

April 9, 2003

MEMORANDUM TO: Docket File

FROM: Jack N. Donohew, Project Manager **/RA/**
Project Directorate IV-2
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: PETITIONER'S INTERVENTION ON EXIGENT STEAM GENERATOR
TUBE INSPECTION LICENSE AMENDMENT REQUEST (LAR) FOR
PALO VERDE UNIT 1 (TAC NO. MB6756)

In the application of September 26, 2002 (102-04844), Arizona Public Service Company (APS) submitted an exigent license amendment request (LAR) to amend Section 5.5.9, "Steam Generator (SG) Tube Surveillance Program," of the Technical Specifications for Palo Verde Nuclear Generating Station, Unit 1. The Sholly Notice for the exigent LAR was published in the *Federal Register* on October 3, 2002 (67 FR 62079). The TAC for the LAR is MB6378.

Thomas Saporito of the National Environmental Protection Center (NEPC) petitioned to intervene on the above exigent LAR. The NRC Staff's Response to Request for Hearing and Petition for Leave to Intervene Filed by National Environmental Protection Center was issued to the Atomic Safety and Licensing Board (ASLB) on November 4, 2002. This was followed by the memorandum to the ASLB that the NRC staff does not oppose the licensee's withdrawal of the subject LAR. The TACs for the staff's review of the petitioner's 2.206 petition on the subject LAR are MB6644, MB6445, and MB6646.

As part of the staff review of NEPC's petition, the Materials and Chemical Engineering Branch addressed several of the petitioner's contentions. The branch's responses to the contentions, which are attached, were sent to the Office of the General Counsel (OGC) to close out the subject TAC MB6756, "Review Related to Request for Hearing and Petition for Leave to Intervene by NEPC on September 26, 2002, LAR."

Docket No.: STN 50-528

Attachment: Branch Responses to Petitioner's Contentions

April 9, 2003

MEMORANDUM FOR: Docket File

FROM: Jack N. Donohew, Project Manager **/RA/**
Project Directorate IV-2
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: PETITIONER'S INTERVENTION ON EXIGENT STEAM GENERATOR
TUBE INSPECTION LICENSE AMENDMENT REQUEST (LAR) FOR
PALO VERDE UNIT 1 (TAC NO. MB6756)

In the application of September 26, 2002 (102-04844), Arizona Public Service Company submitted an exigent license amendment request (LAR) to amend Section 5.5.9, "Steam Generator (SG) Tube Surveillance Program," of the Technical Specifications for Palo Verde Nuclear Generating Station, Unit 1. The Sholly Notice for the exigent LAR was published in the *Federal Register* on October 3, 2002 (67 FR 62079). The TAC for the LAR is MB6378.

Thomas Saporito of the National Environmental Protection Center (NEPC) petitioned to intervene on the above exigent LAR. The NRC Staff's Response to Request for Hearing and Petition for Leave to Intervene Filed by National Environmental Protection Center was issued to the Atomic Safety and Licensing Board (ASLB) on November 4, 2002. This was followed by the memorandum to the ASLB that the NRC staff does not oppose the licensee's withdrawal of the subject LAR. The TACs for the staff's review of the petitioner's 2.206 petition on the subject LAR are MB6644, MB6445, and MB6646.

As part of the staff review of NEPC's petition, the Materials and Chemical Engineering Branch addressed several of the petitioner's contentions. The branch's responses to the contentions, which are attached, were sent to the Office of the General Counsel (OGC) to close out the subject TAC MB6756, "Review Related to Request for Hearing and Petition for Leave to Intervene by NEPC on September 26, 2002, LAR."

