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1CAN029803

U. S. Nuclear Regulatory Commission
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Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Technical Specification Change Request
Allowing The Use Of OTSG Repair Roll Technology

Gentlemen:

Attached for your review and approval is a proposed amendment to Arkansas Nuclear One Unit 1 (ANO-1) Technical Specifications. The proposed amendment request allows the use of the repair roll technology (reroll) for the upper tubesheet region of the ANO-1 steam generators. The basis for this change is a report prepared for ANO: Topical Report BAW-10232P, "OTSG Repair Roll Qualification Report (Including Hydraulic Expansion Evaluation)". This report supports the use of the repair roll technology that has been previously approved for use at Oconee Nuclear Station by letter dated November 21, 1997, with an additional allowance to use hydraulic expansion of the tube prior to performing the repair roll.

This technical specification amendment request contains revision zero of topical report BAW-10232P in Attachment 1 which is proprietary to Framatome Technologies, Inc. (FTI). An affidavit from FTI is included in Attachment 2. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC and addresses the considerations listed in 10 CFR 2.790(b)(4). Accordingly, Entergy Operations requests that the topical report contained in Attachment 1 be withheld from public disclosure. A non-proprietary version of the topical report will be prepared and submitted to the NRC by March 1, 1998.

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that this change involves no significant hazards considerations. The bases for these determinations are included in the attached submittal.

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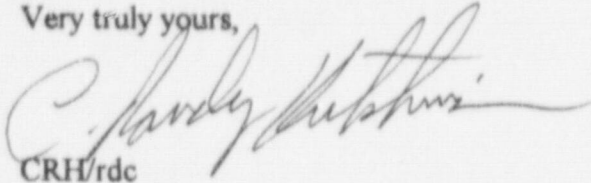


change NRC PDR
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Entergy Operations requests that the effective date for this change be within 30 days of issuance. Although this request is neither exigent nor emergency, your prompt review is requested so that this change can be issued during the next ANO-1 refueling outage (1R14) which is currently scheduled to begin March 28, 1998.

Very truly yours,

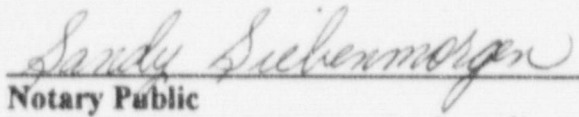


CRH/rdc

Attachments

To the best of my knowledge and belief, the statements contained in this submittal are true.

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for Logan
County and the State of Arkansas, this 9th day of February, 1998.



Notary Public

My Commission Expires May 11, 2000

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ATTACHMENT

TO

1CAN029803

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. DPR-51

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT ONE

DOCKET NO. 50-313

DESCRIPTION OF PROPOSED CHANGES

The Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specifications (TSs) are proposed to be amended as indicated below. Many of the changes included in this TS change request are similar to those proposed by TS change request dated December 12, 1997, (1CAN129702) "Technical Specification Change Request Establishing Alternate Repair Criteria For Outer Diameter Intergranular Attack In The Upper Tubesheet Of The Unit 1 Steam Generators". Many of the same specifications were modified and/or renumbered by this same amendment request. If the earlier submittal is processed before this amendment request, revised TS pages will be provided.

3.1.6.3.b This specification is revised to lower the leakage limit through any one steam generator to ≤ 150 gallon per day (0.104 gpm) from the current limit of 500 gallons per day (0.347 gpm). The 500 gallon per day limit has been reduced in the current technical specification to 144 gallons per day (0.1 gpm) for the remainder of cycle 14. The 144 gallons per day limit was issued with amendment 189 to the ANO-1 TSs and is removed by this amendment request.

4.18.3.b The existing specification 4.18.3.b is renumbered 4.18.3.c to facilitate the addition of a new specification. The new specification 4.18.3.b requires an inspection of the new roll area for the tubes which have been repaired using the repair roll (reroll) process during the inservice inspection.

Notes below 4.18.3.b: Note (3) was added below the Once Through Steam Generator (OTSG) inspection results category. This note will ensure that defective or degraded tube indications found in the new roll area as a result of the special inspections that are performed pursuant to 4.18.3.b and any indications found above the new roll area (outside the pressure boundary) are not included in the determination for the inspection results category of a general steam generator inspection.

4.18.4.c.1: The second paragraph was added to this specification to ensure that all the tubes in the associated OTSG that have been repaired by the reroll process are inspected if a rerolled tube is found to be leaking in the new roll area. An additional requirement was also added to ensure that if the results of this inspection fall into the C-3 category, all of the tubes with rerolled areas in the other steam generator will also be similarly inspected. The last sentence was added to this specification to indicate this inspection will be in lieu of the first sample inspection specified in Table 4.18-2.

