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RECIP. NAME RECIPIENT AFFILIATION

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SUBJECT: Rev to 950418 application for amends to licenses NPF-41, NPF-51 & NPF-74, revising TS Section 3/4.4.4, "Steam Generators & Associated Bases" to allow installation of tube sleeves as alternative to plugging defective SG tubes.

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May 23, 1997

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Reference: Letter 102-03325-WLS/SAB/JRP, dated April 18, 1995, from W. L. Stewart, APS, to NRC, "Technical Specification Amendment Request Sleeving Process for Steam Generator Tube Repair"

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Revised Technical Specification Amendment Request
Sleeving Process for Steam Generator Tube Repair**

In the referenced letter Arizona Public Service Company (APS) transmitted a request for a Technical Specification Amendment allowing the installation of tube sleeves as an alternative to plugging defective steam generator tubes. The Technical Specification surveillance requirements would be revised to allow steam generator tube repair using ABB Combustion Engineering Inc. (ABB/CE), Leak Tight Sleeves. The details of specific qualifications of the sleeve types were documented in a separate report provided as Attachment 2 to the referenced letter.

This amendment request supersedes the referenced letter in its entirety. The information presented here has been revised based on NRC questions concerning the ABB/CE sleeving process. The Staff has requested that licensees consult with ABB/CE, and then submit the appropriate revisions to the CE Topical based on the resolution of their questions. APS has consulted with ABB/CE and the Topical Report "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves" CEN-630-P, Revision 01, dated November, 1996 has been issued.

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APS has reviewed the Topical Report, and the changes address NRC questions with the ABB/CE leak tight-sleeve design and installation. Consequently, the revised Topical Report provides information sufficient to support a Technical Specification Amendment allowing the use and installation of the ABB/CE welded sleeve in steam generators with 3/4" O.D. tubes. The revised Topical Report has been submitted to the NRC for review and approval by Entergy Operations Inc. (ANO-2) on November 26, 1996.

The purpose of this letter is to request that the NRC approve the use of this Topical Report for repair of defective steam generator tubes at PVNGS. APS is requesting an amendment to the PVNGS Technical Specifications for Units 1, 2, and 3 which would revise the surveillance requirements for Technical Specification Section 3/4.4.4, Steam Generators and associated Bases. The amendment would allow the installation of tube sleeves as an alternative to plugging defective steam generator tubes.

Provided in Enclosure 1 to this letter are the following:

- A. Description of the Proposed Amendment Request
- B. Purpose of the Technical Specification
- C. Need for the Technical Specification Amendment
- D. Safety Analysis of the Proposed Technical Specification Amendment
- E. No Significant Hazards Consideration Determination
- F. Environmental Impact Determination
- G. Marked-up Technical Specification Pages

Enclosure 2 provides the marked-up Technical Specification pages to support the proposed amendments. Also included in the enclosure are marked-up pages from the Improved Standard Technical Specifications submittal (Letter Number 102-03794, dated October 4, 1996) for your review.



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

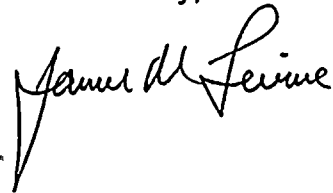
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The proposed amendment has been reviewed and approved by the Plant Review Board (PRB) and the Offsite Safety Review Committee (OSRC) and it has been determined that the amendment involves no significant hazards considerations. APS requests that the proposed amendment to the Technical Specifications be reviewed and approved by December 31, 1997, to allow the option of sleeving defective steam generator tubes during the Unit 1 refueling outage in February 1998. Pursuant to 10 CFR 50.91(b) (1), a copy of this request has been forwarded to the Arizona Radiation Regulatory Agency.

Should you have any questions, please contact Scott A. Bauer at (602) 393-5978.

Sincerely,

A handwritten signature in cursive script, appearing to read "James M. Levine".

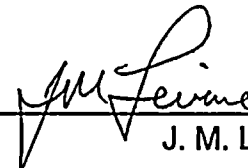
JML/AKK/JRP/mah

Enclosure

cc: E. W. Merschoff
K. E. Perkins
J. W. Clifford
K. E. Johnston
A. V. Godwin (ARRA)

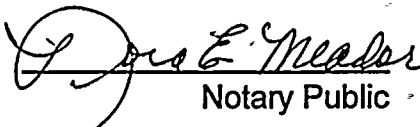
STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, J. M. Levine, represent that I am Senior Vice President - Nuclear, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.



