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JAN 04 1994

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) - UNITS 1 AND 2 - NRC INSPECTION REPORT NO. 390, 391/93-45 - REVISED RESPONSE TO NOTICE OF VIOLATION

The purpose of this letter is to provide a revised response to the Notice of Violation 390, 391/93-45, dated July 20, 1993. This notice of violation (NOV) proposed a failure to measure and document as-constructed dimensions for certain support members and welds during the performance of the Hanger Analysis and Update Program (HAAUP) walkdown effort.

The initial TVA response to this NOV was submitted via TVA letter dated August 19, 1993. NRC disagreed with TVA's basis for disputing the subject violation, and documented their reasons in a followup letter dated October 18, 1993. NRC noted that additional examples of discrepancies between the as-built drawings and installed supports, similar to those cited in the 93-45 violation, were identified during a recent Additional Systematic Records Review (ASRR) audit. Consequently, a revised response to the original violation was requested, which includes a discussion of the ASRR pipe support inspection findings, and whether these findings comply with the QA Records Corrective Action Program (CAP), the HAAUP CAP, and the WBN Quality Assurance Program.

The enclosure to this letter provides a discussion of the information requested by the Staff in the referenced October 18, 1993 transmittal.

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TVA herein admits that the two discrepancies made in the walkdown occurred as stated in the violation. However, the findings were evaluated and found to have no effect on the design of the supports. Additionally, the inspections were performed in accordance with the WBN walkdown instructions which required visual inspection only.

If additional questions exist relative to this information, please contact P. L. Pace at (615)-365-1824.

Very truly yours,

W. J. Museler

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Enclosure
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ENCLOSURE

REVISED RESPONSE TO NOV 93-45-01
INCLUDING DISCUSSIONS OF THE HAAUP CORRECTIVE ACTION PROGRAM,
THE QA RECORDS CAP, AND ASRR PROGRAM

Background

The HAAUP Walkdown Procedure (WP)-32 was issued September 22, 1987, and walkdowns were performed by Bechtel Engineering and Ebasco Services Incorporated (ESI) beginning shortly thereafter. The purpose of these walkdowns was to verify that attributes critical to the design were accurately reflected in the design documentation for pipe supports. These walkdowns were completed in early 1990. During the walkdowns, both TVA QA and Bechtel performed in-line and overview inspections as discussed below.

The HAAUP Corrective Action Plan (CAP) was issued on November 30, 1988, and included the WP-32 walkdowns as an integral part of the program to resolve large and small bore piping and pipe support deficiencies.

The Additional Systematic Records Review (ASRR) program performed an additional independent walkdown of a statistically valid random sample of large and small bore pipe supports during the QA Records CAP. The purpose of this walkdown was to provide assurance that the design records reasonably represented the field conditions. This walkdown found minor discrepancies similar to those found previously. The discrepancies (14) were documented in WBPER930196 issued in August 1993. The results of the evaluation of this Problem Evaluation Report (PER) are discussed in the Inspection Results section of this response.

Inspection Results

The purpose of this section is to identify the inspections and results performed on the HAAUP CAP and the WP-32 walkdowns. The following inspections have been performed:

1. QA Inspections

The initial work process on HAAUP walkdowns involved in-line QA reviews of each walkdown package. In-line reviews were performed on approximately 3500 of the 8700 hangers or about 40% of the total large bore population (3500 large bore hangers represent approximately 175,000 attributes). QA initiated 18 corrective action documents (CAQs) identifying minor discrepancies found with measurements on this population. These discrepancies were the same types of findings reported in WBPER930196. A trend evaluation of the discrepancies was performed by TVA in 1988 and concluded with a 95% confidence level that these discrepancies were less than 5% of the total attributes taken and none were design significant, therefore they were not a safety concern (reference CAQ WBQ880187). Based on this positive trend, QA terminated the in-line reviews and conducted monitoring reviews for the remaining population.

