

General Offices Seiden Street, Berlin Connecticut

P.O. BOX 270 HARTFORD, CONNECTICUT 06414-0270 (203)665-5000

December 20, 1990 MP-90-1316

Re: 10CFR50.73(a)(2)(ii)

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

Reference:

Facility Operating License No. DPR-65

Docket No. 50-336

Licensee Event Report 89-004-03

Gentlemen:

This letter forwards updated Licensee Event Report 39-004-03 required to be submitted pursuant to paragraph 50.73(a)(2)(ii).

Very truly yours.

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace Director, Milistone Station

SES/PJP:mo

Attachment: LER 89-004-03

T. T. Martin, Region I Administrator

W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2 and 3 G. S. Vissing, NRC Project Manager, Millstone Unit No. 2

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Estimated burden per response to comply with this intermation obligation request 50 0 hrs. Forward comments reparding burden estimate to the Reports and Reports Management branch (p-530). (3.5 Mulc Regulatory Commission, Washington, DC 20655, and the Paperwork Reduction Project (3:50-0104). Office Management and Rudgest, Washington, DC 20656. LICENSEE EVENT REPORT (LER)

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TENT CONTINUATION

Description of Event

Millstone Unit 2 had made a decision to remove (4) mechanical plugs from the Steam Generator (SG). No. 2 based on the fact that Westinghouse suspect problem heat treated plugs were installed at MP2 and also based on the SG tube leak at North Anna 1. On 3/20/89 at 1015 hours, with the plant in cold shutdown (Mode 5), a visual inspection of a mechanical plug which had been removed from SG No. 2, line 78 row 74, showed indications of circumferential cracking at the top of the plug, above the expander. Since the plug, manufactured by Westinghouse, was marked with the heat number (NX3513) previously identified as being a heat which was suspected as being susceptible to primary water stress corrosion cracking, an immediate report was generated. There were no operator actions associated with this event since at the time of discovery, the Steam Generators were out of service for repair and testing.

Noulications from Westinghouse had identified three plug heats, NX3962, NX3279 and NX3513 to be susceptible to PWSCC. MP2 Steam Generators contained only one of these heats, NX3513. All hot leg standard Westinghouse mechanical tube plugs not installed in sleeved or stabilized tubes, that were installed from 1986 through 1988, were repaired with a Plug-In-Plug (PIP) device. There are no plugs with susceptible heats installed prior to 1986. The repairs included plugs of both susceptible and non-susceptible heats. This was required because the heat associated with specific line and row locations for plugs were not identified.

Subsequent to the plant returning to service, following repairs to mechanical plugs associated with heat NX3513, the plant, while operating in Mode 1 at 30% power (increasing), on 5/2/89, was notified by Westinghouse that an additional mechanical tube plus heat (NX4523) was found to be susceptible to PWSCC. This information was the result of cracked plugs discovered at other utilities. MP2 has determined that (50) mechanical hot leg plugs, in both sleeved and stabilized tubes, were from heat NX4523. There were no operator actions associated with this later event since no repairs are deemed necessary at this time.

Further investigations of microstructure and corrosion data by Northeast Utilities for Westinghouse plugs manufactured of Inconel 600 have shown similarities between heats NX5222 and NX4523. These similarities have caused Northeast Utilities to consider plugs from heat NX5222 to be suspect to the same crack growth rate as heat NX4523. All hot leg plugs from heat NX5222, not previously repaired, that were installed in 1988 and 1989 were repaired with a PIP during the Fall 1989 shutdown. There were (24) sleeved tube plugs and (4) standard tube plugs installed in 1989. Two stabilized tube plugs and two standard tube plugs were installed in 1988.

On 9/26/90, with the plant shutdown for refueling and maintenance. MP2 was notified by Westinghouse that another plug heat, NX6323, may also be susceptible to PWSCC. This notification was based on plug cracking discovered at North Anna Unit 2. There were 409 plugs from heat NX6323 installed at MP2. all in the hot legs and all installed during the 1989 refueling outage. A repair utilizing the Westinghouse PIP was implemented for each plug of heat NX6323 during the 1990 refueling outage.

Cause of Event

The root cause of plug cracking has been generally described by Westinghouse as Primary Water Stress Corrosion Cracking (PWSCC). PWSCC is correlated to a lack of grain boundary carbides resulting from inadequate post manufacturing heat treatment. Microstructure examinations of plugs from heats NX3513 and NX45_3 substantiate this correlation.

NRC Form 366# (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED JUB NO 31 EXPA 8 4/30/92

Estimated burden per resp hise to comply with this information collection reducts 1.50.0 hrs. Forward comments reparding burden estimate to the Records and Reports Management Branch (p.430). U.S. Nuc. \$30) U.S. Nuclear DC 20555 and to 0+0104). Office of DC 20500 Regulatory Commission: Washington I the Paperwork Reduction Project (3150 Management and Budget: Washington

FACILITY NAME (1)

DOCKET NUMBER 12

Millstone Nuclear Power Station Unn 2

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

Analysis of Event

This event is being reported pursuant to the requirements of paragraph 50.73(a)(2)(ii) due to the degraded condition of the mechanical tube plugs. In reviewing the safety consequences of the initial notification, it was originally determined that if cracking were to occur, a leak before break condition would exist. Based on the Technical Specification leakage limit requirements, a controlled shutdown would be initiated. After reviewing the North Anna 1 incident, calculations were performed which showed that a plug top would be propelled up the tube causing a partial tube rupture event. Calculations were then performed utilizing a leak limiting device installed in the suspect tube plugs. The safety consequences of this event were reviewed with respect to the bounding conditions of a steam generator tube rupture event. It was determined that the plugs with the leak limiting devices installed in them created no safety concerns. This modification ensures that Technical Specification leakage limits and structural integrity margins of Regulatory Guide 1.121 are maintained.