J. M. Levine

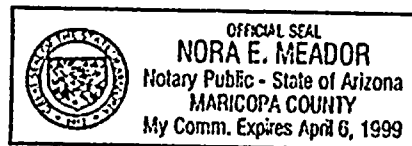
Sworn To Before Me This 23 Day Of May, 1997.



Notary Public

My Commission Expires

April 6, 1999





ENCLOSURE 1
TECHNICAL SPECIFICATION AMENDMENT REQUEST
SLEEVING PROCESS FOR STEAM GENERATOR TUBE REPAIR

A. DESCRIPTION OF THE PROPOSED AMENDMENT REQUEST

The proposed amendment would revise the surveillance requirements for Technical Specification Section 3/4.4.4, Steam Generators and its associated Bases. These amendments would allow the installation of tube sleeves as an alternative to plugging defective steam generator tubes at Palo Verde Nuclear Generating Station using ABB/CE, Leak Tight Sleeves.

The acceptance criteria for steam generator inservice inspections will be revised to allow sleeving as an acceptable means of repairing defective tubes. Reporting requirements have been added for those defect locations spanned by a sleeve.

This proposed Technical Specification amendment modifies Sections 4.4.4.4 and 4.4.4.5 as follows:

- a) Section 4.4.4.4, Acceptance Criteria - Section 4.4.4.4(a) is revised to add the definition of " Tubing or Tube, " and "Tube Repair". The definition of defect was expanded to include a reference to the repair limit. The definition of plugging limit was expanded to include a reference to the repair limit and include sleeving as an alternative to tube plugging. In addition, the discussion of operability in Section 4.4.4.4 (b) was revised to include repaired tubes after sleeving and a reference to the repair methodology to be used.
- b) Reporting requirements of Section 4.4.4.5 have been revised to include the reporting of sleeved tubes, in addition to the reporting of plugged tubes.
- c) Table 4.4-2 "Steam Generator Tube Inspection" is revised to allow repair of defective tubes as an alternative to plugging.

Additionally, the Bases for Technical Specification 3/4.4.4 have been revised to:(1) reflect that defective steam generator tubes can be repaired by sleeving; (2) reference the applicable document for steam generator tube sleeving; and (3) add a discussion related to inservice inspection of sleeved tubes.

B. PURPOSE OF THE TECHNICAL SPECIFICATION

The surveillance requirements for inspection of steam generator tubes ensure that the structural integrity of this portion of the Reactor Coolant System (RCS) will be maintained. The inservice inspection program for the steam generators is essential in order to maintain surveillance of the conditions of the tubes in the event that there is evidence of mechanical damage or progressive degradation due to design, manufacturing errors, or inservice conditions that lead to corrosion. Inservice inspection of steam generator tubing also provides a means of characterizing the nature and cause of tube degradation so that corrective measures can be taken.

C. NEED FOR THE TECHNICAL SPECIFICATION AMENDMENT

Operating experience throughout the industry indicates that steam generator tube repair techniques using sleeves can be applied permitting the affected tube to remain in service and reduce the impact on reactor coolant flow rates. Several specific defect locations observed at PVNGS, such as, the expansion transition above the tube sheet, the flow distribution plate and eggcrate supports are considered candidate locations for repair via sleeving. However, current Technical Specifications require a tube that exhibits a through-wall defect of 40 percent or greater, to be removed from service by means of a tube plug. The tube plug isolates flow through the tube, thereby removing the tube from service.

As tubes are plugged, the effective heat transfer area of the steam generator is reduced and the differential pressure across the steam generator is increased. This results in reduced coolant flow rate available for core cooling.

The purpose of a sleeve is to repair specified steam generator tube defects in order to maintain the original function and integrity of the tube. The sleeving methodology consists of inserting and welding a sleeve to the inside of the defective original tube, bridging the defect and forming a new pressure boundary. By spanning the degraded section of tube, the sleeve and sleeve joint maintain the structural integrity of the steam generator tube under normal and accident conditions, and prevent leakage should a through-wall breach in the tube wall at the original defect location develop.

The installation of a sleeve(s) into a tube results in a flow restriction within the primary system, with an associated increase in pressure drop in the steam generator. The effects of this flow restriction on plant operation are much smaller than the effects of a tube plug and are evaluated in the same manner that tube plugging effects are analyzed. The effect of sleeve installation on steam generator heat removal capability and system flow rate are discussed in Topical Report CEN-630-P, Revision 01.

