

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 62003

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### INSPECTION OF STEEL AND CONCRETE CONTAINMENT STRUCTURES AT NUCLEAR POWER PLANTS

PROGRAM APPLICABILITY: 2515

SALP FUNCTIONAL AREA: MAINTENANCE (MAINT)

#### 62003-01 INSPECTION OBJECTIVES

01.01 Evaluate by visual examination and/or review of licensee documentation the condition of steel and concrete containment structures at nuclear power plants and verify containment integrity. Implementation of the NRC containment inspection program requirements contained in this procedure are consistent with the monitoring requirements of 10 CFR 50.65 (maintenance rule) and required by 10 CFR 50.55a, which endorses, in part, the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Subsections IWE and IWL.

#### 62003-02 INSPECTION REQUIREMENTS

02.01 The inspector will verify, either through direct inspection of containment structure or through review of licensee documentation, that the containment structure has not experienced degradation. The inspector will also verify, if degradation exists, that corrective actions have been taken, and that the degradation has been fully documented and reported.

02.02 Verify that the licensee has implemented the inspection requirements of the amended 10 CFR 50.55a (rule) effective September 9, 1996, which references the 1992 Addenda of Subsection IWE, "Requirements for Class MC and Metallic Liners of Class CC Concrete Components of Light-Water Cooled Power Plants," and Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants," of Section XI, Division 1, of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code).

#### 62003-03 INSPECTION GUIDANCE

##### General Guidance

Evaluation and assessment of the effectiveness of licensees' inspection programs (developed on the basis of the requirements in NRC rules) by NRC inspectors will provide confidence in the integrity of the containment structures at nuclear power plants.

examples of degradation not found by licensees, but initially detected at plants through NRC inspections, are (1) corrosion of steel containment shells in the drywell sand cushion region, resulting in wall thickness reduction to below the minimum design thickness; (2) corrosion of the torus of the steel containment shell (wall thickness below minimum design thickness); (3) extensive corrosion of the liner of a concrete containment with local degradation at many locations to approximately half-depth; (4) leakage of protective grease from the tendon sheathing of prestressed concrete containments; and (5) leaching and excessive cracking in concrete containments.

The NRC staff has issued information notices on the preceding degradation mechanisms, such as Information Notice (IN) 85-10, "Post-Tensioned Concrete Anchor Head Failure"; IN 86-99, "Degradation of Steel Containments"; and IN 88-82, "Torus Shells With Corrosion and Degradation of Coatings." These publications were meant to alert the licensee to these potential degradations. Also, implementation of Regulatory Guide (RG) 1.35, "Inservice Inspection of UngROUTed Tendons in Prestressed Concrete Containments," is a useful resource in inspecting for degraded post-tensioned tendons in prestressed concrete containments.

Additionally, it is expected that licensees would use the containment monitoring programs which they develop to comply with the requirements of 10 CFR 50.55a to satisfy the monitoring requirements of 10 CFR 50.65 (maintenance rule). The NRC encourages licensees to utilize such programs for implementing the requirements of 10 CFR 50.65. For those licensees that choose to use this program to meet the maintenance rule monitoring requirements, the NRC inspector should verify that the performance or condition of the containment structure is properly evaluated per the licensees' maintenance rule programs. Guidance for monitoring structures per the maintenance rule can be found in Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

### Specific Guidance

03.01 The inspector will follow the 1992 edition with the 1992 addenda of Subsections IWE and IWL of Section XI, Division 1 of the ASME Boiler and Pressure Vessel Code as modified by the amended 10 CFR 50.55a of the NRC's regulations effective September 9, 1996, in monitoring the licensees' inspection programs related to steel and concrete containments.

The inspector will review the UFSAR and Technical Specifications for additional specific licensee requirements for the performance of containment inspections. The inspector will review the UFSAR and applicable construction drawings and records to become familiar with the construction details of the containment structure to determine the appropriate inspection requirements necessary to comply with the Technical Specifications.

The inspector will also review a sample of the licensee's inspection records to determine if the licensee is complying with containment inspection requirements, taking appropriate action to document, evaluate, and repair identified defects, and perform re-inspections, as necessary.

03.02 Paragraph 03.01(a) of IP 62002, "Inspection of Structures, Passive Components, and Civil Engineering Features at Nuclear Power Plants," states that this inspection procedure will provide guidance on the use of Subsections IWE and IWL of the ASME Code. The guidance is provided in the following paragraphs in the numerical order of the paragraphs of the subsections. The guidance is provided only where additional explanation is needed. No guidance is provided if the requirements of the paragraphs need no clarification.

### Subsection IWE

IWE-1232: In Section 50.55a(b)(x)(A), the rule additionally requires that the licensee shall evaluate the acceptability of the inaccessible areas when conditions exist in accessible areas that could indicate degradation. The rule requires the licensees to document specifics of such areas in the Inservice Inspection (ISI) Summary Report.

IWE-2200: In Section 50.55a(g)(6)(ii)(B)(1), for currently licensed operating reactors, the rule clarifies that the examination performed during the first period of the first inspection interval, which is required to have been completed prior to September 9, 2001, will serve as the preservice examination.

IWE-2400: In case of contradiction between the requirements in IWE-2400 and Table IWE-2500-1 regarding the inspection frequencies, the detailed requirements of Table-2500-1 will control.

