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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
2005 STEAM GENERATOR TUBE INSPECTIONS (TAC NO. MD2102)

In a letter dated December 12, 2006, the NRC requested additional information related to the 2005 annual steam generator tube inspection report for Millstone Power Station Unit 2.

The attachment to this letter provides the information requested.

Should you have any questions about the information provided or require additional information, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

A. J. Jordan
Plant Manager - Nuclear

Attachments: (1)

Commitments: None

cc: See next page

A001

cc: U.S. Nuclear Regulatory Commission
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ATTACHMENT

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RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

2005 STEAM GENERATOR TUBE INSPECTIONS (TAC NO. MD2102)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

In a letter dated December 12, 2006, the NRC requested additional information related to the 2005 annual steam generator tube inspection report for Millstone Power Station Unit 2.

The information requested is provided below.

NRC Question No. 1.

Table 2 of Enclosure 1 to your January 31, 2006,[1] letter describes the rotating probe examinations performed during the 2005 steam generator tube inspections. Regarding this table:

a. Please discuss whether all dents, dings, bulges, possible loose parts, over expansions and fan bar wear were inspected with a rotating probe (e.g., is there only one tube that was partially expanded, are there only two tubes with bulges). If not, discuss the basis for the sample scope and expansion.

b. Please discuss whether any of the dents, dings, overexpansions, or bulges were service-induced. If so, discuss the cause. Please discuss whether the signals from these locations are consistent with the baseline examination (recognizing that there may be differences in examination techniques including calibration and steam generator position (horizontal versus vertical).

DNC Response

a. With regard to the items listed in Table 2 of Enclosure 1:

PTE - There is only one tube that contains a Partial Tube Expansion (PTE). The partial tube expansion is in the hot leg tubesheet of tube #R69-C14. A rotating coil examination was performed on the full length of this tubesheet.

PLP - All of the tubes that record Possible Loose Part (PLP) signals were interrogated with rotating coil techniques. Additionally, during the outage in which the PLP was first reported, any tubes adjacent to the tube recording a PLP are examined with a rotating coil technique in the same vicinity (axial length of tubing) as the recorded PLP signal.

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[1] DNC letter 06-060, Technical Specifications Annual Report, January 31, 2006, (ADAMS Accession No. ML060380615)

DNT/DNG - During the April 2005 inspection, twenty-five tubes recorded Dent or Ding (DNT/DNG) signals. Of these tubes, twenty-three (DNT/DNG) locations were examined by rotating coil techniques.

The inspection plan called for the reporting of all DNT/DNG signals recording a signal amplitude of 2 volts and greater and performing a diagnostic rotating coil examination of all DNT/DNG locations recording signal amplitudes of 3 volts or greater. The inspection scope also calls for a diagnostic rotating coil examination of all DNT/DNG locations recording signal amplitudes of less than 3 volts that exhibit a change from any of the previous two inspections. (Change is defined as a greater than 10 degree variation in phase angle or a variation of greater than 0.5 volts.) These changes to the Steam Generator Eddy Current Data Analysis Reference Manual reflect actions taken as a result of the information provided in NRC IN 2003-05.

However, one tube that recorded a DNG with signal amplitude of 4.18 volts was not interrogated with a rotating coil technique. Access to the location of this DNG, (high up in a large radius U-bend), required an exceptionally long U-bend probe to perform a rotating coil exam. The supply of these specialty probes was exhausted before completion of this examination. The bobbin coil data for this one DNG was reviewed by the Lead Analyst of the primary analysis team, the Independent Qualified Data Analyst (QDA), and the DNC Eddy Current Level III QDA for evidence of flaw like components distorting the DNG signal, and no evidence was found.

The final (25th) ding recorded a signal amplitude of only 2.36 Volts and did not meet any of the pre-planned criteria that would require a rotating coil examination.

