or NRC requirement to remove insulation to make the surfaces accessible for IWE-2500-1 (E-A) general visual examination
- Violation is not supported by the requirements of ASME Section XI or 10 CFR 50.55a

Questions

