U. S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NO:	50-245/94-21
LICENSEE:	Northeast Nuclear Energy Company
FACILITY:	Millstone Nuclear Power Station, Unit 1 Waterford, Connecticut
DATES:	May 9, 1994, through May 13, 1994

INSPECTOR: P. Patnaik 6-8-94
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APPROVED BY: 6/8/94
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Areas Inspected: An announced safety inspection was conducted of the erosion/corrosion program and related activities, including repair of nuclear piping in Class 1, 2, and 3 systems.

Results: Overall, the erosion/corrosion program was found to be good and was well implemented. An extensive sample of components was selected by the licensee for examination of wall thinning. The criteria used for selection of components covers industry experience, trending of erosion data, and EPRI methodology, as executed in the CHECWORKS computer program. The evaluation of erosion data was conservative. The repair of cracking in the nuclear piping by depositing weld overlay and the repair of a leaking joint in the service water piping supplying the reactor building closed cooling water heat exchanger, were well planned and executed.

DETAILS

1.0 EROSION/CORROSION MONITORING PROGRAM (IP49001)

1.1 Scope

Mitigation of erosion/corrosion in high energy piping is important at nuclear power plants in order to maintain the structural integrity of piping and components. During this inspection at Millstone Unit 1, the licensee's criteria for the selection of susceptible components for examination, nondestructive examination of components for thickness measurement, erosion/corrosion data for a sample of components, were assessed.

1.2 Findings

During the 14th refueling outage of Millstone Unit 1, Northeast Nuclear Energy Company (NNECo), the licensee, selected 268 locations for examination of wall thinning due to erosion/corrosion. Each location represented one or more components, as required by the procedure for gridding; and, hence, a total of 763 individual components were examined for wall thinning. The components were selected based on the EPRI methodology as used in the CHECWORKS computer program, the industry experience, the plant experience, and from trending of erosion data on components from previous outages. The following systems were examined during the current refueling outage:

- Auxiliary Steam, Condensate, Containment Cooling, Control Rod Drive, Core Spray, Crossover, Crossunder, Extraction Steam, Extraction Steam Drains, Feedwater, Fuel Pool Cooling, Heater Drains, Heater Vents, Heating Steam, Isolation Condenser, Main Steam, Miscellaneous Drains, Moisture Separator Drains/Vents, Off-Gas, Steam Bypass, Steam Packing Exhauster, and Steam Seal.

Several of these systems, not currently in the scope of the Millstone 1 erosion/corrosion program, were examined as a result of industry experience to determine susceptibility and possible inclusion into the program. As a result of the examination, one component, a straight pipe on the 42-inch crossunder system located at the moisture separator nozzle, required repair. There were three areas of thinning identified by visual inspection and, subsequently quantified by ultrasonics. The utility performed an internal weld repair and returned the pipe to an acceptable thickness for continued service. Six additional components required replacement due to erosion/corrosion-induced wall thinning. Three components were located in the heater vent system, two in the miscellaneous drain system, and one on the steam seal header. All of the components were replaced with like material and a baseline examination was performed.

The utility examined a large sample of components from many susceptible systems to develop an extensive ultrasonic inspection database for a better understanding of the condition of components that were in scope and to minimize possibility of erosion-related failure. The decision to repair/replace any degraded component was conservatively made, following the guidelines of the erosion/corrosion program.

The inspector reviewed the analysis for the erosion/corrosion for feedwater and heater vent systems. The utility used the EPRI CHECWORKS computer program to model the system. This is the latest computer program developed by EPRI, which provides more refined wear calculation than the previous version of the program CHECMATE, by allowing point-to-point trending of wear between outages. The inspector noted that the data input to CHECWORKS came from the following sources:

Input	**Source**
Oxygen	Plant Chemistry Department
pH	Plant Chemistry Department
Cycle data	Plant Operations Department
Design temperature/pressure	Millstone 1 line list
Operating temperature/pressure	Heat balance/operations
Enthalphy	Heat balance
Flowrate	Heat balance/operations
Material type and nominal thickness	Millstone 1 line list/pipe specification

The inspector verified some of the inputs against the original document and found them to be correct. The inspector also verified that the licensee's program had well-defined criteria for the selection of inspection locations, inspection frequency, trending of inspection data, and actions to be taken when wall thinning was detected. The licensee's structural evaluation of sample data indicated that the calculations of predicted thickness and the remaining service life were conservative. The inspector reviewed the licensee's implementation of the erosion/corrosion monitoring program. The program coordinator for Millstone Unit 1 was solely responsible for the proper execution of the erosion/corrosion program. The corporate engineering department was fully involved in planning and data evaluation.