Since no flaws were detected in the twenty-three (out of twenty-five total) DNT/DNG signals interrogated with rotating coil techniques, and since this steam generator was manufactured with crack resistant tubing, it was determined with a high degree of confidence that no cracking of dent or ding locations has occurred.

BLG - There are only two locations that have recorded Bulge (BLG) indications and both of these locations were interrogated with rotating coil diagnostic techniques.

OXP – The number of OXP locations examined with a rotating coil technique as listed in the 2005 annual steam generator tube inspection report for Millstone Power Station Unit 2, represent a small sample of the total OXP population.

During the baseline examination, over expansion (OXP) signals were recorded at 307 locations in 287 tubes. The Degradation Assessment prepared for the steam generators evaluated the susceptibility of the steam generator tubing to cracking and concluded that cracking is not likely to occur at any region of tubing in the foreseeable future.

Despite the lack of susceptibility to cracking, the pre-outage inspection plan called for performing a diagnostic rotating coil examination of all baseline OXP indication locations recording signal amplitudes of 40 volts or greater on the hot leg tubesheet and all baseline OXP indication locations recording signal amplitudes of 80 volts or greater on the cold leg tubesheet.

Fan Bar Wear - There are two tubes that have recorded minor wear at fan bar locations. Tube number R40C155 first recorded a minor wear indication (9% through wall) in February 2002. This tube also recorded a minor wear indication (9% through wall) at the same location in April 2005. During both outages the location was interrogated with a rotating coil technique even though the detection and quantification technique for wear is bobbin coil.

Tube number R140C93 first recorded a minor wear indication (9% through wall) in February 2002. This tube also recorded a minor wear indication (9% through wall) at the same location in April 2005. During the February 2002 outage this location was interrogated with a rotating coil technique even though the detection and quantification technique for wear is bobbin coil. During the April 2005 examination, a rotating pancake coil (RPC) was not performed at this location. Although a rotating coil examination is not required for this fan bar wear location, Dominion Nuclear Connecticut (DNC) would typically perform a rotating coil examination on this location as 'special interest' since this steam generator has recorded so few signals of interest to date; however, a rotating coil examination was not performed on this location as the supply of lengthy U-bend rotating probes was exhausted prior to examining this tube.

Bobbin I-Codes – Every tube location recording an indication of a discontinuity that receives an 'I-Code' as defined in the EPRI technical report, "Pressurized Water Reactor Steam Generator Guidelines: Revision 6," was examined with a rotating coil technique.

b. No new bulges or over-expansions have been reported since the baseline examination. Although not all dent and ding signals reported in recent examinations are traceable to the reported baseline examination results, any increase in the number of dent and ding indications reported are more likely the result of improvements in the equipment, examination technique, or changes in reporting criteria rather than being the result of service induced phenomenon.

Limitations exist for the detection and quantification of all discontinuities. Detection of signals attributed to local geometry variations such as dents, dings, bulges, and over-expansions prove to be particularly challenging since these signals exist in the same phase window as signals from 'noise' due to probe-wobble.

Although it is impractical to expect that all geometry variations have been identified and interrogated with specialized diagnostic techniques, the ability of nondestructive examination techniques to detect smaller deviations from the designed geometry has improved in recent years.

The eddy current examinations performed during February 2002 and April 2005 utilized a 0.610-inch diameter bobbin probe. During the eddy current examinations conducted on the tubes of this steam generator prior to February 2002, a 0.600-inch diameter probe was used. The increase in probe diameter has resulted in 'cleaner' eddy current data, (an increase in signal to noise ratio), and a more consistent centering of the probe diametrically within the tube.

Prior to each examination, a minimum reporting threshold is established for the reporting of detectable dent and ding signals. Preceding the most recent Steam Generator tube examination conducted in 2005, the Steam Generator Eddy Current Data Analysis Reference Manual was revised to lower the threshold for the reporting of dent and ding signals to 2 volts. The previous examination conducted on the tubes of this steam generator (during February 2002) did not require the analysts to record dent and ding signals less than 3 volts.

