

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.: 50-298
License No.: DPR-46
Report No.: 50-298/97-04
Licensee: Nebraska Public Power District
Facility: Cooper Nuclear Station
Location: P.O. Box 98
Brownville, Nebraska
Dates: April 7-11, 1997, with in-office inspection continuing until April 21,
1997
Inspector: Clifford A. Clark, Reactor Inspector, Maintenance Branch
Division of Reactor Safety
Approved By: Dr. Dale A. Powers, Chief, Maintenance Branch
Division of Reactor Safety
ATTACHMENT: Supplemental Information

EXECUTIVE SUMMARY

Cooper Nuclear Station
NRC Inspection Report 50-298/97-04

This inspection consisted of a review of the licensee's planned and implemented activities associated with the erosion/corrosion monitoring program and the inservice inspection program. The inspection report covers a 1-week period on site, with followup in the office performed by one region-based inspector.

Maintenance

- Licensee reviews in 1993, 1994, and 1995 failed to properly account for erosion/corrosion monitoring program results of service water system degradation. As a result of these oversights, Diesel Generator 1 became inoperable when a leak occurred in its lube oil cooler (Section M1).
- Erosion/corrosion and inservice inspection procedures and records were adequately developed for the identified tasks. Examination personnel and equipment were properly certified (Sections M3.1 and M3.2).
- Erosion/corrosion and nondestructive inservice inspector examinations were properly performed by knowledgeable contract personnel (Sections M4.1 and M4.2).

Report Details

Summary of Plant Status

The unit was in Mode 5 for Refueling Outage RFO17 during this inspection period.

II. Maintenance

M1 Conduct of Maintenance

a. Inspection Scope (49001)

The inspector reviewed the information available on a February 28, 1997, failure of service water piping to Diesel Generator 1 lube oil heat exchanger.

b. Observations and Findings

The inspector reviewed the information and noted that on February 28, 1997, a pinhole leak (a self-disclosing condition) was discovered in service water piping to the lube oil heat exchanger for Diesel Generator 1, and the generator was declared inoperable. The leak occurred in a 6 by 8-inch reducer downstream of Air Operated Valve SW-AOV-2797AAV, and was documented in Problem Identification Report 2-12489. The problem identification report was not, however, classified as a condition adverse to quality.

The failed reducer was being monitored in the licensee's erosion/corrosion program under the microbiologically-induced corrosion inspection scope. The applicable erosion/corrosion program identification for this reducer was SW-DG-1-R-2. The following background information was provided for the inspector's review:

- The reducer was replaced in 1991 as a result of a similar leakage.
- Ultrasonic thickness examination was performed on the reducer during the 1993 refueling outage. Wall thinning was identified, and the component was evaluated by design engineering for structural integrity. As a result of an inadequate review, the 1993 design engineering evaluation did not recognize the 1991 replacement of the reducer and, therefore, used a calculated 14.22 years for the time that the component had been in service.
- In May 1994, a review of the calculated operating years for service water components was performed. The review identified the 1991 replacement of the subject reducer. The updated calculated operating years was forwarded to design engineering for incorporation into the service water pipe stress calculation performed for erosion/corrosion considerations. As a result of an

inadequate review, the updated operating years determination was not incorporated into the results of the calculation. Based upon the change in calculated operating time, the reducer wall thinning rate should have been increased from 0.013 to 0.083 inch per year.

- The reducer structural integrity was reviewed in 1995, to verify readiness for startup from the 1994-1995 unscheduled shutdown. As a result of an inadequate review, this evaluation used the originally-provided, erroneous wear rate of 0.013 inch per year, and concluded that the remaining service life would be an additional 12.3 years.
- Unfortunately, the reducer was omitted from the 1995 outage erosion/corrosion inspection scope based upon the information provided in the 1995 evaluation.

The licensee evaluation of this reducer failure noted the following:

- Multiple protection barriers (i.e., missed opportunities) were broken, which resulted in the failure to determine the need to replace the reducer prior to its developing a through-wall leak.
- The failures of these protection barriers indicated a lack of consistent program ownership. The erosion/corrosion program experienced significant turnover of program ownership in the period from 1993 through August 1996. Compounding the inconsistency in the program ownership was the early stage of development of the microbiologically-induced corrosion monitoring element for the service water system. Further, microbiologically-induced corrosion monitoring for the service water system had been based solely upon maintenance experience and engineering judgement. This was because the licensee was not aware of any suitable predictive model available for industry use for service water applications.