Docket No.: STN 50-528

Attachment: Branch Responses to Petitioner's Contentions

DISTRIBUTION:

PUBLIC	PDIV-2 Reading
RidsNrrDlpmLpddiv (HBerkow)	RidsNrrPMJDonohew
RidsNrrLAMMcAllister	CKhan (NRR/DE/EMCB)

ADAMS Accession No.: ML030990669

NRR-106

OFFICE	PDIV-2/PM	PDIV-1/LA	EMCB	PDIV-2/SC
NAME	JDonohew::sp	MMcAllister	CKhan	SDembek
DATE	4/2/2003	4/1/03	4/8/03	4/9/03

DOCUMENT NAME: C:\ORPCheckout\FileNET\ML030990669.wpd

OFFICIAL RECORD COPY

BRANCH RESPONSES TO PETITIONER'S CONTENTIONS

NEPC REQUEST FOR HEARING AND PETITION TO INTERVENE - NOVEMBER 8, 2002 PALO VERDE NUCLEAR GENERATING STATION (PVNGS) UNIT 1 CONTENTION NUMBER FOUR

This document refers to a limited amount of proprietary information. The proprietary information is identified, but not provided in the branch response.

Throughout contention #4, the Petitioner stated: "To the extent that the NRC relied on the licensee's safety analysis under 10 C.F.R. 50.92(c) in proposing a no significant hazards consideration, the NRC is [stopped] from approving the licensee's LAR." On November 19, 2002, the reviewer had a conversation with OGC (Sherwin Turk) who indicated that this particular contention required a legal response, not a technical response. Therefore, the responses below do not address this particular aspect of the contention. OGC also indicated that at this point, the branch (NRR/DE) does not have to provide a discussion as to the technical merits of the Petitioner's contention. However, the staff has asked requests for additional information (RAIs) related to several of the Petitioner's concerns. These are identified in the discussion below.

ISSUE 1: *Petitioner contends that the Westinghouse WCAP-15947 report is apparently flawed and therefore cannot be relied upon by the licensee as a basis for their amendment request and therefore cannot be relied upon by the NRC in approving the licensee's LAR. Thus the licensee's safety analysis under 10 C.F.R. 50.92(c) is apparently invalid and the NRC's review of the licensee's safety analysis under 10 C.F.R. 50.92(c) is also apparently invalid and requires a finding that the NRC's proposed no significant hazards consideration is apparently invalid as well. Therefore, the NRC is estopped from approving the licensee's LAR.*

RESPONSE 1 - This is a very general statement. No specific details are provided which support the basis for this contention. The Petitioner raises detailed statements/concerns in the remainder of Contention #4 which are addressed below.

ISSUE 2:

PART A - *The licensee identifies the PVNGS Unit 1 steam generator to be a CE System 80 design and fabricated by Combustion Engineering ("CE"). See, licensee's September 26th, 2002 letter to the NRC, Enclosure 1 at p.1.*

RESPONSE, PART A - The Petitioner stated that the licensee identifies the PVNGS Unit 1 steam generators to be a CE System 80 design and fabricated by Combustion Engineering (CE). This statement is accurate, however no contention was raised on this point.

PART B - *The licensee's requested an inspection criteria limit of seven (7) inches in consideration of the licensee's review of the WCAP, NRC Safety Evaluations for Sequoyah Unit 2 and SONGS Units 2 and 3 and comparative review of the W*WCAP. Thus, the licensee's more conservative approach in requesting an inspection criteria limit of seven (7) inches*

appears to be based on a safety issue identified in the NRC's Safety Evaluation of the Sequoyah Unit 2 and the SONGS Units 2 and 3, and not based on any NRC Safety Evaluation conducted by the agency on the PVNGS Unit 1 SG.

RESPONSE, PART B - There is no technical merit to this contention. The staff does not develop a safety evaluation on a specific plant's request until after the request is submitted. In addition, the licensee is stating that they developed a technical justification for the inspection distance which included consideration of the staff's previous evaluations from other plants. This practice is encouraged by the NRC.

PART C - *The licensee apparently fails to explain its rationale and reasoning in requiring and inspection criteria limit of seven (7) inches. Indeed, twelve (12) inches would be an even more conservative approach. However, because the licensee failed to delineate the basis for its conclusions in requesting an inspections criteria limit of seven (7) inches, there is a great deal of uncertainty about the margin of safety which is established by the licensee 's safety analysis and conclusions therein. Consequently, to this extent, the NRC's review of the licensee's safety analysis is apparently invalid and cannot be relied upon by the agency in approving the licensee's LAR.*

RESPONSE, PART C - There is no technical merit to this contention.