The term denting refers to a local reduction (plastic deformation) in the tube diameter due to a buildup of corrosion products (magnetite). The replacement steam generator wrapper and tube supports were fabricated with corrosion resistant 410 stainless steel, it is highly unlikely that corrosion induced denting has occurred.

The term ding refers to a local reduction (plastic deformation) in the tube diameter caused by manufacturing, vibration, support plate shifting, or other mechanical means. Of these, the most likely cause of the local reduction in the tube diameter is manufacturing dings.

The eddy current results indicate that widespread vibration is not occurring, (only 2 of the 8,523 tubes have recorded minor (9%) vibration induced wear). The eddy current data is also screened for evidence of distorted or missing support plates, with none reported.

NRC Question No. 2.

You detected several possible loose part indications with only the rotating probe. In addition, loose parts were only located during the secondary side inspections (presumably by visual examination). In light of the above experience (i.e., several possible loose part indications were not found during the bobbin coil examination) and operating experience at other plants (refer to NRC Information Notice 2004-17, "Loose Part Detection and Computerized Eddy Current Data Analysis in Steam Generators"), please discuss your basis for not performing additional rotating probe examinations at the top of the tubesheet (or other locations where the bobbin probe may not be sensitive to possible loose part indications).

DNC Response

Bobbin coil and rotating pancake coil (RPC) examinations were conducted in parallel with the water lancing, visual examinations, and Foreign Object Search and Retrieval (FOSAR). The bobbin coil and RPC examinations were conducted from the hot and cold legs and the visual examinations were conducted on the secondary side. As a result, any one of the three techniques might record the initial detection of a possible loose part. Once initially detected, the other techniques were employed (along with a review of historical data) to further characterize the indication. In eight of eleven locations, the possible loose parts were detected by at least two of the techniques. At the remaining three locations, the possible loose parts could only be detected visually. Possible loose part indications were bounded through rotating coil examination until all affected tubes at the location were identified. Expansions would be driven by the identification of damage associated with a loose part. No tube damage associated with loose part wear was identified, thus, no expansions were prescribed.

NRC Question No. 3.

There were several loose parts (or indications attributed to possible loose parts) left in service. Please discuss what analyses were performed to ensure these loose parts (or indications attributed to possible loose parts) do not compromise tube integrity for the period of time between inspections.

DNC Response

Framatome analyses conducted following 2R13 and 2R14 provide reasonable assurance, based on the part size, mass, and flow induced vibration analysis, that loose parts remaining in the steam generators at that time would not result in tube wall degradation in excess of the tube plugging limit over the life of the steam generators. These analyses have been validated through operating experience over several subsequent operating cycles. Specifically, the existence of small foreign objects in

areas adjacent to the tube sheet has not resulted in unacceptable wear on the steam generator tubes. The additional foreign objects remaining in the steam generators following 2R16 were reviewed against the existing analyses and history. This documented review concluded that the additional parts remaining in the steam generators were bounded by those existing analyses and history.

NRC Question No. 4.

Please discuss the scope and results of any secondary side inspections.

DNC Response

Inspections during 2R16 were performed after water lance operations in both steam generators with access to the secondary side provided through 4 - 6" handholes located at the tubesheet elevation. No upper bundle or steam drum inspections were performed. There were no damaged or degraded components or structures in the areas inspected.

NRC Question No. 5.

Please discuss the extent to which any tubes may be in closer than nominal proximity to each other. If any tubes are (or have been) in closer than nominal proximity, please discuss whether the number of tubes affected has increased/decreased since the steam generators were installed.

DNC Response

Direction is provided in the Steam Generator Data Analysis Reference Manual for recording of tubes in contact with each other or in close proximity to each other. No tubes have ever been reported to be in contact with each other or in close proximity to each other in this steam generator.