UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

December 1, 1989

NRC INFORMATION NOTICE NO. 89-79: DEGRADED COATINGS AND CORROSION OF STEEL CONTAINMENT VESSELS

Addressees:

All holders of operating licenses or construction permits for light-water reactors.

Purpose:

This information notice is intended to alert addressees to the discovery of severely degraded coatings and the corrosion of steel ice condenser containment vessels that are caused by boric acid and collected condensation in the annular space between the steel shell and the surrounding concrete shield building. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On August 24, 1989, Duke Power Company reported significant coating damage and base metal corrosion on the outer surface of the steel shell of the McGuire Unit 2 containment which was discovered during a pre-integrated leak rate test inspection (as required by Appendix J to 10 CFR Part 50). Subsequently, Duke Power identified similar degradation of the McGuire Unit 1 containment, which is essentially identical to the Unit 2 structure.

Both units have ice condenser-type containments consisting of a freestanding steel shell surrounded by a concrete shield building. Between the shell and the shield building is a 6-foot-wide annular space. The steel shells have a nominal thickness near the annulus floor of 1 inch. The degraded area on the shells of both units is limited to 30-foot circumferential sections no higher than 1½ inches above the annulus floors. The average depth of the corrosion is 0.1 inch with pits of up to 0.125 inch. Corrosion that is up to 0.03 inch deep was also found in areas below the level of the annulus floor on the Unit 2 shell, where concrete was removed to expose the shell surface. This below-floor corrosion is due to a lack of sealant at the interface between the shell and the annulus floor.

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The probable cause of the degradation is attack by condensed boric acid coolant leaking from instrument line compression fittings. Drains are provided in the annulus floor, but they are widely separated and the floor is not sufficiently graded to prevent pooling of the condensate between the drain locations. The current average thickness of the corroded areas of the containment shells of 0.9 inch is expected to be reduced to no less than 0.85 inch for Unit 1 and 0.88 inch for Unit 2 by the time they are repaired during the next planned outages for these units. These estimates were made assuming the worst corrosion rates that could reasonably be expected and are greater than the minimum thickness allowed by the applicable ASME Code.

On September 21, 1989, Duke Power Company discovered coating damage and base metal corrosion during inspections of the steel shells of its two Catawba containments. These containments are also of the ice condenser type and are very similar to the McGuire containments; the nominal floor level shell thickness is 1 inch. Here also, the degradation was located on the outer surfaces of the shells at the intersection of the shell and the concrete annulus floor. At Catawba the damage was less extensive and was limited to a circumference of 15 feet, a height of 1 inch above the annulus floor, and an average depth of 0.03 inch. The cause is also believed to be attack by boric acid coolant, which had leaked from instrument line compression fittings, condensed, and collected on the annulus floor.

Duke Power Company plans to repair the steel shells of all four units during their next respective refueling outages. This will include weld repair and recoating of the corroded areas.

Discussion:

The degradation of the containment shells at the McGuire and Catawba plants is considered significant for several reasons. The fact that the corrosion affects four different units indicates that other steel containments with similar configurations may be susceptible to the same problem. Furthermore, the observed rate of corrosion far exceeds the allowance made for corrosion in the containment design. This condition leads to the concern that such corrosion could result in undetected wall thinning to less than the minimum design thickness, accompanied by a loss of leaktightness or structural integrity. This problem can be prevented by a containment inservice inspection program that is adequate to ensure early detection and the maintenance of design margins through proper corrosion control.

The NRC regulations (Appendix J to 10 CFR Part 50) require that a general visual inspection of the accessible surfaces in the containment be performed before each integrated leak rate test. The purpose of this inspection is to identify any evidence of structural deterioration or other problems that may affect containment integrity or leaktightness. As a result of these and other inspections, several instances of containment wall thinning due to corrosion have been discovered during the past 3 years at operating power reactors. However, the visual inspections done in connection with the integrated leak

rate tests are only required to be performed three times in each 10-year period. In addition, because of the physical arrangement of plant systems, the steel surfaces in the annular spaces of some containments may not be easily accessible to the visual inspections associated with leak tests. Considering the frequency and severity of recent instances of containment degradation due to corrosion, additional efforts to inspect steel containment surfaces potentially susceptible to corrosion may be prudent.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

José G. Calvo for

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Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-56, Supp. 1	Questionable Certification of Material Supplied to the Defense Department by Nuclear Suppliers	11/22/89	All holders of OLs or CPs for nuclear power reactors.
89-78	Failure of Packing Nuts on One-Inch Uranium Hexafluoride Cylinder Valves	11/22/89	All NRC licensees authorized to possess and use source material and/or special nuclear material for the heating, emptying, filling, or shipping of uranium hexafluoride in 30- and 48-inch diameter cylinders.
89-77	Debris in Containment Emergency Sumps and Incorrect Screen Configurations	11/21/89	All holders of OLs or CPs for PWRs.
89-76	Biofouling Agent: Zebra Mussel	11/21/89	All holders of OLs or CPs for nuclear power reactors.
89-75	Falsification of Welder Qualifications for Contractor Employees	11/20/89	All holders of OLs or CPs for nuclear power reactors.
89-74	Clarification of Transportation Requirements Applicable to Return of Spent Radiopharmacy Dosages from Users to Suppliers	11/7/89	All manufacturers and distributors of radiopharmaceuticals for medical use, nuclear pharmacies, and medical licensees.
89-73	Potential Overpressurization of Low Pressure Systems	11/1/89	All holders of OLs or CPs for nuclear power reactors.
89-72	Failure of Licensed Senior Operators to Classify Emergency Events Properly	10/24/89	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Document Name: IN 89-79

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*OGCB:DOEA:NRR	*EMTB:DET:NRR	*ESGB:DET:NRR	*C/ESGB:DET:NRR	*D/DET:NRR
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instances of containment wall thinning due to corrosion have been discovered during the past ~~three~~ 5 years at operating power reactors. However, the visual inspections done in connection with the integrated leak rate tests are only required to be performed three times in each ~~ten~~ 10 year period. In addition, because of the physical arrangement of plant systems, the steel surfaces in the annular spaces of some containments may fall outside of the usual scope of the ~~leak test related~~ visual inspections associated with leak tests. Considering the frequency and severity of recent instances of containment degradation due to corrosion, additional efforts to inspect steel containment surfaces at some plants may be prudent.

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