SSINS No.: 6835
IN 85-37

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

May 14, 1985

IE INFORMATION NOTICE NO. 85-37: CHEMICAL CLEANING OF STEAM GENERATORS AT MILLSTONE 2

Addressees:

All pressurized water reactor (PWR) facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This information notice is being provided as notification of a potentially significant problem pertaining to corrosion product buildup in the secondary side of steam generators which may mask eddy current signals. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem occurring at their facilities. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Millstone 2 is a two-loop, 2700 megawatt-thermal PWR that was licensed in 1975. Secondary water treatment has been all-volatile since startup. Northeast Nuclear Energy Company (NNECo) had plugged 941 tubes in steam generator (SG)-1 and 759 in SG-2 and had sleeved 894 tubes in SG-1 and 1128 in SG-2 prior to the current outage. The deteriorating condition of the tubes has been attributed to the buildup of sludge containing, principally, copper and iron. Condenser and feedwater heater tubes made of a copper-alloy are thought to be the source of the copper. A sludge pile, the source of corrodants causing denting and pitting, existed in the secondary side on the tube sheet and around the tubes to a maximum depth of 13 inches.

Before cleaning the secondary side of the steam generators in early April 1985, NNECo conducted eddy current testing of all 8500 tubes in SG-2 and a statistical sample of tubes in SG-1 and projected the need to sleeve 300 tubes in each steam generator. Sludge lancing removed about 300 pounds of sludge from each steam generator. Chemical cleaning of the secondary side removed about 300 pounds more of the sludge. For the basic chemical process, NNECo selected the Electric Power Research Institute's Steam Generator Owners Group Generic Process. The concentration of the various chemicals in the solvents was adjusted to yield the most efficient cleaning of the site-specific materials and configuration. The procedure was designed to remove the sludge pile with few adverse effects on the steam generators or internals.

The cleaning process involves the use of iron and copper solvents in a specified number of applications under controlled conditions. The iron solvent uses an inhibitor to protect the base metal, while the copper solvent has been virtually noncorrosive to carbon steel and Inconel 600 in tests. Corrosion of the Inconel tubes has been less than 0.1 mil in sludge cleaning tests.[1] NNECo had qualified the specific solvents and processes for use at Millstone 2 before their use.

Following chemical cleaning, eddy current testing of each of the steam generators tubes was again performed. NNECo reported that 1077 tubes in the cold leg and 552 tubes in the hot leg of SG-1 will be sleeved. In SG-2, 1074 tubes in the cold leg and 145 tubes in the hot leg will be sleeved. This represents an increase of nearly a factor of five in the number of tubes to be sleeved, compared to the projections made based on eddy current testing prior to cleaning. In addition, 19 tubes (12/7) will be plugged in the two SGs.

This is the first use of this cleaning process at any nuclear plant. The tube defects found after cleaning are thought to have been present prior to the cleaning. The copper and iron constituents of the sludge apparently generated a signal which masked the signal of the smaller defects. Pits of 0.075 inch diameter and larger can be detected in the presence of copper. After cleaning, smaller diameter defects were identified. Essentially all of these defects were found in the region of the sludge pile; that is, within a height of 13 inches above the tube sheet.

No specific action or written response is required by this information notice. If there are any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Edward J. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

Technical Contact: Mary S. Wegner, IE
(301) 492-4511

Attachments: List of Recently Issued IE Information Notices

---

[1] NP-3009, Steam Generator Chemical Cleaning Process Development, Electric Power Research Institute, Palo Alto, CA, April 1983.

LIST OF RECENTLY ISSUED IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
84-55 Sup. 1	Seal Table Leaks At PWRs	5/14/85	All power reactor facilities holding an OL or CP
85-20 Sup. 1	Motor-Operated Valve Failures Due To Hammering Effect	5/14/85	All power reactor facilities holding an OL or CP
85-36	Malfunction Of A Dry-Storage, Panoramic, Gamma Exposure Irradiator	5/9/85	All licensees possessing gamma irradiators
84-52 Sup. 1	Inadequate Material Procurement Controls On The Part Of Licensees And Vendors	5/8/85	All power reactor facilities holding an OL or CP
85-35	Failure Of Air Check Valves To Seat	4/30/85	All power reactor facilities holding an OL or CP
85-34	Heat Tracing Contributes To Corrosion Failure Of Stainless Steel Piping	4/30/85	All power reactor facilities holding an OL or CP
84-84 Rev. 1	Deficiencies In Ferro-Resonant Transformers	4/24/85	All power reactor facilities holding an OL or CP
85-33	Undersized Nozzle-To-Shell Welded Joints In Tanks And Heat Exchangers Constructed Under The Rules Of The ASME Boiler And Pressure Vessel Code	4/22/85	All power reactor facilities holding an OL or CP
85-32	Recent Engine Failures Of Emergency Diesel Generators	4/22/85	All power reactor facilities holding an OL or CP

OL = Operating License
CP = Construction Permit