

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, DC 20555-0001

May 9, 2016

**NRC REGULATORY ISSUE SUMMARY 2016-07  
CONTAINMENT SHELL OR LINER MOISTURE BARRIER INSPECTION**

**ADDRESSEES**

All holders of an operating license or construction permit for a nuclear power reactor under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except for those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of and applicants for a power reactor early site permit, combined license, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." All applicants for a standard design certification, including such applicants after initial issuance of a design certification rule.

**INTENT**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to reiterate the NRC staff's position in regard to inservice inspection requirements for moisture barrier materials, as discussed in the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (hereinafter "the ASME Code"), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Subsection IWE. No specific action or written response is required.

**BACKGROUND INFORMATION**

Requirements in 10 CFR 50.55a, "Codes and standards," paragraph (g), "Inservice inspection requirements," require, in part, that licensees implement an inservice inspection program for metal containments and metallic liners of concrete containments. The program shall be in accordance with the latest edition and addenda of Subsection IWE of Section XI of the ASME Code that has been incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month inspection interval, and is subject to the applicable conditions in 10 CFR 50.55a(b)(2)(ix).

Section XI of ASME Code, Item E1.11, in Table IWE-2500-1 (E-A), requires general visual examination of 100 percent of accessible surface areas during each inspection period, while Item E1.30 in the same table requires general visual examination of 100 percent of accessible moisture barriers during each inspection period. Note 4 (Note 3 in editions before 2013) for Item E1.30 under the "Parts Examined" column states, "Examination shall include moisture barrier materials intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete-to-metal interfaces and at

**ML16068A436**

metal-to-metal interfaces which are not seal-welded. Containment moisture barrier materials include caulking, flashing, and other sealants used for this application.”

Note 4 also defines the moisture barriers that are required to be examined in terms of intended function. Table IWE-2500-1, third column, “Examination Requirements/Fig. No.,” for Item E1.30, references Figure IWE-2500-1, “Examination Areas for Moisture Barriers” (shown below). Figure IWE-2500-1 depicts typical moisture barrier examination areas for concrete-to-metal interface moisture barriers. Figure IWE-2500-1 does not include an illustration of metal-to-metal interface moisture barriers, which are included as part of the definition of moisture barriers, and are areas to be examined in accordance with Note 4. Thus, the NRC understands the figure to be an example, not a definitive depiction, of the parts required to be examined under the scope of Item E1.30. There may be other configurations in which a material has been applied to prevent moisture from making contact with inaccessible areas of the metal containment shell or liner. These materials should be inspected as a moisture barrier under item E1.30. Additional discussion of this issue can be found in NRC Information Notice (IN) 2014-07 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14070A114).