In Enclosure 1 to the September 26, 2002, submittal, the licensee states that the inspection criteria limit of 7 inches was established for conservatism and to provide additional bounding assurance.

In the "Supplemental Report to WCAP 15947-P For the Palo Verde Nuclear Generating Station," which was part of the September 26, 2002, submittal, the licensee documents the technical basis for their conclusion that an inspection distance of 4.75 inches is the minimum required and that the requested inspection distance of 7 inches conservatively bounds the 4.75 inch minimum.

The purpose of the staff's review is to ensure the licensee's analysis is appropriate and includes an appropriate level of conservatism. The licensee has responded to RAIs on this issue. The staff has not reached a final conclusion regarding the adequacy of the responses.

ISSUE 3:

PART A - *The licensee admits that the WCAP is based on assumptions rather than scientific facts and/or certainties. See, licensee September 26th, 2002 letter at the Executive Summary at p.1.*

RESPONSE, PART A - The Petitioner is referring to page iii of the Executive Summary of WCAP-15947-P. The Executive Summary states; "The inspection extent value of five inches has been derived based on a conservative assumption that a maximum number of tubes equal to [

]." The Information in brackets is proprietary and the Petitioner does not have access to the information.

The inspection distance is based on ensuring the PVNGS steam generators maintain structural integrity and leakage integrity. The assumption above refers to assumptions related to the leakage integrity. In the original submittal, the licensee's conclusions are based on both test data (which is described in the WCAP) and the assumption identified above. The Petitioner

is partly correct. (Note: The licensee has responded to RAIs on this issue. The staff has not reached a final conclusion regarding the adequacy of the responses.)

PART B - *Moreover, the licensee further admits p.3 of the Executive Summary that the "steam generators at PVNGS Units 1, 2, and 3 were designed and fabricated by Combustion Engineering (CE), and are currently the only US operated units of the System 80 design." However in contrast to the licensee's System 80 CE designed steam generators, the NDE Inspection Strategy for the Tubesheet Region in Palo Verde Unit 1 ("NDEIS") at Section 1 p.1, clearly states that "Testing was performed using tubesheet mockups and a canceled plant steam generator to determine the leak and burst limiting tube to tubesheet joint length needed to assure operation within generic licensing and industry developed limits." Thus the NDEIS safety analysis is based on testing of a different type of steam generator other than the CE System 80 steam generator and a steam generator apparently not manufactured by Combustion Engineering. Thus, as stated above, the NDEIS is based on assumptions and not based on an exact science using identical steam generators manufactured by Combustion Engineering.*

RESPONSE, PART B - The Petitioner's first statement, "... only US operated units of the System 80...", is located on Page 3 of the Supplemental Report to the WCAP. The Petitioner's second statement, "... using tubesheet mockups and a canceled plant....," is located in Section 1.0 of the WCAP.

The Petitioner concludes that the NDEIS safety analysis is based on testing of a different type of steam generator other than the CE System 80 steam generator and a steam generator apparently not manufactured by Combustion Engineering.

The Petitioner is referring to the "Boston Edison Steam Generator" which is discussed in detail in Section 3.3.1 of the WCAP and the "Single Tube Mockups," discussed in detail in Section 3.3.2 of the WCAP.

The Boston Edison (BE) steam generator was fabricated for a plant that was never completed. The WCAP indicates that the design, material and manufacturing properties of the tube and tubesheet region of the BE steam generators are typical of the PVNGS steam generators. More specific details are contained in the WCAP.

The Single Tube Mockups were fabricated using similar design, material and manufacturing properties of the tube and tubesheet region of the PVNGS steam generators.

The staff believes it is reasonable to use this test data assuming the licensee can demonstrate they adequately simulate the PVNGS steam generators. Note: RAIs have been asked on this issue requesting further justification regarding the applicability of the test data to the PVNGS steam generators. Based on the RAI response, staff does not have any concerns.