4.18.5.a.7: The "plugging limit" definition was modified in this specification to allow the use of the reroll technology as a tube repair alternative. A second paragraph was also added to this definition in order to specify that: "The reroll repair process will only be used to repair tubes with defects in the upper tubesheet area. The reroll repair process will be performed only once per steam generator tube using a 1 inch roll length. The new roll area must be free of detectable degradation in order for the repair to be considered acceptable. The reroll repair process is described in the topical report, BAW-10232P, Revision 00."

4.18.5.a.9: The "tube inspection" definition was modified to ensure that the degraded tube above the new roll area is excluded from future periodic inspection requirements. This is acceptable because this area is no longer part of the pressure boundary after a repair roll has been performed on the tube.

4.18.5.b: This specification was modified to allow the use of the reroll technology as a tube repair alternative. The one time exception that was added to this specification by amendment 189 is also being removed by this amendment request.

4.18.6.d: An additional reporting requirement was added to this specification to ensure that the number of tubes repaired by the rerolling process and the number of indications detected in the new roll area of the repaired tubes are reported to the NRC.

4.18 Bases: The bases section for this specification was changed to elaborate on the reroll repair technology.

Table 4.18-2: This table was modified to allow the use of the reroll technology as a tube repair alternative.

BACKGROUND

The inservice inspection of the ANO-1 OTSGs is conducted in accordance with ANO-1 TS 4.18. Specification 4.18.2 states: "Inservice inspection of steam generator tubing shall include non-destructive examination by eddy-current testing or other equivalent techniques." Specification 4.18.3 requires that a minimum sample size be examined in accordance with specification 4.18.5. Specification 4.18.5.b. notes: "The steam generator shall be determined operable after completing the corresponding actions (plug or sleeve all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 4.18-2." Table 4.18-2 specifies the expansion criteria for sampling of the steam generator tubes and requires "defective" tubes to be plugged or sleeved. Specification 4.18.5 defines a Defect as follows: "an imperfection of such severity that it exceeds the plugging limit except where the imperfection has been spanned by the installation of a sleeve. A tube containing a defect in its pressure boundary is defective." Plugging Limit is defined in the same specification as follows: "the imperfection depth at or beyond which the tube shall be restored to serviceability by the installation of a sleeve or removed from service because it may become unserviceable prior to the next inspection; it is equal to 40% of the nominal tube wall thickness."

The bases for specification 4.18 states: "The surveillance requirements for inspection of the steam generator tubes ensure that the structural integrity of this portion of the RCS will be maintained. The program for inservice inspection of steam generator tubes is based on a modification of Regulatory Guide 1.83, Revision 1."

During the ANO-1 thirteenth refueling outage (1R13) approximately twenty percent of the tubes in both steam generators were examined at the upper roll transition utilizing a rotating pancake coil (RPC) eddy current probe. As a result of this inspection 20 tubes were identified with indications at the roll transition. Tube R53L116 of the "B" OTSG, which had one of the larger eddy current indications, was removed for metallurgical examination. The 20 tubes with RPC indications were removed from service by plugging during the 1R13 outage. A letter summarizing the eddy current findings was transmitted to NRC on January 7, 1997 (1CAN019701) [this letter was inadvertently dated January 7, 1996]. The results of the metallurgical examination of tube R53L116 showed the tube to have a short inside diameter axial stress corrosion crack (SCC) in the roll transition. The crack was approximately 0.083 inch long with an average depth of approximately 46%. This crack did not represent a structural or leakage concern. The metallurgical examination results for tube R53L116 are summarized in Entergy's letter to the NRC dated May 9, 1997 (1CAN059703).

Tube R53L116 and the other 19 tubes with indications detected in the upper roll were stress relieved during the original manufacturing process. It was previously believed that the B&W manufacturing process, with post manufacturing heat treatment, would substantially reduce the probability of stress corrosion cracking at the roll transition. While this process has minimized the potential for SCC, it has not been eliminated.

Additionally, during 1R13 over 400 tubes were left in service with intergranular attack (IGA) indications within the upper tubesheet sized by bobbin at less than the 40% through-wall repair limit. Subsequent to this outage, as a result of pulled tube evaluations, it was determined that the sizing technique applied by Entergy was not valid. Enforcement discretion and a subsequent exigent technical specification amendment was granted allowing ANO-1 to continue to operate for the remainder of cycle 14 with degraded steam generator tubes potentially in excess of technical specification repair limit.