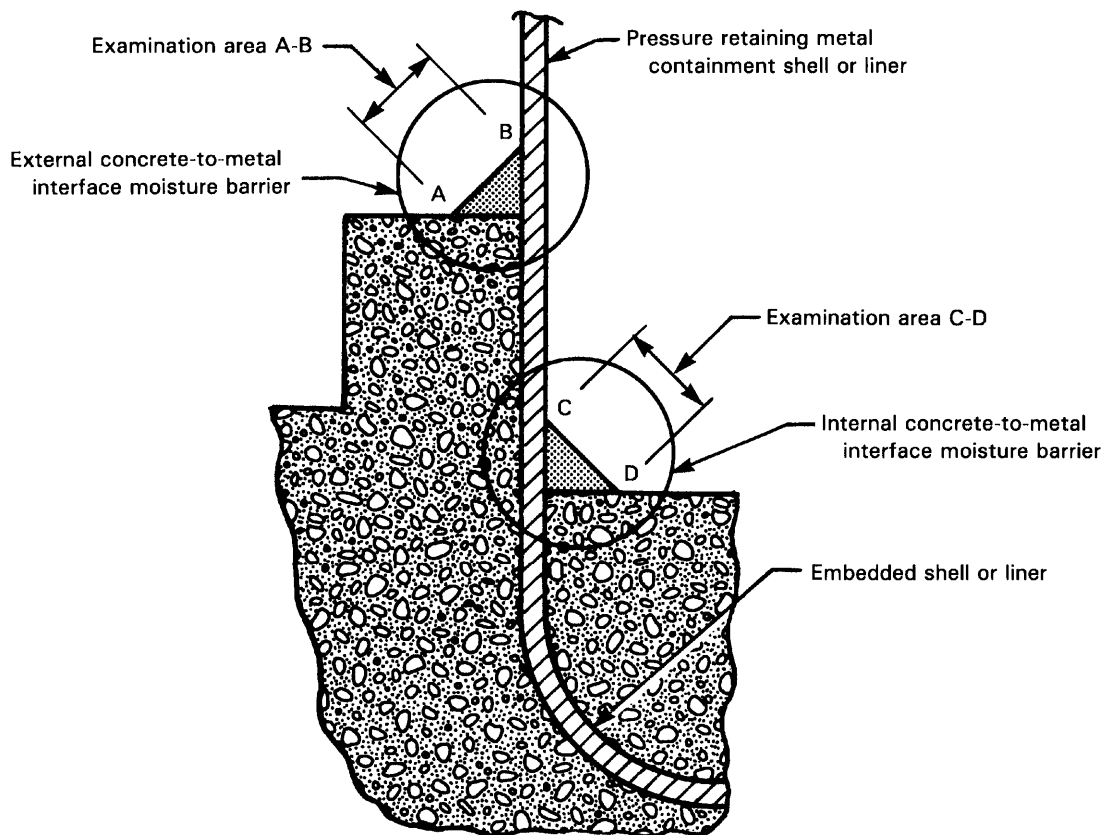


Figure IWE-2500-1  
Examination Areas for Moisture Barriers

Section XI of ASME Code, IWE-1241, "Examination Surface Areas," identifies areas that are subject to accelerated degradation, and require augmented examinations in accordance with Table IWE-2500-1 (E-C). This paragraph further notes that typical locations "are those exposed to standing water, repeated wetting and drying ... and those with geometries that permit water accumulation ..." The paragraph goes on to state that such areas may include concrete-to-shell or liner interfaces. To protect these areas, and to avoid the augmented examination requirement, the areas discussed in IWE-1241 are commonly protected from moisture by some type of moisture barrier material.

## **SUMMARY OF ISSUE**

The NRC staff identified several instances in which containment shell or liner moisture barrier materials were not properly inspected in accordance with ASME Code Section XI, Table IWE-2500-1, Item E1.30. Note 4 (Note 3 in editions before 2013) for Item E1.30 under the "Parts Examined" column states that "Examination shall include moisture barrier materials intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete-to-metal interfaces and at metal-to-metal interfaces which are not seal-welded. Containment moisture barrier materials include caulking, flashing, and other sealants used for this application." Examples of inadequate inspections have included licensees not identifying sealant materials at metal-to-metal interfaces as moisture barriers because they do not specifically match Figure IWE-2500-1, and licensees not inspecting installed moisture barrier materials, as required by Item E1.30, because the material was not included in the original design or was not identified as a "moisture barrier" in design documents. Two examples of recent operating experience are provided below.

### Watts Bar Nuclear Plant, Unit 2

Watts Bar Nuclear Plant, Unit 2, uses a stand-alone steel containment vessel shell. The concrete base mat is poured directly against the containment shell. The lower approximately 4-foot (1.2-meter) portion of the containment vessel is covered by a thermal insulation package that includes stainless steel flashing and caulking. The flashing and caulking acts as a barrier to protect the insulation underneath from moisture. As a result, the thermal barrier also protects the concrete-liner interface and serves as a moisture barrier. Inspection of the flashing was performed as a non-ASME Code examination.

NRC inspectors questioned whether this barrier also acts to prevent moisture intrusion at the base mat to containment vessel shell interface and should be inspected per the ASME requirements, specifically Subsection IWE, Table IWE-2500-1, Category E-A, Item E1.30, "Moisture Barriers." The applicant subsequently revised its Containment Preservice Inspection Program Plan to include the flashing and caulking as an Item E1.30 ASME Code examination. This issue was documented as an observation in Inspection Report (IR) 05000391/2015604 (ADAMS Accession No. ML15181A446).