The proposed amendment allows for sleeve installation in the Palo Verde steam generators, according to the qualifications and technologies discussed in Topical Report CEN-630-P, Revision 01. APS requests that sleeving be included as an approved alternative to tube plugging for defects identified at the expansion transition, flow distribution plate and eggcrate supports.

D. SAFETY ANALYSIS OF THE PROPOSED TECHNICAL SPECIFICATION AMENDMENT

The proposed amendment will allow the use of tube sleeves to repair steam generator tubes which exhibit degradation and can be sleeved. The Technical Specification Amendment will reference Combustion Engineering Inc., Topical Report CEN-630-P, Revision 01 dated November, 1996, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves", which provides information sufficient to support a Technical Specification change allowing installation of sleeves in 3/4" O.D. tube steam generators.

The proposed sleeving provides for a substitution in kind for a portion of a steam generator tube. The proposed change has no significant affect on the configuration of the plant and the change does not affect the way in which the plant is operated. Design criteria were established prior to performing the analysis and test program which, if met, would prove that these sleeves are an acceptable repair technique. These criteria conformed to the stress limits and margins of safety of Section III of the ASME B & PV Code. The safety factors of 3 for normal operating conditions and 1.5 for accident conditions were applied. Based upon the results of the analytical and test programs described in the Topical Report these sleeve types fulfill their intended function as leak tight structural members and meet or exceed the established design criteria.

E. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility does not involve a significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involve a significant reduction in a margin of safety.

A discussion of these standards as they relate to the amendment request follows:

Standard 1 -- Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

The proposed amendment to permit the use of steam generator tube sleeves as an alternative to tube plugging is a safe and effective repair procedure that does not result in removing a tube from service. Mechanical strength, corrosion resistance, installation methods, and inservice inspection techniques of sleeves have been shown to meet NRC acceptance criteria.

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Analytical verifications were performed using design and operating transient parameters selected to envelope loads imposed during normal operating and accident conditions. Fatigue and stress analysis of sleeved tube assemblies were completed in accordance with the requirements of Section III of the ASME Code. The results of qualification testing, analysis and plant operating experience at other facilities demonstrates that the sleeving process is an acceptable means of maintaining steam generator tube integrity. The sleeve configuration has been designed and analyzed in accordance with the structural margins specified in Regulatory Guide 1.121 (RG 1.121). Furthermore, the installed sleeve will be monitored through periodic inspections on a sample basis with eddy current techniques. A sleeve-specific plugging margin, per the recommendations of Regulatory Guide 1.121, has been specified with appropriate allowances for NDE uncertainty and defect growth rate. Therefore, since the sleeve provides the same protection against a tube rupture as the original tube, the use of sleeves does not involve a significant increase in the probability of an accident previously evaluated .

Recently, industry experience with forced shutdown events associated with tube failures at sleeve junctions was assessed by APS and ABB-CE. The root cause of these events has been attributed to the lack of proper post-installation stress relief and/or the imposition of high stresses due to tube growth restrictions at locked tube supports. The material and design of the PVNGS steam generator supports minimizes the potential for locked supports. The tube supports are of eggcrate design and are constructed of ferric stainless steel. The large flow area in the eggcrate design provides better irrigation and reduces the potential for steam blanketing, therefore, the tube-to-tube support crevices are less likely to be blocked by crud, boiler water deposits and corrosion products. Since the support material is type 409 ferric stainless steel, it is not susceptible to magnetite corrosion which has resulted in denting and lockup at plants with carbon steel supports. These conclusions have been substantiated via tube pull activities conducted in PVNGS Unit 2. Although ABB/CE does not require post-weld heat treatment in all applications, APS will require that a post-weld stress relief be conducted for sleeve installations. Therefore, with proper sleeve installation the proposed change will not involve a significant increase in the probability of an accident previously evaluated.

The consequences of accidents previously analyzed are not increased as a result of sleeving activities. The hypothetical failure of the sleeve would be bounded by the current steam generator tube rupture analysis contained in the PVNGS UFSAR. Due to the slight reduction in diameter caused by the sleeve wall thickness, it is expected that the primary release rates would be less than assumed for the steam generator tube rupture analysis, and, therefore, would result in lower primary fluid mass release to the secondary system. Additionally, further conservatism is introduced if the break were postulated to occur at a location on the tube higher than the location where a sleeve is installed. The overall effect would be reduced steam generator tube rupture release rates. The minimal reduction in flow area associated with a tube sleeve has no significant affect on steam generator performance with respect to heat transfer or system flow resistance and pressure drop. The installation of sleeves rather than plugging also maintains a greater

heat transfer surface in the steam generator. In any case, the impacts are bounded by evaluations which demonstrate the acceptability of tube plugging, which totally removes the tube from service.