To address the upper tubesheet IGA indication Entergy has submitted to the NRC for review and approval a voltage based alternate repair criteria (ARC) by letter 1CAN129702 dated December 12, 1997. Application of the voltage based ARC will allow the majority of the upper tubesheet IGA indications to remain in service with no repair necessary. For those indications which exceed the voltage threshold specified in the ARC, repair or plugging will be required.

The repair roll or reroll process has been developed to repair tubes with flaws in the tubesheet region and thus allowing them to remain in service. This tube repair process consists of creating a new mechanical tube to tubesheet structural joint in the upper tubesheet below the tube defects. The new roll establishes a new pressure boundary for this tube which places the defect outside this boundary. This type of repair has been previously qualified by FTI for Westinghouse recirculating steam generators at Connecticut Yankee, Point Beach 2, DC Cook, and Indian Point 2. By letter dated November 3, 1997, Oconee Nuclear Station submitted FTI topical report BAW-2303P Rev. 3, "OTSG Repair Roll Qualification Report". Oconee Nuclear Station was issued TS amendments by letter dated November 21, 1997, to allow use of the same reroll process.

It is Entergy Operations' desire to utilize the reroll technique to repair tubes with upper tubesheet roll transition flaws and IGA indications within the upper tubesheet in excess of the ARC voltage based repair threshold. The existing ANO-1 TSs allow tubes to be repaired by the use of a sleeve for these type of indications. Although the sleeving process provides an acceptable means of repair, it is considerably more costly and time consuming than using the reroll technique. The additional time needed for sleeve repairs results in additional radiation exposure to the workers performing the sleeving activity. Furthermore, the added time for sleeve repair typically will result in extended refueling outage duration and, depending upon plant configuration, may result in additional time in reduced inventory. A disadvantage of sleeve repair is that it precludes any additional future repairs. Steam generator tube sleeves have their own roll transition degradation mechanisms which can limit their useful life before plugging is necessary. The reroll process allows ANO future repair options that would not be available if the tube were initially sleeved. If additional repairs are necessary once a tube has been rerolled, it can still yet be sleeved. With additional analyses that would be used to support a future TS change, a repair rolled tube could be rerolled again deeper in the tubesheet as an additional repair alternative.

Due to the concern of potential tube denting caused by the trapping of water between the original and repair roll when applying the reroll deep in the tubesheet, ANO contracted FTI to perform additional analysis and testing on the repair roll methodology to allow the use of a hydraulic expansion process. This process expands the tube prior to the reroll and thereby minimizes the potential trapped water volume between the original and repair roll. Thus, the process minimizes the potential of the Obrigheim effects of trapped water and ensures the inside tube diameter will remain large enough to allow future inservice inspections. FTI topical report BAW-2303P has been reissued as BAW-10232P, Revision 00 to address the hydraulic expansion process and the questions asked by the NRC during the review of the Ocone submittal.

DISCUSSION OF CHANGE

The ANO-1 TSs will be revised by this amendment request to indicate that upper tubesheet flaws can be repaired by rerolling. This amendment request will revise the steam generator tubing surveillance section of the TSs. The current TSs for steam generator tubing surveillance allow for the repair of the steam generator tubes by use of a sleeving process and also allows the tubes to be plugged if necessary. This amendment request will revise the TSs to allow a rerolling repair process to be used to repair steam generator tube defects within the upper tubesheet. The rerolling process will create a new roll area and pressure boundary for the steam generator tube. The rerolling process will ensure that the area of degradation is outside the pressure boundary, thus permitting the tube to remain in service.

The qualification of the reroll joint is based on establishing a mechanical roll length which will carry all of the structural loads imposed on the tube with required margins. A series of tests and analyses were performed to establish this length. Tests that were performed included

leak, tensile, fatigue, ultimate load, and eddy current measurement uncertainty. The analyses evaluated plant operating and faulted loads in addition to tubesheet bow effects. Testing and analysis evaluated the tube springback and radial contact stresses due to temperature, pressure, and tubesheet bow. Based on the FTI qualification, as well as the history for similar industry repair rolls, there are no new safety issues associated with a reroll repair. Additional details about the reroll process, requirements, and verification are contained in the FTI topical report in attachment 1.

The TS requirements will allow the use of the reroll process to repair tubes with confirmed indications within the upper tubesheet. The attached topical report qualifies the reroll process for use on the tubes in the upper tubesheet.

