EDO Principal Correspondence Control

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FINAL REPLY:

Debbie B. Grinnell
C-10 Research and Education Foundation

TO:

Chairman Diaz

FOR SIGNATURE OF : ** GRN ** CRC NO: 03-0567

Borchardt, NRR

DESC:

Seabrook - Steam Generator Tube

ROUTING:

Travers
Norry
Paperiello
Kane
Collins
Dean
Burns/Cyr
Miller, RI
Zimmerman, NSIR

DATE: 09/05/03

ASSIGNED TO: CONTACT:

NRR Borchardt

SPECIAL INSTRUCTIONS OR REMARKS:

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OFFICE OF THE SECRETARY
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3503

"dedicated to radiological monitoring, research, and education since 1991"

August 27, 2003

Nils J. Diaz, Chairman
U.S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Dear Chairman Diaz;

The presence of many cracks and high residual stresses in thermally treated alloy 600 steam generator tubes that were discovered during the eighth refueling outage at Seabrook raises serious safety concerns which must be fully addressed before the plant returns to service following the next scheduled outage in October, 2003.

Our concern stems from the fact that prior to the unexpected discovery of the severely degraded tubes, Seabrook operated for at least two years with high vulnerability to radioactivity releases that exceed, by many orders of magnitude, the 10CFR PART 100 limits. This vulnerability exists now and will remain if proper steps are not taken to correct the problems at Seabrook during the next outage.

Between the 7th and the 8th refueling outage (2000 – 2002), 15 steam generator tubes operated with numerous cracks with 10 tubes exceeding the 40% through wall repair limits specified in the plant technical specifications. **If a steam line break had occurred at the affected steam generator during the above period it could have resulted in a meltdown followed by radioactivity releases with containment bypass.**

The discovery of fast growing cracks in tubes that were believed to be immune to stress corrosion cracking indicates that the crack initiating period has been reached in an unknown and unquantifiable number of tubes. This is of great concern because it indicates that even very small cracks that are easily missed during inspection can now enlarge quickly when the local stresses are sufficiently large. We are particularly disturbed that historical data from other steam generators is of limited use because the tubes at Seabrook have been subjected to an unknown fabrication process.

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The rapid and massive crack growth in steam generator tubes, the discovery of high residual stress levels in the straight sections of the tubes from unknown sources, and the vulnerability of main steam lines to terrorist attacks are factors which introduce a new risks to our community. To help us to understand our risk to catastrophic failures at Seabrook we have prepared a list of questions that we respectfully request that you answer before the next outage is completed.

Sincerely,

Debbie B. Grinnell,
Research Advocate
C-10 Research and Education Foundation

cc; Sandra Gavutis, Ex. Dir., C-10 Foundation
Congressman John F. Tierney
Congressman Edward J. Markey
James Milkey, Chief of Environmental Protection,
MA. Office of the Attorney General

REQUEST FOR INFORMATION REGARDING THE NEW STEAM GENERATOR DEGRADATIONS DISCOVERED DURING THE EIGHT REFUELING OUTAGE AT SEBROOK.

1. The NRC has recently reported, Reference 1, that during the 8th refueling outage in 2002, 15 cracked tubes were discovered with lengths ranging between 0.3-0.75 inches and a maximum through wall penetration of 62%. Unacceptable tube wear was also observed in at least one tube.

Since at least 11 tubes exceeded the 40% through wall repair limits set by the plant technical specifications Seabrook was not in compliance with 10 CFR Part 50. Please describe what steps did the NRC take prior to and following the 2002 outage to ensure that the tubes will not fail under normal, transient, and postulated accident conditions including terrorist initiated accidents. Does the NRC plan on requiring that tubes with any crack indications, however small, be plugged during future outages at Seabrook?

2. What steps does the NRC take when it discovers that a plant has been operating with steam generator tube that exceeded the plugging limit?

3. Reference 1 attributed the high residual stresses of tubes at the support plate's intersections and at the straight leg sections to "non optimal tube processing" during manufacturing. The precise process could not be conclusively determined.

Since the tubes with the unspecified fabrication procedure have been in service since 1990 why the existence of these highly stressed tubes was not detected and reported previously.

4. The root cause report, Reference 2, highlights certain important factors:

   (a) Seabrook is the first plant in the U.S. to exhibit high residual stresses in thermally treated alloy 600 with an unknown fabrication process, therefore, no historical data is available to guide tube repair requirements at this plant.
   (b) Some stressed tubes in rows 1-11 did not exhibit any cracks while others with the same residual stress signals were cracked indicating that there is no direct correlation between residual stress and crack initiations.
   (c) The eddy current offset technique to detect stress relies on relative current measurements, it does not measure stress directly. Consequently tubes with high residual stresses (close to yield) throughout their length may not be detected during inspection.

(d) Minimum crack growth rates can exceed the tube repair limits by 55% in two years.
(e) The appearance cracks at the support plate intersections instead on tubes on top of the tube sheet indicate that we are facing a new phenomenon in the development of stress corrosion cracking.

Taking the uncertainties introduced by the above factors into account, please describe the rationale for not removing from service in 2002, the six tubes with high residual stresses in the straight legs in the low rows.

5. During refueling outage 5 in 1997, Reference 3, severe tube wear (56% through wall) was detected, on tubes at the AVBs. This wear was attributed to loose parts. However, these loose parts were not present at some wear locations, indicating perhaps that loose parts may be moving from one location to another.

Please describe the assessment that was conducted by the NRC to allow operations with mobile loose parts of unknown size and shape inside the steam generator. Was the possibility that loose parts may lodge on tubes, which have already been damaged by stress corrosion, been considered.

6. It is apparent that Seabrook has been operating with loose parts in the steam generators knowing that tube wear from such parts is unpredictable. Indeed, during refueling outage 8 it was observed that at least one tube was worn beyond the 40% through wall technical specification limit.

7. Why does the NRC allowed Seabrook to operate with loose parts in the steam generators? Are you going to request that all identified loose parts are removed at this outage?

8 Reference 4 stated that only the bobbin probes will used to inspect 100% of the tubes in all steam generators and a rotating probe will be used to inspect 50% of the tubes in the hot leg only and all tubes in row I and 2.

Given the inability of the bobbin coil to detect small cracks and residual stresses the above inspection plan may not eliminate the possibility that highly stressed tubes with at least 30% wall penetrations will remain in service following the October outage.

Please describe any assessments that may have been conducted to determine the risk of tube failures and the release of radioactivity during normal and accident conditions.

Since there is an unknown mode of failure mechanism in operation, which is not amenable to statistical analysis, will the NRC require 100% rotating probe inspection?

References

1. NRC Information Notice 2002-021, Supplement 1: Axial Outside Diameter Cracks Affecting Thermally Treated Alloy 600 Steam Generator Tubing

2. FPL Energy, Seabrook Station, Root Cause Analysis for CR 02-08166 Evaluation of "D" Steam Generator Tube Cracking.

3. NUREG-1771, Experience with Thermally Treated Alloy 600 Steam Generator Tubes.

4 Letter, Victor Nerses, NRC, to Mark E. Warner, FPL Energy Seabrook, " Summary of Pre-Outage Call with FPL Regarding the Inspection Scope for the Upcoming Inspection at the Seabrook Station, Unit No. 1 " July 23, 2003