Following notification of the additional suspect heat (NA4523). Northeast Utilities performed evaluations for the (50) plugs installed at MP2 from this heat. Westinghouse has developed algorithms that predict the time for plugs to crack to the extent necessary to duplicate the North Anna 1 type plug failure. All cold leg plugs, including those from heats NX4523 and NX3513, were determined to not need repair due to their much longer time to predicted crack initiation. The Westinghouse algorithm for the hot leg plugs from heat NX4523 postulated that they could exhibit similar PWSCC to that associated with the North Anna event before the end of operating cycle 10. Since Northeast Utilities had categorized plugs from heat NX5222 to be similar to heat NX4523, then this additional heat was also considered possible to exhibit PWSCC before the end of cycle 10.

All the hot leg plugs from heat NX4523 are installed in either sleeved (27) or stabilized tubes (23) at MP2. The safety consequences were examined for these plugs. A failed sleeve plug will travel up to two inches before it encounters the transition from the expanded to unexpanded sleeve. Interference transition configurations have been tested and analyzed to suggest that a failed plug top would be captured in the unexpanded portion, thereby precluding an event similar to North Anna. The stabilized tube plugs were also analyzed. Westinghouse stabilizer plugs are a one piece assembly consisting of an integrally attached steel cable stabilizer, about 40° long and a mechanical tube plug. Should a stabilizer plug crack, leak, then subsequently sever, the energy available to the plug top would be limited, due to the pressure equalization across the plug caused by the leakage past the plug into the tube. For both the sleeved plug and stabilized plug failure, if the tube contained a prior through wall defect, the pressure from the secondary side is sufficient to prevent the plug top from projecting upward and rupturing the tube. Tests were undertaken by Westinghouse both with Westinghouse stabilizer plugs and standard plugs with C.E. steel rod stabilizers installed within their tubes. The tests were conducted at energies in excess of that predicted by Westinghouse to be sufficient to penetrate a tube and damage adjacent tubes. None of the tests yielded a tube penetration. It is concluded that a failure of a plug associated with a stabilizer will not cause a multiple tube failure accident.

Northeast Utilities furthermore considered a worst case scenario assuming a plug top release and subsequent partial tube rupture. Such an event would result in a primary to secondary leak rate less than an analyzed accident event. Eleven simultaneous North Anna partial tube rupture events would be required to exceed the MP2 safety analysis. This is not considered likely.

An additional plug heat, NX6323, has been identified by Westinghouse to be potentially susceptible to PWSCC. This was based on cracking discovered at North Anna Unit 2. At the time of this notification MP2 was shutdown for refueling and maintenance. Preliminary assessments by Westinghouse indicated that MP2 may have been able to operate throughout some or all of cycle 11 without exceeding the predicted plug life, since these plugs were installed only 18 months earlier. It was decided to repair these plugs to preclude potential in-service failures or mid-cycle shutdown requirements. Plugs from heat NX6323 were only installed in hot legs at MP2

There were no safety systems effected by these events.

NRO Form 386A

U. E. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this information objection request 50.0 fms. Forward comments regarding surden estimate to the Repords and Reports Management Branch (p-530). U.S. Nuclear Regulatory Commission, VLShington, DC 20555, and to the Paperwork Reduction Project (3150-0104). Office of Management and Subget. Washington, DC 20503.

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IV. Corrective Action

The tube from which the cracked tube plug was removed was repluged with a new mechanical tube plug. Other affected tube plugs associated with heat NX3513 were plugged with a leak limiting device. This "plug-in-plug" (PIP) device was torqued into the plug expander then tack welded to the bottom of the plug. This device was installed in all hot leg plugs that were suspected to be from heat lot NX3513. Westinghouse initially manufactured the plug lot in question in 1984. Millstone researched the QA records related to plugging programs since this time and found that the suspect plugs were installed in 1986, 1987 and 1988. A total of 446 PIPs were installed in the MP2 Steam Generators. All PIP installation work was reviewed with resident and senior resident NRC inspectors.

A Justification For Continued Operation (JCO) was prepared to address the issues associated with plug heats NX4523 and NX5222. The Unit 2 PORC reviewed the JCO and concurred with its findings and conclusions that no additional repairs be required at MP2 until the unit's mid-cycle shutdown, scheduled for October 1989. These conclusions were previously presented to the resident NRC inspector for MP2. All hot leg plugs from heats NX4523 and NX5222, installed in 1988 and 1989 were repaired with a PIP during the Fall 1989 mid-cycle shutdown.

Following notification by Westinghouse, MP2 repaired all hot leg plugs from heat NX6323 with the Westinghouse Plug-In- Plug.

Further updates will not be issued unless additional plug heats are identified for MP2 to be susceptible to PWSCC.

V. Additional Information

Plug Manufacturer Westinghouse

Model: 27 / C-E

Size: 3/4 inch

EIIS Code: AG - PLUG - W351

Steam Generator

EllS Code: AB - SG - C490

Similar Events: None