IWE-2430: Section 50.55a(b)(2)(x)(D) of the rule provides an alternative to the requirements of this section. The alternative would allow the licensees to determine the number of additional components to be examined based on an evaluation to determine the extent and nature of the degradation. The relaxed alternative was provided in the final rule in response to the public comments on this subject.

Table IWE-2500-1: For examination categories E-B and E-F related to pressure retaining welds, Section 50.55a(b)(2)(x)(C) of the rule makes the requirement optional on the basis of the experience thus far that there is no evidence of problems associated with these welds under the operating conditions.

IWE-3112: This section provides for acceptance of containment components by  
(1) examination, (2) repair, (3) replacement, and/or (4) evaluation. When a licensee documents an acceptance of a flaw or degradation by evaluation, a reduction of up to 10 percent of the nominal plate thickness of either a steel containment shell or steel liner of a Class CC component is acceptable. If a licensee

desires to accept flaw sizes larger than 10 percent, the adequacy of the degraded component must be demonstrated by analysis. Any engineering evaluation of this type is subject to review.

In addition to the disposition of the flaws or areas of degradation revealed during the examination in accordance with this section, the rule for metal containments and the liners of concrete containments, requires the licensees to evaluate the acceptability of the inaccessible areas when conditions in the accessible areas indicate potential for such degradation in the inaccessible areas.

#### Subsection IWL

If the integrity of the post-tensioning system and that of the post-tensioned containment is periodically ensured by a licensee in accordance with the plant's technical specification requirements or by the provisions of Revision 3 of Regulatory Guide 1.35, the rule considers these requirements to satisfy the expedited examination requirement of the post-tensioning tendons of Subsection IWL. However, the requirements for concrete surfaces examination in accordance with Subsection IWL, and that for liner plate examination in accordance with Subsection IWE, has to be supplemented to ensure compliance with the requirements of the rule.

IWL-2420: The  $\pm 6$  months and 1 year latitude given in these requirements are meant to enable licensees to conveniently schedule the examinations considering the schedules for other ISI requirements and refueling outages.

IWL-2500: If the VT-3C or VT-1C examination of the concrete surfaces, or the examination of post-tensioning tendons of the prestressed concrete containments, or the liner surface examination (in accordance with Subsection IWE), indicates a flaw, degradation, or corrosion in the accessible areas that could indicate the existence of a flaw, degradation, or corrosion in the inaccessible area, the condition needs to be evaluated and documented in the ISI summary report, as required by 10 CFR 50.55a(b)(2)(ix)(E) of the rule.

IWL-2510: The use of guidelines given in ACI 349.3R-96, in addition to ACI 201.1R-68, will be useful in examining and evaluating the concrete surface condition.

IWL-2524: Additional examination of grease caps is required, as in 10 CFR 50.55a(b)(2)(ix)(A) of the rule.

#### Table IWL-2525-1:

(1) The acceptance limit for chemically combined water is 10 percent by weight and that for free water is zero, as required by 10 CFR 50.55a(b)(2)(ix)(D)(1) of the rule.

(2) The acceptance limit for the absolute difference between the amount of grease replaced and removed is 10% of the net duct volume, as per IWL-2526.

IWL-3221: Additional trending analyses will be performed as required in 10 CFR 50.55a(b)(2)(ix)(B) of the rule.

IWL-3221: For the tendons to be completely detensioned for the removal of wire or strand samples, the elongations corresponding to the specific prestressed force in the tendons should be assessed as required by 10 CFR 50.55a(b)(2)(ix)(C) of the rule.

#### 62003-04 RESOURCE ESTIMATE

For planning purposes, the average estimated time to complete the requirements of this inspection procedure is 36 hours per nuclear power plant unit. This estimate is based upon the assumption that most of the licensee's inspection and maintenance documentation is available. This estimate assumes that the NRC inspector will review licensee documentation and perform spot checks of a few critical areas.

#### 62003-05 REFERENCES

ACI 201.1R-68, "Guide for Making a Condition Survey of Concrete in Service."

ACI 349.3R-96, "Evaluation of Existing Nuclear Safety-Related Concrete Structures."

ASME Section XI, Subsection IWE, "Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants."

ASME Section XI, Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Plants."

ASME Section XI, Subsection IWF, "Requirements for Class 1, 2, 3, and MC Component Supports of Light Water Cooled Plants."

NUREG-1522, "Assessment of Inservice Conditions of Safety-Related Nuclear Plant Structures," U.S. Nuclear Regulatory Commission, June 1995.

USNRC Regulatory Guide 1.35, "Inservice Inspection of UngROUTED Tendons in Prestressed Concrete Containments."

USNRC Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments."

#### *Related Documents:*

USNRC IN 85-10, "Post-Tensioned Containment Anchor Head Failure."

USNRC IN 86-99, "Degradation of Steel Containments."

USNRC IN 88-82, "Torus Shells With Corrosion and Degradation of Coatings."

USNRC IN 89-79, Supplement 1, "Degraded Coatings and Corrosion of Steel Containment Vessels."

USNRC IN 97-10, "Liner Plate Corrosion in Concrete Containments."

USNRC IN 97-11, "Cement Erosion From Containment Subfoundations at Nuclear power Plants."

USNRC IN 97-13, "Deficient Conditions Associated with Protective Coatings at Nuclear Power Plants."

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