The following procedures used in the erosion/corrosion monitoring program were reviewed:

- Ultrasonic Procedure for Thickness Measurement, NDE-UT-30, Revision 9;
- Grid Marking Procedure for Erosion/Corrosion, NU-GM-1, Rev. 0; and
- Visual Examination of the Inside Surface of Piping and Component to Detect Degradation caused by erosion/corrosion, NU-VE-5, Rev. 0.

The above procedures provided good detail and guidance to perform erosion/corrosion-related inspections, and the overall program was found to meet the latest EPRI guidelines.

1.3 Conclusion

The evaluation of erosion data by the utility's engineering department was assessed by the inspector to be conservative and the overall implementation of the program was determined to be satisfactory. The utility has been safety-conscious, with an extensive program well implemented to mitigate erosion-related failures of high energy systems at Millstone 1.

2.0 CLEANUP WATER WELD INDICATION - WELD CUB 6

During the 14th refueling outage, an axial indication was revealed, during in-service inspection, in Weld No. CUB-6 located in the reactor water cleanup piping. The portion of piping containing the indication was replaced with new piping during the outage, and a specimen containing the indication was sent to a vendor's laboratory for metallurgical evaluations. Based upon preliminary metallurgical analysis, the ultrasonic indication appeared to be the result of an original pipe fabrication flaw. The indication had the characteristics of an incomplete penetration in the longitudinal seam weld of the pipe elbow located in the midsection of the pipe wall. The inspector reviewed the photomicrographs of the specimen containing the indication and concurred with the above evaluation.

3.0 WELD OVERLAY REPAIR OF CRACKED WELDS

The licensee performed repairs of the following welds containing cracks caused by intergranular stress corrosion in the heat affected zone of the inside surface.

SYSTEM	WELD NOS.
Reactor Recirculation Piping	RCAJ-1, RCBJ-5, RCAJ-7
Low Pressure Coolant Injection	CCAJ-1
Isolation Condenser Steam Supply	ICAC-F-3

Pursuant to 10 CFR 50.55(a)(3)(i), the licensee requested NRC approval to use the provisions of Code Case N-504 titled, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," pursuant to 10 CFR 50.55(a)(3)(i) for above-weld repairs. The NRC approved the use of Code Case N-504, and the weld overlay was done during the outage. The inspector reviewed the welding procedure for application of the weld overlay, the certifications of the welding personnel, the thickness data on the weld overlay obtained by ultrasonic examination, and the measured delta ferrite of the overlay. The overlay repair was performed by a vendor under licensee's supervision, and the inspector assessed the repair capability of the vendor to be good. All repairs were well executed.

4.0 SERVICE WATER PIPING REPAIR

A visual examination by the licensee of a bell and spigot joint in the service water piping, located between a section of cement-lined carbon steel pipe and the prestressed concrete pipe located on the east side of the reactor building, revealed slight leakage. This segment of service water line supplies cooling water from the intake structure to the reactor building closed cooling water (RBCCW) heat exchangers. The licensee repaired the leak by installing a Weko seal/sleeve assembly inside the pipe across the bell and spigot joint. The leak tightness and the integrity of the joint following the repair was ensured by performing an air pressure test and an in-service leak test, in accordance with the provisions of ASME Code Section XI, IWA 5211.

The inspector reviewed the following documentation pertaining to the repair of service water piping:

- the Project Design Change Request (PDCR) No. 1-045-94, Rev. 0;
- the Installation Procedure for the Weko seal; and
- the Procedure and the Safety Evaluation of Service Water System Outage.

The design change request addressed those requirements for the installation of the seal, which is considered to be the most significant for the maintenance of its structural integrity. The installation of the seal was well executed.

5.0 EXIT MEETING

The findings of the inspection were presented to and discussed with members of the licensee's management at the exit meeting, conducted on May 13, 1994. The licensee concurred with the findings of the inspection. Prakash Patnaik was the Reactor Inspector who represented the NRC at this exit meeting. The members of NU Millstone 1 management attending the exit were: J. Ferguson, Manager, Design Engineering; and D. Harris, Licensing Engineer.