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January 8, 1990

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/89-20

Gentlemen:

Attached is Licensee Event Report 413/89-20 submitted as a Courtesy Report concerning both abnormal degradation of the steel containment vessel due to corrosion by standing water in the annulus areas.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony B. Owen
Station Manager

keb:COURTESY.LER

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1/1

IE22

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Abnormal Degradation of Steel Containment Vessels Due To Corrosion By Standing Water In The Annulus Areas

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
									CNS, Unit 2	0 5 0 0 0 4 1 4
0 9	2 1	8 9	8 9	- 0 2 0	- 0 0	0 1	0 9	9 0	MNS, Unit 1	0 5 0 0 0 3 6 9

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	Courtesy LER
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
R.M. Glover, Compliance Manager	8 0 3 8 3 1 1 - 1 3 2 3 6

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On September 21, 1989, a preliminary visual inspection of the Catawba Units 1 and 2 Steel Containment Vessel (SCV) exterior surfaces was performed between azimuths 0 degrees and 360 degrees at elevation 552 feet + 0 inches. Units 1 and 2 were in Mode 1, Power Operation, at 100% and 98% power respectively, when the inspection was conducted. The observed corrosion was caused by standing water in the Annulus Areas. The most significant corrosion occurred in areas where boric acid deposits were also found. The root cause of this event is assigned as a design oversight because the slope of the Annulus floors was not sufficient to cause flow to the installed floor drains. A contributing cause of Unanticipated Environmental Interaction is also assigned because of the chemical reaction between the boric acid and SCV. Design Engineering personnel evaluated the extent of corrosion by comparison to the conditions previously observed at McGuire Nuclear Station. The corrosion observed at the Catawba SCVs bases is not as advanced as at McGuire and does not warrant a separate operability review. The SCV will be repaired and recoated, as applicable, during the next two refueling outages for each Unit. This is a Courtesy LER.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

BACKGROUND

The general purpose of the Reactor Building and the Containment Vessel [EIIS:VSL] is to provide a barrier confining potential releases of radioactivity resulting from design basis accidents. This is accomplished by maintaining leak tightness within specified bounds. As a design feature, the Reactor Building and Containment Vessel are provided primarily for the protection of public health and safety. The free standing steel containment has an outer reinforced concrete Reactor Building and an annular space which is maintained at a lower-than-atmospheric pressure following a Loss of Coolant Accident (LOCA). These structures form a double barrier to prevent the escape of fission products should a LOCA occur.

The Steel Containment Vessel (SCV) is an ASME Class MC free-standing welded steel structure consisting of a vertical cylinder with a hemispherical dome and a flat circular base. The Containment shell is anchored to the Reactor Building foundation by 182 anchor bolts equally spaced around the perimeter of the cylinder base. The flat base of the Containment vessel is a 1/4 inch liner plate encased in concrete which functions only as leak-tight membrane and is not designed to serve as a structural element.

The vertical cylinder and hemispherical dome are constructed from carbon steel plate, ASME specification SA516 GR60. The lower approximate 14 feet of the vertical cylinder is 1 inch nominal thickness. The upper cylinder is 3/4 inch nominal thickness and the dome is 11/16 nominal thickness.

The Code of Federal Regulations, Title 10, Part 50 (10CFR50), Appendix J, Section V, Subsection A, requires that a general inspection of the Containment vessel be performed prior to each Type A Integrated Leak Rate Test (ILRT). This inspection is intended to identify any evidence of structural deterioration and interferences which may affect either the Containment structural integrity or leak tightness.

Technical Specification 4.6.1.6 states in part, that the structural integrity of the Containment vessel shall be determined during the shutdown for each Type A Containment leakage rate test by visual inspection of the exposed accessible interior and exterior surfaces of the vessel.

The Annulus area concrete floor was designed to circumferentially slope toward four equally spaced drains located at azimuths 45, 135, 225, and 315 degrees. The Annulus area, including the outside of the SCV, is coated to Service Level II requirements. Service Level II coating is meant for surface areas outside the primary Containment facilities that are subject to radiation or contamination. Service Level II coating is not intended for immersion conditions.

During the previous structural inspections conducted prior to Integrated Leak Rate Testing, the SCV corrosion was not identified because the SCV/concrete floor interface is inaccessible due to HVAC duct.

EVENT DESCRIPTION

The corrosion of the McGuire Nuclear Station Unit 2 Steel Containment vessel discovered during the structural inspection prior to an Integrated Leak Rate Test (ILRT) prompted, by procedure, an inspection of the Catawba Units 1 and 2 SCV for similar type degradation (see McGuire LER 369/89-020). On September 21, 1989, Design Engineering and Catawba Station personnel performed a preliminary visual inspection of Units 1 and 2 SCV exterior surfaces between azimuths 0 degrees and 360 degrees at elevation 552 feet + 0 inches. Units 1 and 2 were in Mode 1, Power Operation, at 100% and 98% power, respectively, when the inspection was performed. The observed corrosion was caused by standing water in the Annulus Area with the most significant corrosion occurring in areas where boric acid deposits resulted from leaking instrumentation connections.