PART C - *Indeed, the Westinghouse testing was apparently performed on a fairly "new" steam generator taken from a canceled plant in contrast to the PVNGS Unit 1 which has been in operation since 1986 under the demanding temperatures and the demanding pressures of full operation in that time period. Moreover, the PVNGS Unit 1 SG has been subject to having many of its tubes plugged over the course of its operation. Because the PVNGS Unit 1 SG has had a great many of its tubes plugged, the overall diminished flow through the plugged SG tubes would apparently result in a greater amount of pressure being exerted on the remaining SG tubes considering all other operational parameters remained the same.*

Thus, because the NDEIS failed to consider any effects which the plugging of the PVNGS Unit-1 SG tubes may have with respect to any increase in the amount of internal

pressure applied to the SG tubes, in comparison to the NDEIS safety analysis of the Westinghouse mockup SG unit, the NDEIS safety analysis is apparently invalid and cannot be used by the licensee as a basis to request a LAR from the NRC. To the extent that the NRC relied on the licensee's safety analysis under 10 C.F.R. 50.92(c) in proposing a no significant hazards consideration, the NRC is estopped from approving the licensee's LAR.

RESPONSE, PART C - This contention has no technical merit.

The Petitioner's statement that "testing was apparently performed on a fairly 'new' steam generator taken from a canceled plant in contrast to the PVNGS Unit 1 which has been in operation since 1986 under the demanding temperatures and the demanding pressures of full operation in that time period" does not have conclusions associated with it. Therefore, the staff is not responding to this statement.

The Petitioner has indicated that, during testing, the licensee has not accounted for the increase in internal pressure due to tube plugging.

This has no technical merit because internal pressure does not increase as a result of tube plugging. [Note: The pressure differential (across the tubes) does increase as tube plugging increases. The pressure differential which the licensee utilized for testing takes into account current and potential future plugging conditions, and thus the potential increase in differential pressure. The licensee has responded to an RAI clarifying this point.]

ISSUE 4: *The NDEIS safety analysis at Section 1, p.1 states in part that, "The threshold distance of five inches is based on the number of tubes in the steam generator." Thus, the NDEIS did not take into consideration any amount of tubes in the PVNGS Unit-1 SG that are plugged and not in service. Therefore the NDEIS is apparently invalid and not based on scientific data or a realistic and material comparison of identical steam generator units having an identical number of operable tubes. Therefore the licensee's safety analysis is apparently invalid and cannot be relied upon in requesting a LAR from the NRC. To the extent that the NRC based their proposed no significant hazards consideration on the agency's review of the licensee's safety analysis, the NRC is estopped from approving the licensee's LAR. Notably, the Babcock & Wilcox designed plants have discovered tube cracks within the tubesheet region "leading the NRC to issue Information Notice (IN 98-27) alerting the PWR [pressurized water reactor] industry to the events." See, NDEIS at Section 1 at p.1.*

RESPONSE 4 - The first statement identified by the Petitioner is located in Section 1.1 of the WCAP. This statement actually refers to the issue identified in Issue 3, Part A (above), although the WCAP does not clearly identify this.

This 5-inch inspection distance is not actually tied to the number of in-service tubes (i.e., non-plugged tubes) and plugged tubes would not affect the licensee's conclusions. This may not be completely clear in the submittal, partly because the information associated with this issue is proprietary. NOTE: The staff has raised questions on this general topic through RAIs.

The second statement identified by the Petitioner (regarding IN 98-27) is located in Section 1.1 of the WCAP. The Petition does not clearly indicate how this statement is linked to the discussion and conclusions earlier in the paragraph. However, the WCAP does state that "The B&W tube-to-tubesheet joint design is a rolled joint that has limited applicability to the CE design but highlighted the need to review inspection practices in this region." Therefore, the statement related to IN 98-27 does not appear to have technical merit.

