JUN 0 5 1989

Docket No. 50-336

Northeast Nuclear Energy Company
ATTN: Mr. E. J. Mroczka
Senior Vice President - Nuclear
Engineering and Operations Group
P. O. Box 270
Hartford, Connecticut 06141-0270

Gentlemen:

Subject: Millstone 2 Mid-Cycle Steam Generator Inspection

The NRC staff has reviewed the results of the Millstone Unit 2 steam generator tube inservice inspections performed during the 1989 refueling outage. The steam generator tube inspections were the subject of NRC Region I inspection number 50-336/89-03 and of two meetings held at the NRC headquarters office on March 16 and April 21, 1989. Based on our review of the inservice inspection results we have concluded that a mid-cycle inspection of the Millstone Unit 2 steam generator tubes is necessary to assure compliance with the plant technical specifications and to provide reasonable assurance of operation within the design basis of the plant.

Specifically, we have concluded that a mid-cycle steam generator tube inspection is necessary to confirm that boric acid treatment has effectively arrested the caustic cracking mechanism so as to assure the continued operability of the steam generator. Our technical basis for this conclusion is discussed in the enclosure.

You are hereby requested to provide the NRC in writing and within 30 days of receipt of this letter your proposed schedule for the next steam generator tube inspection at Millstone Unit 2. In addition, we request that prior to that inspection you submit for NRC review the scope and acceptance criteria for the inspection. Should you not agree that it is both prudent and necessary for a mid-cycle inspection to assure continued operability of the steam generator, the NRC will consider what action, including ordering this inspection be done, is appropriate.

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Original Signed By:
Thomas T. Martin

cc:
W. D. Romberg, Vice President, Nuclear Operations
S. E. Scace, Station Superintendent
D. O. Nordquist, Director of Quality Services
R. M. Kacich, Manager, Generation Facilities Licensing
Gerald Garfield, Esquire
Public Document Room (PDR)
Local Public Document Room (LPDR)
Nuclear Safety Information Center (NSIC)
NRC Resident Inspector
State of Connecticut

bcc:
Region I Docket Room (with concurrences)
~~Management Assistant, DRMA (w/o encl)~~
DRP Section Chief
T. T. Murley, NRR
F. Miraglia, NRR
T. Martin, RI
W. Kane, RI
L. Shao, NRR
W. Johnston, RI
J. Richardson, NRR
J. Stolz, NRR
J. Durr, RI
C. Y. Cheng, NRR
J. Strosnider, RI
K. Wichman, NRR
G. Vissing, NRR
R. Winters, RI
R. Bores, DRSS
J. Shedlosky, SRI, Haddam Neck

Suggest shortening but OK technically

RI:DRS	RI:DRS	RI:DRP	NRR
Strosnider	Martin	Kane	Shao L.S. by phone 6/2/89
5/23/89	5/24/89	5/25/89	~~5/ /89~~ J.S

NRR	RI:RA
Stolz J.S. by phone	Russell
6/2 /89	6/5 /89

ENCLOSURE

During the 1989 steam generator tube inservice inspection, circumferentially oriented defects were detected at the top of the tube sheet in a large number of steam generator tubes (309 tube ends). Many of these defects extended a significant distance around the tube circumference (>300 degrees). Because of their location in the sludge pile near the top of the tube sheet, only defects of approximately 40% or more in depth could be reliably detected and sizing of the crack depths was not possible. As a result, tubes with defects at or near the plugging limit may have been returned to service. Also, because of the limitation in inspection capability a reliable estimate of the crack growth rate does not exist. The tubes with circumferential defects tended to be clustered in selected regions of the tube bundle cross section.

During the meetings at NRC headquarters your staff stated that operation for the next refueling cycle is acceptable based on the concept of leak-before-break and the ability of boric acid injection, which was initiated during the last cycle of operation, to stop further growth of defects.

We recognize that the leak-before-break concept is a major part of the defense-in-depth approach to assuring steam generator tube integrity and we strongly support aggressive leak rate monitoring programs. However, leak-before-break is not acceptable as the sole basis for assuring tube integrity. Operating experience has demonstrated that steam generator tubes can rupture prior to leaking detectably. Also, the detection of cracks that have extended 300 degrees or more around the tube circumference with significant through wall depth without leaking raises serious concerns relative to the validity of leak-before-break for this mode of degradation.

Re-analysis of previous eddy current data indicates that the rate of initiation and growth of circumferential defects may be decreasing as a result of boric acid injection initiated during the last cycle of operation. However, the detection of approximately 60 new circumferential indications during the 1989 inspection represents a significant number of degraded tubes and suggests that the caustic cracking mechanism is still active to some degree. We recognize that autoclave tests have demonstrated boric acid injection can be effective in neutralizing caustic conditions; however, the accuracy with which these tests represent actual conditions in the steam generator sludge pile region is questionable.

Based on the above we have concluded that; although your inspections were comprehensive and utilized state of the art technology, your reliance on leak-before-break to assure steam generator tube integrity does not satisfy the bases or the intent for the technical specification tube plugging limits, and therefore, do not provide a basis to have reasonable assurance that the steam generator can be considered operable throughout the next cycle of operation.

In addition, the circumferential orientation of the defects and the grouping of defective tubes in close proximity increases the likelihood of multiple tube ruptures. We are aware that calculations performed by your staff indicate that circumferentially defected tubes could withstand a postulated main steam line break. However, this accident is not the most probable or the most challenging for these types of defects. Of greater concern is the failure, due to any mechanism, of a single tube near the top of the tube sheet which could cause successive failures of adjacent, circumferentially defected tubes as a result of jet impingement forces or tube whipping. Multiple steam generator tube failures is an unanalyzed condition, outside the plants' single steam generator tube rupture design basis.

Based on the above, we have concluded that a mid-cycle steam generator tube inspection is necessary to confirm that boric acid treatment has effectively arrested the caustic cracking mechanism. Although the technical specifications normally require steam generator tube inspection only during refueling outages, it is necessary and prudent to perform additional inspections when, as in this case, the nature of the degradation or limits in nondestructive testing technology challenge the ability to clearly satisfy the intent of the technical specifications or to provide adequate assurance that the design basis of the plant will not be violated.

To minimize adverse impacts, this inspection could be performed on an appropriate sample of tubes in the steam generator with the worst circumferential cracking experience. The need for additional inspections could be determined based on the results of the initial sample.

Additionally, a mid-cycle inspection outage also would provide opportunity to take actions for steam generator mechanical plugs supplied by Westinghouse whose estimated lifetime do not extend to the next scheduled refueling outage. The staff is reviewing the Justification for Continued Operation (JCO) that was submitted to the NRC on May 18, 1989, and will contact you should they have further comments on the plug issue.