The inspector reviewed recent licensee corrective actions implemented for this reducer failure and noted the following:

- The affected reducer was replaced, and Diesel Generator 1 was returned to an operable status. Additional service water components in Diesel Generator 1, and similar components in Diesel Generator 2, were ultrasonically examined to ensure there were no similar degradations.
- A Problem Identification Report 2-12502 was issued upon discovery that some components adjacent to the failed reducer also contained areas of wall thinning. This condition was identified during the replacement of the failed reducer. These components were subsequently either evaluated acceptable or identified for replacement during the current 1997 refueling outage.

- The 1997 erosion/corrosion inspection scope was reviewed by the licensee to ensure that microbiologically-induced corrosion examinations of the service water system had not been inappropriately omitted. Subsequently, all microbiologically-induced corrosion examinations of the service water system were found to have been included.
- The wear rate calculations for the service water system were reviewed by the licensee to ensure that they adequately reflected known replacement history for affected components. No additional component replacements were found which had not already been incorporated into the wear rate calculations.

The inspector noted that the licensee had implemented the following actions to prevent recurrence:

- The vacant erosion/corrosion program owner position had been filled.
- Tools for a more effective program management had been established. These tools included the erosion/corrosion program document and an inspection database. The licensee representative stated these tools were flexible enough to grow with the program, and provide a basis to ensure consistency in the program in the event of a future turnover of the program owner.

Based on available information, the inspector could not determine the scope of this implementation problem with the erosion/corrosion monitoring program and the adherence to the requirements for reporting quality-related problems. This is an unresolved item pending further NRC review (50-298/97004-01).

c. Conclusions

Licensee reviews in 1993, 1994, and 1995 failed to properly account for erosion/corrosion monitoring program results of service water system degradation. As a result of these oversights, Diesel Generator 1 became inoperable when a leak occurred in its lube oil cooler.

M3 Maintenance Procedures and Documentation

M3.1 Review of Erosion/Corrosion Monitoring Certifications, Procedures, and Records

a. Inspection Scope (49001)

The inspector interviewed licensee and contract personnel involved in erosion/corrosion activities. The inspector also reviewed the erosion/corrosion monitoring documents, completed Refueling Outage RFO17 erosion/corrosion examination records, and contractor equipment and personnel certification records.

b. Observations and Findings

The licensee's "1997 Pipe Monitoring Inspection Scope," recommended inspecting a total of 215 components for the various pipe wall monitoring efforts at Cooper Nuclear Station. The specific programs and areas of concern and the number of recommended component inspections were as noted below:

- Erosion/corrosion program - 96 components
- Augmented erosion/corrosion program - 17 components
- Components downstream of throttling devices - 18 components
- Microbiologically-induced corrosion program - 72 components
- Small bore piping - 12 components

As of March 10, 1997, the scope of components scheduled to be examined during the current Refueling Outage RFO17 for the various pipe wall monitoring efforts, had increased (as a result of further licensee reviews) to 235 components.

The inspector found that in the last year the licensee used the Electric Power Research Institute's Checworks family of codes, along with other industry information and experience, to identify and rank suspected locations in piping systems for the Refueling Outage RFO17 erosion/corrosion inspections. The inspector noted that the licensee had modeled 1076 components in a Checworks database, which was currently undergoing an offsite independent verification of data input. The licensee representative identified that the following systems were included in the Checworks database:

- Condensate
- Turbine cross-under piping
- Extraction steam
- Heater drains
- Reactor feedwater
- Reactor water cleanup

The inspector determined that contractor equipment and personnel certification records were complete and current. Refueling Outage RFO17 erosion/corrosion examination data packages identified approximately 20 data packages available as of March 10, 1997. The inspector found them to be complete (for the stage of development they had undergone).

c. Conclusions

The inspector concluded that erosion/corrosion records and procedures were adequate for the identified tasks. Examination personnel and equipment were properly certified in accordance with procedure requirements.

M3.2 Review of Inservice Inspection Certifications, Procedures, and Records

a. Inspection Scope (73753)

The inspector reviewed the inservice inspection documents and equipment and personnel certification records. The inspector also interviewed contract and licensee personnel.

b. Observations and Findings

The inservice inspection examinations were scheduled to be performed in Refueling Outage RFO17 in accordance with the ASME, Section XI, "Inservice Inspection Program Plan," the first inspection of the first 40-month period of the third Ten-Year Interval. The inservice inspection program plan was written in accordance with the requirements of the 1989 Edition of Section XI of the ASME Boiler and Pressure Code, no addenda. The inspector found that the documents (procedures, records, and reports) had been developed in accordance with licensee procedures, regulatory requirements, and applicable ASME Code requirements.