### Surry Power Station, Units 1 and 2

The Surry Power Station containment configuration includes a concrete containment with a steel liner, and a concrete floor poured flush to the steel liner. The original design did not include a moisture barrier at the interface between the concrete floor and the steel liner. Subsequently, the licensee installed a moisture barrier at this junction. However, the area was never identified as a moisture barrier, and never received the appropriate inspections per ASME Section XI,

Subsection IWE. Once the licensee installed a moisture barrier, regardless of the original design, examinations per Table IWE-2500-1, Item E1.30, were required under 10 CFR 50.55a(b). The licensee later removed the moisture barrier. At this point, the licensee reintroduced the configuration that is discussed in IWE-1240, "Surface Areas Requiring Augmented Examination." Section XI of ASME Code, IWE-1241, "Examination Surface Areas," specifically mentions concrete-to-steel shell or liner interfaces as areas that may require augmented examinations in accordance with Table IWE-2500-1, Examination Category E-C, Item E4.11. When the licensee reintroduced this configuration, an augmented examination should have been performed, or an evaluation should have been completed demonstrating why augmented examinations in accordance with IWE-1241 were unnecessary. The lack of proper inspection resulted in a green finding with an associated non-cited violation because the licensee failed to make an augmented examination in accordance with Section XI, Subsection IWE-1241, Table IWE-2500-1, Category E-C, Item E 4.11, as required by 10 CFR 50.55a(g). This issue is documented in IR 05000280/2015002 (ADAMS Accession No. ML040280056).

The NRC staff expects licensees to inspect 100 percent of accessible moisture barriers during each inspection period, in accordance with Table IWE-2500-1, Item E1.30, as required by 10 CFR 50.55a(g). Items within the scope of E1.30 inspections shall be identified based on the function of the item as described in the associated Table IWE-2500-1 note rather than relying on the name given to the material or the similarity to Figure IWE-2500-1. As noted previously, Figure IWE-2500-1 represents one typical moisture barrier geometry; however, it is not all-inclusive. If a material prevents intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete-to-metal interfaces or at metal-to-metal interfaces that are not seal-welded, the material shall be inspected as a moisture barrier. If the material is used as a basis for not performing augmented examinations of a shell or liner interface location per IWE-1241, the material is serving the purpose as described above, and shall be inspected as a moisture barrier. Furthermore, if the Item E1.11 and Item E1.30 inspections are addressed in the same procedures, the inspection scope and acceptance criteria should identify the different surfaces. Items E1.11 and E1.30 address different materials with different geometries and acceptance criteria.

## **BACKFITTING AND ISSUE FINALITY DISCUSSION**

This RIS requires no action or written response. This RIS does not present any new or changed NRC position or interpretation with respect to ASME Code, Section XI, Subsection IWE. Consequently, the staff did not perform a backfit analysis.

## **FEDERAL REGISTER NOTIFICATION**

The NRC published a notice of opportunity for public comment on this RIS in the *Federal Register* (80 FR 80401) on December 24, 2015. The agency received comments from four commenters. The staff considered all comments, which resulted in minor revisions to the RIS. The evaluation of these comments and the resulting changes to the RIS are discussed in a publicly available memorandum which is in ADAMS under Accession No. ML16060A450.

## **CONGRESSIONAL REVIEW ACT**

This RIS is not a rule as defined in the Congressional Review Act (5 U.S.C. §§ 801-808).

## PAPERWORK REDUCTION ACT STATEMENT

This RIS does not contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget (OMB) under control number 3150-0011.

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### CONTACT

Please direct any questions about this matter to the technical contact(s) or the lead project manager listed below, or to the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under "NRC Library" > "Document Collections."

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**TAC: MF6496 \*via e-mail**

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<b>DATE</b>	09/01/2015	09/08/2015	08/31/2015	09/21/2015	09/29/2015	09/29/2015
<b>OFFICE</b>	NRR/PMDA	OIS	OGC (pre comment)	NRR/DPR/PGCB/LA	NRR/DPR/PGCB	NRR/DPR/PGCB/BC
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<b>NAME</b>	AMohseni	MCheok	MBailey	LKokajko	ELee	AGarmoe
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