CONCLUSION

The root cause of this event is assigned a design oversight due to the unanticipated interaction between the SCV and leaking instrumentation lines. The slope of the Annulus floor was not sufficient to cause flow to the installed floor drains. The design is considered adequate to handle large water spills. Design Engineering personnel evaluated the extent of corrosion by comparison to the conditions previously observed at McGuire Nuclear Station. The McGuire inspections found corrosion with an average depth of 0.1 inch with pits of up to 0.125 inch. The corrosion observed at the Catawba SCV base is not as advanced as at McGuire and does not warrant a separate operability review. The need to continue weekly or bi-weekly Annulus inspections, as well as the need for periodic coating inspections in the Annulus, will be evaluated.

The pooling conditions allowed time for the water to infiltrate the coating to the SCV through pin hole surface imperfections that are allowable under Service Level II requirements. The water could then wick its way between the coating and SCV. Although no accumulation of water had been identified in previously documented pre-ILRT inspections, pooling in the Annulus area is evident from previous observance of standing water and from multiple water level lines on the SCV and other Annulus area components. The number of occasions or the length of time that water was standing in the Annulus areas could not be determined. Inspection accessibility will be improved by removing or relocating HVAC ducts. Areas not already inspected due to inaccessibility will be inspected.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A contributing cause of Unanticipated Environmental Interaction because of the chemical reaction between the low carbon steel and boric acid is assigned. Corrosion is more prevalent in areas where boric acid deposits were present. These boric acid deposits were from leaking instrumentation line connections. Immersion of the SCV base in pooled, borated water was not anticipated when Service Level II coating was prescribed. Concrete floors and the lower portions of the SCVs will be recoated or topcoated and sealed for immersion conditions. The need for other SCV protection barriers, or repairs to the Annulus floor slope, will be evaluated after other corrective actions are implemented and their effectiveness is assessed.

This event is not Nuclear Plant Reliability Data System (NPRDS) reportable.

LER 414/89-017 describes a previous incident in which the Turbine Driven Auxiliary Feedwater Pump [EIIS:P] was rendered inoperable due to control valve [EIIS:V] stem corrosion; this incident, however, did not involve a design oversight/unanticipated system interaction. Other drain problems have been associated with blockage, debris, etc. Corrosion/degradation of the SCV is not considered a recurring problem at Catawba.

There were no personnel injuries, radiation overexposures, or releases of radioactive materials as a result of this event. This report is submitted as a Courtesy LER.

CORRECTIVE ACTION

SUBSEQUENT

1) Operations began performing weekly surveillances of both Unit 1 and Unit 2 Annulus areas to identify and remove any standing water or boric acid deposits. No major problems were identified from these inspections. Bi-weekly inspections began in December, 1989.

PLANNED

1) Those areas of the Unit 1 and Unit 2 Annulus where significant coating failures were observed will be inspected and repaired, as required, in their upcoming outages. In addition, the interior face of the SCV will be inspected.

2) Nuclear Station Modifications will be written to relocate or remove the HVAC duct along both Unit 1 and Unit 2 Annulus floors to make those areas accessible for visual examination.

3) Remaining Unit 1 and Unit 2 Annulus Areas will be fully inspected and repaired, as required, following duct relocation/removal. In addition, the interior face of the SCV will be inspected.

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4) The SCVs in both Unit 1 and Unit 2 will be weld repaired as necessary per applicable acceptance criteria. Concrete floors will be recoated or topcoated and sealed for immersion conditions. The SCVs will be recoated or topcoated and sealed for immersion conditions up to 9 inches above the floor base.

5) Installation of SCV protection barriers (water dam and diverter) or repair to the floor slope will be considered after the effectiveness of the above corrective actions can be evaluated.

6) The need to continue weekly or bi-weekly inspections of the Annulus area and the need for periodic coating inspections in that area will be evaluated.

SAFETY ANALYSIS

The design of the Catawba Containment is based on analysis in accordance with ASME Section III, NE-3200. Supplemental calculations using code formula equations (NE-3300) are also contained in the Catawba SCV Stress Report. These show the minimum required SCV wall thickness at the base to be 0.6875 inches as governed by external pressure (NE-3133). Re-analysis would give a lower value than that determined by formula but is not warranted at this time. Thus, the Catawba SCVs can be considered operable if the minimum wall thickness at the base is greater than 0.6875 inches.

The preliminary visual inspection of the Catawba SCVs revealed that the corrosion present is not nearly as advanced as that observed at McGuire. The time frame for corrective actions at McGuire and Catawba are similar (17 months and 24 months, respectively). Based on the calculated worst case corrosion rate at McGuire (38.5 mils per year), the amount of corrosion that will occur during the delayed time for implementation of corrective actions will not result in further significant loss of metal in the 1 inch nominal shell plate at the base of the Catawba SCVs.

As discussed above, the SCVs were not rendered inoperable as a result of the corrosion and subsequent loss of metal, and is capable of fulfilling its intended safety functions. The health and safety of the public were not affected by this event.

*U.S. GPO: 1988-520-589/00070