The inspector determined the contractor equipment and personnel certification records were complete and current. The various Refueling Outage RFO17 inservice inspection examination records available March 10, 1997, were found to be complete (for the stage of development they had undergone).

c. Conclusions

The inspector concluded that the inservice inspection procedures and records were adequate for the identified tasks. The inspector found the equipment and examiners were properly certified in accordance with ASME Code requirements.

M4 **Maintenance Staff Knowledge and Performance**

M4.1 Erosion/Corrosion Staff

a. Inspection Scope (49001)

The inspector observed contract personnel perform erosion/corrosion ultrasonic thickness examinations of condensate and extraction steam piping. The inspector assessed licensee and contract personnel knowledge and performance in this area.

b. Observations and Findings

As a result of a licensee management decision to stop site work in order to conduct briefings on safe work practices, there were a limited number of erosion/corrosion examinations available for inspector observation.

The inspector observed ultrasonic thickness examinations properly performed by qualified nondestructive examination personnel on Condensate Piping Components CH-E-9-2819-6 and CH-R-4-2819-4, and Extraction and Bleed Steam Component BS-A-18-2812-2.

c. Conclusions

The inspector concluded that the observed erosion/corrosion ultrasonic examinations were performed in accordance with the appropriate procedures by knowledgeable contract personnel.

M4.2 Inservice Inspection Staff

a. Inspection Scope (73753)

The inspector observed inservice inspection examinations and assessed the contract and licensee personnel knowledge and performance in this area.

b. Observations and Findings

As a result of the management decision to stop site work, there were a limited number of inservice inspection examinations available for inspector observation.

The inspector observed a magnetic particle examination performed by qualified nondestructive examination personnel on Main Steam Piping Weld RAS-CF-14 (Report R-120).

c. Conclusions

The inspector concluded that the observed nondestructive examination was performed in accordance with the appropriate procedure by knowledgeable contract personnel.

M8 Miscellaneous Maintenance Issues (92902)

M8.1 (Closed) Violation 50-298/95015-01: Failure to Establish Reference System for Welds

The inspectors, while observing 1995 nondestructive examinations of Section XI repair/replacement activities on welds, discovered that some welds installed during the second 10-year interval of the inservice inspection program had not been physically marked in accordance with the requirements of Appendix IV of Section XI. The 1980 ASME Code, Winter 1981 Addenda, Section XI, Mandatory Appendix III, Article III-4000, Paragraph III-4330, stated, in part, "[c]ircumferential welds in Class 1 and 2 piping requiring volumetric examination shall be marked [in reference to weld centerline] once before or during preoperational examination to

establish a reference point." Since preservice examination was not performed at Cooper Nuclear Station, existing welds were excluded from this requirement and before 1991, there was no reference system, including permanently marking for determining the actual centerline of welds at Cooper Nuclear Station.

The licensee initiated Condition Report 95-1192 to address this inspector-identified deficiency. The licensee reviewed the documentation of examinations performed on repair/replacement welds during the second 10-year inservice inspection interval. The licensee found that those welds which had not been marked at one time during the second 10-year interval had subsequently been either replaced and appropriately marked, or were reconciled as no longer requiring marking in accordance with Section XI Code requirements. The licensee representative noted that a contributing factor to not marking the welds may have been the lack of adequate technical knowledge of ASME Section XI in 1984, when the second 10-interval inservice inspection program was developed. The licensee representative noted that since that time, an experienced inservice inspection engineer had been hired.

The inspector interviewed personnel, reviewed documentation, and verified that administrative controls were in place in Procedures O.30, "ASME Section XI Repair/Replacement and Temporary Non-Code Repair Procedure," Revision 11, and 3.28.1.2, "Weld Preparation and Marking for ISI," Revision 1 C1, to ensure future repair/replacement welds were appropriately marked for inservice inspection.

M8.2 (Closed) Violation 50-298/95015-02: Failure to Initiate a Condition Report

Calibration blocks from the Duane Arnold Nuclear Plant were shipped to Cooper Nuclear Station for use in performing inservice inspection program examinations. The licensee's inservice inspection staff temporarily lost control of them prior to the engineering department's inspection acceptance and release. During that time, the calibration blocks were used by contractor technicians to calibrate and perform ultrasonic examinations. This happened despite the inservice inspection coordinator informing the contractor technicians not to use the blocks until the engineering department had verified the blocks were within acceptable tolerances and released them for use. Even though these calibration blocks were identified by the licensee's engineering department, a condition report was not prepared to document and correct this deficiency until the inspector discussed this issue with licensee personnel. This failure to initiate condition reports had been a continuing problem at Cooper Nuclear Station.