Therefore, in comparison to plugging, tube sleeving is considered a significant improvement with respect to steam generator performance. Therefore, based on the above, the proposed amendment does not significantly increase the probability or consequences of an accident previously evaluated.

Standard 2--Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

A sleeved steam generator tube performs the same function in the same passive manner as an unsleeved steam generator tube. Tube sleeves are designed and qualified to the stress and pressure limits of Section III of the ASME Code and Regulatory Guide 1.121.

The installation of the sleeve, including weld and welder qualification and nondestructive examination (NDE), meets or exceeds the requirements of ASME Section XI. Three types of NDE are conducted. Ultrasonic Testing (UT) is performed to verify the adequacy of the tube to sleeve weld assuring proper fusion. Eddy Current testing (ECT) is performed following each installation to establish baseline data for each sleeve in order to monitor future degradation of the primary to secondary pressure boundary. Visual inspections will be performed to verify or ascertain the mechanical and structural condition of a weld. Critical conditions which are checked include weld width and completeness, and the absence of visibly noticeable indications such as cracks, pits, and burn through.

ABB Combustion Engineering, Inc., Report CEN-630-P, Revision 01, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves" dated November, 1996, demonstrates that the repair of degraded steam generator tubes using tube sleeves will result in tube bundle integrity consistent with the original design basis. Extensive analyses and testing have been performed on the sleeve and sleeve to tube joints to demonstrate that the design criteria are met. The proposed amendments have no significant effect on the configuration of the plant, and the change does not affect the way in which the plant is operated. Therefore, reactor operation with sleeves installed in the steam generator tubes does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Standard 3--Does the proposed change involve a significant reduction in a margin of safety?

Evaluation of the sleeved tubes indicates no detrimental effects on the sleeve-tube assembly resulting from reactor coolant system flow, coolant chemistries, or thermal and pressure conditions. Structural analyses have been performed for sleeves which span the tube at the top of the tube sheet and which span the flow distribution plate or eggcrate support. Mechanical testing has been performed to support the analyses. Corrosion testing of typical sleeve-tube assemblies has been completed and reveals no evidence of sleeve or tube corrosion considered detrimental under anticipated service conditions.

Steam generator tube integrity is maintained under the same limits for sleeved tubes as for unsleeved tubes, ie., Section III of the ASME Code and Regulatory Guide 1.121. The portions of the installed sleeve assembly which represents the reactor coolant pressure boundary can be monitored for the initiation and progression of sleeve/tube wall degradation, thus satisfying the requirements of Regulatory Guide 1.83. The degradation limit at which a sleeve/tube boundary is considered inoperable has been analyzed in accordance with Regulatory Guide 1.121 and is specified in the proposed amendment. Eddy current detectability of flaws has been verified by ABB Combustion Engineering. Additionally, the Technical Specifications continue to require monitoring and restriction of primary- to- secondary system leakage through the steam generators. The minimal reduction in RCS flow due to sleeving results in an insignificant impact on RCS operation during normal or accident conditions and is bounded by tube plugging evaluations.

Based upon the testing and analyses performed, the installation of tube sleeves will not result in a significant reduction in a margin of safety.

F. ENVIRONMENTAL IMPACT DETERMINATION

APS has determined that the proposed amendment involves no change in the amount or type of effluent that may be released offsite, and there is no increase in individual or cumulative occupational radiation exposure. As such, operation of PVNGS Units 1, 2, and 3 in accordance with the proposed amendment, does not involve an environmental impact.

G. MARKED- UP TECHNICAL SPECIFICATION PAGES

| UNIT 1 | UNIT 2 | UNIT 3 |
|----------|----------|----------|
| 3/4 4-14 | 3/4 4-14 | 3/4 4-14 |
| 3/4 4-15 | 3/4 4-15 | 3/4 4-15 |
| 3/4 4-17 | 3/4 4-17 | 3/4 4-17 |
| B3/4 4-3 | B3/4 4-3 | B3/4 4-3 |

Marked-up Improved Standard Technical Specification pages:

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5.0-13
5.0-14
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5.0-16
5.0-17