ISSUE 5:

PART A - *The Combustion Engineering company pioneered the use of explosive expansion for steam generator tubesheet joints, termed "expansion." The desired design features were to provide a cost-efficient method for closing the tube to tubesheet gap over the full length with sufficient pullout strength, leak tightness and without excessive residual stress in the tube. See, NDEIS at Section 1, p.2. Notably, the use of the expansion technique is a relatively "new" concept without a significant database of information to determine its reliability over an expected 40-year life span of a steam generator. Moreover, the NDEIS states that, "Incomplete expansions have been detected operating units ..." NDEIS at Section 1, p.2.*

RESPONSE, PART A - This contention has no technical merit.

The first statement is located in Section 1.2 of the WCAP. The Petitioner's concluded that "Notably, the use of the expansion technique is a relatively 'new' concept without a significant database of information to determine its reliability over an expected 40-year life span of a steam generator." The basis for this conclusion is not clear. Section 1.2 of the WCAP also states that "Beginning in 1961, Combustion Engineering pioneered the use of explosive expansion for steam generator tubesheet joints, termed 'expansion'." Obviously, this is not a recent design/manufacturing change. In addition, periodic inspection of the steam generator tubes is required over the life of the steam generators to continue to monitor their condition.

The Petitioner's second statement is also located in Section 1.2 of the WCAP. The Petition does not clearly indicate how this statement is linked to the discussion and conclusions earlier in the paragraph. However, the licensee's submittal (the WCAP and the Supplemental Report to the WCAP) contains a significant amount of additional discussion of this statement and its impact on the inspection extent. NOTE: The staff previously posed an RAI on this topic for further clarification.

PART B - *Of even greater concern to the Petitioner is the fact that the NDEIS considered a W^* developed based on two radial zones to credit less tubesheet flexure for the radial zone nearest the steam generator shell. However, only one radial zone was considered for the CE designed SG tube threshold distance based on an assumption that the tubesheets in the PVNGS Unit-1 experience less flexure near the stay cylinder and the shell due to the support provided by these parts of the steam generator.*

RESPONSE, PART B - This contention has no technical merit.

The W^* criteria are approved for a plant (Diablo Canyon) with steam generators designed by Westinghouse. The Westinghouse steam generators experience much less tubesheet flexure towards the periphery of the tubesheet, and the highest amount of flexure in the center of the tubesheet bundle. Two radial zones were used so the licensee can limit the extent of the required inspections in the region of the tubesheet that experiences less flexure (i.e., the periphery of the tube bundle).

PVNGS Combustion Engineering steam generators also experience less tubesheet flexure in the periphery of the tubesheet bundle as compared to the interior of the tubesheet bundle. Based on a technical analysis of the design (not assumptions as the Petitioner asserts), the licensee concluded the difference in the amount of flexure between these two regions is less than that in the Westinghouse design.

PVNGS uses only one radial zone. However, the proposed inspection distance assumes the largest amount of tubesheet flexure occurs across the entire tubesheet.

Therefore, in the periphery, the region with the smallest amount of tubesheet flexure, the inspection distance is even more conservative.

PART C - *The NDEIS assumptions also failed to consider what, if any, effect any increased operating pressure caused by the plugged SG tubes in PVNGS-1 may have on the tubesheet flexure for the radial zone nearest the SG shell. Therefore[,] the licensee's safety analysis is apparently invalid and cannot be relied upon in requesting a LAR from the NRC. To the extent that the NRC based their proposed no significant hazards consideration on the agency's review of the licensee's safety analysis, the NRC is estopped from approving the licensee's LAR.*

RESPONSE, PART C - This contention has no technical merit.

The Petitioner has indicated that the licensee has not accounted for the increase in operating pressure, and therefore the amount of tubesheet flexure, due to tube plugging.

This has no technical merit because internal operating pressure does not increase as a result of tube plugging. As previously stated in response to Issue 3, Part C, the pressure differential does increase, and the value assumed by the licensee takes into account current and potential future plugging conditions, and thus the potential increase in differential pressure. The licensee has responded to an RAI clarifying this point.

