North Atlantic

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The Northeast Utilities System

October 31, 2002

Docket No. 50-443

NYN-02114

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Seabrook Station, Unit No. 1
Response to Request for Information – Steam Generator Tubes

North Atlantic Energy Service Corporation (North Atlantic), provides, in the enclosure, the information requested by the NRC staff during an October 9, 2002 conference call.

Should you have any questions regarding this matter please contact Mr. James M. Peschel at (603) 773-7194.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

Joe M. Vargas
Director Engineering

cc:

H. J. Miller, NRC Region I Administrator
R. D. Starkey, NRC Project Manager, Project Directorate I-2
G. T. Dentel, NRC Senior Resident Inspector

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Enclosure 1 – NYN 02114

NRC Request 1 **Please explain the typical null signal and the procedure used to determine regions of stress by variations in the null signal?**

North Atlantic Response

There is no absolute null signal set. The null signal is established for each tube by the analyst to center the signal on the analyst's window. An absolute null signal is not required to detect the characteristic signature for a tube with elevated residual stress. It is the relative signal between a high stress and low stress region that characterizes the signal. Thus, in the low row u-bends, it is the presence of a deviation to the left that indicates the stress-free state, knowing that the straight legs have high residual stress (from pulled tube testing) and knowing that the u-bends were stress relieved (from record and process review).

Tests were performed for San Onofre in 1986 to explain a similar issue on the straight legs of the tubes. Mill Annealed tubes were thermally treated over part of their length, and tested with a bobbin probe. No specific null signal was set. A clear shift in the null signal was observed at the transition from Mill Annealed to Thermally Treated. Therefore, the absolute value of the null signal is not relevant; rather the shift from the null signal voltage, is the important feature.

It is believed that the specific property of the material being measured by the eddy current probe is conductivity, which is known to vary with the degree of strain of the material. Stress is not being directly measured, but is inferred from the knowledge that the pulled tubes have high residual stress in the straight legs, and that the low row u-bends were stress relieved. This knowledge, compared to the normal eddy current signal for the remainder of the low-row tubes in the "D" steam generator and all of the tubes in "A", "B" and "C" steam generators, suggests that the u-bends material state is "different" than that in the straight legs. In addition, this difference can readily be explained by the data from the pulled tubes and from the destructive examination of the pulled tubes.

NRC Request 2 **Please explain the origin of the technique and the procedure used to detect the degradation.**

North Atlantic Response

As stated in the response to Request 1 above, the technique is based upon work performed for San Onofre in the mid 1980s. The technique being used is the standard bobbin technique and no special probes or setups are required. The (low frequency) 150k Hz absolute channel is used to identify the signal characteristic because it is sensitive to material property changes.

The characteristic signature of the degraded tubes was found during an eddy current data search for other artifacts that could help explain the root cause for the failures. It was noted that all of the degraded tubes had this characteristic signature, and with the exception of an additional 4 tubes in the "D" steam generator, none of the other tubes in the 4 steam generators exhibited this signal. The 100% correspondence of the degraded tubes with the signal characteristics is not considered to be coincidental.

NRC Request 3 **Please describe how you will modify your process to evaluate the tubes in rows 11 to 59.**

North Atlantic Response

A relative comparison was made using the eddy current signals from the "D" steam generator rows 11-59 tubes. On average, the offset values provide an excellent correlation with the bend radius (row number), with scatter among the signal offsets for the tubes in each row. The scatter has not been fully analyzed and no conclusion has been reached. However, there are no obvious outliers, (e.g., signal reversals or the absence of offsets) that would indicate that a particular tube is outside the "normal" scatter. If these data are interpreted that all the tubes are from a single population, then the absence of observed corrosion would suggest that none of the tubes possess the same or similar large residual stresses.

The correlation between the degraded tubes and the signal characteristic was 100%. The correlation between the signal characteristic and the observed degradation was almost *75% (15* of 19). A similar correlation should apply for the long row tubes since it is reasonable to assume that there is insignificant variation in the deposit chemistry in the radial direction. Therefore, if any rows 11-59 tubes were susceptible for the same reason as the degraded short row tubes, some indications should have been observed by now.

In addition, a comparison standard could be derived by comparing the rows 11-59 u-bend signal offsets for Thermally Treated tubing to the signal offset from Mill Annealed tubing. The signals from good Thermally Treated Tubes and good Mill Annealed tubes will provide a comparison standard. If no Thermally Treated tubes look like Mill Annealed tubes, the result is good Thermally Treated tubes.