The licensee initiated Condition Report 95-1109 to address this deficiency involving the lack of control over calibration blocks. The licensee identified that the personnel involved in this issue were reinstructed as to the expectation that the condition report process was to be used to document potential conditions adverse to quality. Additionally, this issue was described to licensee personnel in a posted newsletter on outage progress and activities.

The inspector interviewed personnel, reviewed documentation, and verified that identified corrective actions had been accomplished.

V. Management Meetings

X1 Exit Meeting Summary

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection. The licensee personnel acknowledged the findings presented.

The inspector asked the licensee personnel whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Terry Ackerman, Engineer, Inservice Inspection
Michael Bennett, Supervisor, Licensing
Michael Boyce, Manager, Engineering Special Projects
Bradford Houston, Manager, Licensing
David Madsen, Senior Engineer, Licensing
James Pelletier, Senior Manager, Engineering
Michael Spencer, Supervisor, Engineering Programs

NRC

Mary Miller, Senior Resident Inspector
Chris Skinner, Resident Inspector

INSPECTION PROCEDURES USED

IP 49001 Inspection of Erosion/Corrosion Monitoring Programs
IP 73753 Inservice Inspection
IP 92902 Followup - Maintenance

ITEMS OPENED AND CLOSED

Opened

50-298/97004-01 URI Problem in the implementation of the erosion/corrosion monitoring program.

Closed

50-298/95015-01 VIO Failure to establish reference system for welds.
50-298/95015-02 VIO Failure to initiate a condition report.

LIST OF DOCUMENTS REVIEWED

<u>Procedure</u>	<u>Revision</u>	<u>Title</u>
0.30	11	"ASME Section XI Repair/Replacement and Temporary Non-Code Repair Procedure"
3.10	4.4	"Examination and Evaluation of Pipe Wall Thinning"
3.28	2	"Inservice Inspection and Testing Programs"
3.28.1	1	"Inservice Inspection Program Implementation"
3.28.1.1	0	"Visual Inspection of Pressure Retaining Bolting and Integral Attachments, VT-1"
3.28.1.2	1C1	"Weld Preparation and Marking for ISI"
UT-CNS-102V1	0	"Procedure for Manual Ultrasonic Examination of Similar and Dissimilar Metal Piping Welds"
UT-CNS-104V0	2	"Procedure for Manual Ultrasonic Planar Flaw Sizing"
UT-CNS-106V1	0	"Procedure for Manual Ultrasonic Examination of Ferritic Piping and Vessel Welds 2" and Less in Thickness"
GE-ADM-1001	0	"Procedure for Performing Linearity Checks on Ultrasonic Instruments"

Erosion/Corrosion Outage Reports

"Piping Wall Thickness Monitoring Program Spring 1993 Outage Inspection Report," dated March 17, 1996

"Piping Wall Thickness Monitoring Program Fall 1995 Outage Inspection Report," dated March 17, 1996

Inservice Inspection Audit

QA Audit 95-23, "Inservice Inspection," dated January 17, 1996

Contractor Equipment/Examiner Certifications

Erosion/Corrosion - Sonic Systems International, Inc.

Inservice Inspection - GE Nuclear Energy

Condition Reports

CR 95-1109

CR 95-1192

CR 97-0284

Problem Identification Report

2-12489

2-12502

Other Documents

"Cooper Nuclear Station Erosion/Corrosion Monitoring Program," dated January 10, 1996

"1997 Pipe Monitoring Inspection Scope," (no date of issue)

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Terry Ackerman, Engineer, Inservice Inspection
Michael Bennett, Supervisor, Licensing
Michael Boyce, Manager, Engineering Special Projects
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IP 73753 Inservice Inspection
IP 92902 Followup - Maintenance

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3.28.1.2	1C1	"Weld Preparation and Marking for ISI"
UT-CNS-102V1	0	"Procedure for Manual Ultrasonic Examination of Similar and Dissimilar Metal Piping Welds"
UT-CNS-104V0	2	"Procedure for Manual Ultrasonic Planar Flaw Sizing"
UT-CNS-106V1	0	"Procedure for Manual Ultrasonic Examination of Ferritic Piping and Vessel Welds 2" and Less in Thickness"
GE-ADM-1001	0	"Procedure for Performing Linearity Checks on Ultrasonic Instruments"

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CR 97-0284

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2-12502

Other Documents

"Cooper Nuclear Station Erosion/Corrosion Monitoring Program," dated January 10, 1996

"1997 Pipe Monitoring Inspection Scope," (no date of issue)