ISSUE 6: *Petitioners assert here that the NDEIS conducted a parametric approach for testing the pressure, temperature, and expansion contact force effects to consider the key contributions to joint integrity, and that the NEDIES [NDEIS] parametric approach was applicable to the Boston Edison canceled plant as-built steam generator and not applicable to the CE System 80 steam generator employed at the PVNGS Unit-1. Therefore[,] the licensee's safety analysis is apparently invalid and cannot be relied upon in requesting a LAR from the NRC. To the extent that the NRC based their proposed no significant hazards consideration on the agency's review of the licensee's safety analysis, the NRC is estopped from approving the licensee's LAR.*

RESPONSE 6 - This basic concern identified in this Issue is the same as that identified in Issue 3, Part B (i.e., data from the Boston Edison canceled plant is not applicable to the PVNGS steam generators). The staff's conclusions are the same as identified above.

ISSUE 7: *Under MSLB [main steamline break] conditions, the differential pressure across the tubesheet causes tubesheet flexure and dilation of the tubesheet hole. Dilation of the hole reduces the contact force in the region of dilation. NDEIS at Section 1, p.5. The Petitioner notes here that nowhere in the NDEIS does there appear to be a safety analysis that takes into account the age of the PVNGS Unit-1 SG, or the stresses experienced by the PVNGS Unit 1 SG during [the] events which may have caused a significant increase in the differential pressure which induces axial and hoop stresses on the tube inside diameter. These transient events in the PVNGS Unit-1 SG should have been considered in the NDEIS to the extent that such events could have fatigued any number of the SG tubes. Therefore[,] the licensee's safety analysis is apparently invalid and cannot be relied upon in requesting a LAR from the NRC. To the extent that the NRC based their proposed no significant hazards consideration on the agency's review of the licensee's safety analysis, the NRC is estopped from approving the licensee's LAR.*

RESPONSE 7 - The Petitioner does not clearly indicate what effect he believes the age of the PVNGS steam generators would have on the inspection distance. The staff is not aware of any related impacts. (PVNGS steam generators have experienced tube degradation, which continues to occur as long as the tubes are in operation. However, the license amendment request, and therefore the inspection distance, accounts for this.)

The Petitioner asserts that transient events in the PVNGS steam generators should have been considered in the inspection distance (NDEIS) because the events could have fatigued any number of steam generator tubes. It is not clear what events the Petitioner believes could have impacted the condition of the steam generator tubes. However, the steam generators (and tubes) are designed to withstand various transients and postulated events. In addition, the purpose of the periodic steam generator tube inspections is to verify that the condition of the steam generator tubes is still adequate for operation.

ISSUE 8: *The NDEIS states that, "Tubesheet hole surface roughness was addressed in the fabrication of tubesheet mockups and visual inspection of the roughness in the Boston Edison steam generator and several single tube mockups... Tubesheet mockup holes were fabricated by drilling to represent the CE design applicable to Palo Verde 1..." The Petitioner asserts here that the NDEIS testing is not valid because it was conducted under ideal laboratory conditions using "new" materials and no testing was conducted using materials similar to the aged and fatigued materials employed in the PVNGS Unit-1. Therefore the licensee's safety analysis is apparently invalid and cannot be relied upon in requesting a LAR from the NRC. To the extent that the NRC based their proposed no significant hazards consideration on the agency's review of the licensee's safety analysis, the NRC is estopped from approving the licensee's LAR.*

RESPONSE 8 - This contention has no technical merit.

The Petitioner is correct that the materials were "new" and not aged. The Petitioner does not indicate what may have fatigued the materials and the staff is not aware of such a potential condition.

However, as previously stated in response to previous issues, the staff believes the licensee's approach could be acceptable, assuming they can support their conclusions that the laboratory mockups and resulting test results simulate the field conditions.

In fact, the staff believes that aged tube and tubesheet materials may actually improve the steam generator's structural and leakage integrity due to an increase in corrosion of the tubesheet. Increased corrosion may lead to increased resistance to tube pullout (structural integrity) and increased resistance to primary-to-secondary leakage (leakage integrity).

Principal Contributor: Cheryl Khan

Dated: April 9, 2003