The proposed TSs require that the new roll area of the tubes, which are repaired by the reroll process, to be inspected during each inservice inspection. This ensures that any detectable degradation in the new roll area will be discovered in subsequent inspections of the steam generators. The TSs have been revised to exclude the new roll area inspection results from being used in the classification of the inspection results category. This exclusion is consistent with the exclusion provided for the other special inspections in the steam generators.

Another change to the TSs defines the steam generator inspection scope following a primary to secondary leak in excess of the limits of TS 3.1.6.3.b. This change indicates that the inspection scope will be limited to the new roll area if the tube leakage is the result of a defect in the new roll area.

The final part of the reroll TS amendment indicates that the reroll process will only be performed once per steam generator tube using a 1 inch roll length. In order for the reroll repair to be acceptable, the TSs indicate that the new roll area must be free of detectable degradation. These requirements ensure that the acceptance criteria for the use of the reroll process are contained in the TSs.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

An evaluation of the proposed change has been performed in accordance with 10 CFR 50.91(a)(1) regarding no significant hazards considerations using the standards in 10 CFR 50.92(c). A discussion of these standards as they relate to this amendment request follows:

Criterion 1 - Does Not Involve a Significant Increase in the Probability or Consequences of an Accident Previously Evaluated.

The reroll process utilizes the original tube configuration and extends the roll expanded region. Thus all of the design and operating characteristics of the steam generator and connected systems are preserved. The reroll joint length has been analyzed and tested for design, operating, and faulted condition loading.

The qualification of the reroll joint is based on establishing a mechanical roll length which will carry all of the structural loads imposed on the tubes with required margins. A series of tests and analyses were performed to establish this length. Tests that were performed included leak, tensile, fatigue, ultimate load, and eddy current measurement uncertainty. The analyses evaluated plant operating and faulted loads in addition to tubesheet bow effects. Testing and analysis evaluated the tube springback and radial contact stresses due to temperature, pressure, and tubesheet bow. At worst case, a tube leak would occur with the result being a primary to secondary system leak. Any tube leakage would be bounded by the ruptured tube evaluation which has been previously analyzed. The potential for a tube rupture is not increased by the use of the reroll process.

The reroll process establishes a new pressure boundary for the associated tube in the upper tubesheet below the flaw. Qualification testing indicates that normal and faulted leakage from the new pressure boundary joint would be well below the Technical Specification limits. Since the normal and faulted leak rates are well within the Technical Specification limits, the analyzed accident scenarios are still bounding.

Applying a hydraulic expansion prior to making a repair roll near the secondary face of the upper tubesheet minimizes the potential for Obrigheim denting of the tube above the new roll. The hydraulic expansion does not have an adverse impact on the structural integrity of the tube or tubesheet. A tube that is rerolled deep into the tubesheet and not hydraulically expanded has the potential of denting inward if water is trapped between the new and old roll regions. The dented portion of the tube would be outside the pressure boundary and therefore not a safety concern. If the tube were dented, such that future inspections would not be possible, the tube would have to be removed from service.

Based on the Framatome Technologies Inc. qualification, as well as the history for similar industry repair rolls, there are no new safety issues associated with a reroll repair. Therefore, this change does not involve a significant increase in the probability or consequences of any accident previously evaluated.

Criterion 2 - Does Not Create the Possibility of a New or Different Kind of Accident from any Previously Evaluated.

The reroll process establishes a new pressure boundary for the associated tube in the upper tubesheet below the flaw. The new roll transition may eventually develop primary water stress corrosion cracking (PWSCC) and require additional repair. Industry experience with roll transition cracking has shown that PWSCC in roll transitions are normally short axial cracks, with extremely low leak rates. The standard MRPC eddy current inspection during the refueling outages have proven to be successful in detecting these defects early enough in their progression to facilitate repair.

In the unlikely event the rerolled tube failed and severed completely at the transition of the reroll region, the tube would retain engagement in the tubesheet bore, preventing any interaction with neighboring tubes. In this case, leakage is minimized and is well within the assumed leakage of the design basis tube rupture accident. In addition, the possibility of rupturing multiple steam generator tubes is not increased. Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

Criterion 3 - Does Not Involve a Significant Reduction in the Margin of Safety.

A tube with degradation can be kept in service through the use of the reroll process. The new roll expanded interface created with the tubesheet satisfies all of the necessary structural and leakage requirements. Since the joint is constrained within the tubesheet bore, there is no additional risk associated with tube rupture. Therefore, the analyzed accident scenarios remain bounding, and the use of the reroll process does not reduce the margin of safety. Consequently, this change does not involve a significant reduction in the margin of safety.

Based upon the reasoning presented above and the previous discussion of the amendment request, Entergy Operations has determined that the requested change does not involve a significant hazards consideration.