2. Bechtel Inspections

TVA contractor, Bechtel performed the WP-32 walkdowns with two-man teams qualified to the site specific requirements of ANSI N45.2.6, using one team member to measure/inspect and the other to verify. In order to ensure accuracy and compliance to WP-32 requirements, a review of all walkdown packages was performed and hardware was re-inspected. Differences found during the reviews were corrected. Data from each review was input into a trending log. Weekly quality improvement meetings were held with the inspectors. Based on findings in the trending log, training sessions were held with the inspectors to discuss the results and re-emphasize proper inspection methods. Additionally, Bechtel employed the use of an independent statistical sampling program. Packages were assembled and, through computer generated random sampling, attributes were selected and re-verified by personnel certified to Bechtel's Quality Control Program. When differences were found, similar attributes in the package were looked at for mistakes. Differences found were corrected and this data input into the trending log for subsequent review and inspector training.

3. NRC Inspections

NRC performed 11 reviews/inspections from 1989 to present which relate to the HAAUP CAP (Inspection Report Numbers 89-14, 90-14, 90-18, 90-20, 90-28, 91-03, 92-201, 92-26, 92-35, 93-07, and 93-45). Eight of the 11 NRC reviews involved field inspections of the pipe supports. The field inspections were done on 237 supports with 21 findings. These findings were similar in nature to the ones found in the ASRR review. The findings were:

A. 6 welds undersized by 1/16"

B. 3 cut, broken, or missing washers

C. 3 component deficiencies (cotter pin not spread, indentions on a snubber, and a bent and rusty rod)

D. 2 drawing errors

E. 3 incorrect member sizes

F. 2 identification problems

G. 1 loose nut

H. 1 improper staking of threads

These findings have been evaluated, and no structural modifications due to drawing discrepancies have been required. Maintenance requests were initiated in some cases to correct minor installation errors.

4. ASRR Walkdowns

The ASRR re-inspected a statistically valid sample of 72 large bore and 72 small bore supports and compared those to the final design output records. Twelve supports involving 4752 attributes were found to contain 14 deficiencies. (11 large bore deficiencies in 3600 attributes, and 3 small bore discrepancies in 1152 attributes). These deficiencies were documented in WBPER930196. The deficiencies were as follows:

A. Welds - 8

B. Standard component parts - 3

C. Dimensions - 1

D. Identification - 1

E. Drawing error - 1

The above corresponds to an error rate for large bore pipe supports of 0.31% and a small bore error rate of 0.26%. The error rates are based on the number of attributes for each support. The attributes primarily consist of weld size and length dimensions on support drawings and members. A large number of supports were reviewed to determine an average number of attributes. The average used was 50 for large bore and 16 for small bore, again using only welds, members, and dimensions. The SEQUAL computer program was used to develop the confidence level of the sample. Computer runs were performed on this population by ASRR and passed the sampling acceptance criteria. This is a conservative count of inspection attributes since five of the 14 deficiencies (component parts [3], support I.D., and drawing error) were not counted in the base of total inspection points.

The ASRR made an assessment of the overall results to gain insight into the nature and extent of the apparent discrepancies and to determine if any significant trends existed that could prompt improvements in specific areas for pipe support installations. The results indicate that the apparent discrepancies were minor in nature and randomly distributed throughout the sample. Of the 14 discrepancies, only one represents a significant deviation from design output; a tube steel flare bevel weld underfilled by 3/16". The remaining 13 deficiencies were minor exceedances, such as 1/8" to 1/16" undersized welds and member dimensions out of tolerance by 1" or less. The majority of the deficiencies involve welds in the large bore support sample population. Only one support had more than one weld deficiency. All supports met their design allowables and none required modifications. Also, for welds, the pipe support analysis considers the strength of each joint independent of other joints. There is no re-distribution of loads to stronger, more massive welded joints. Therefore, if it is hypothesized that several of these weld discrepancies were found on a single support, there is reasonable assurance that each weld would be acceptable-as-is (non-design significant) based on the sampling acceptance results. Since there is no cumulative effect on the structure as a whole, the pipe support installation would have enough weld strength in the joints to resist the applied loading. Based on their statistical sampling analysis, the ASRR Project has determined that the small and large bore pipe support hardware populations are acceptable.

5. Notice of Violation - 93-45

TVA responded to the Notice of Violation 93-45 on August 19, 1993, noting that visual inspection methods were not precise but were done in accordance with the WP-32 walkdown instructions. For a discussion of visual inspection and member size margins, see the following section on "Margin Evaluation". The response also noted that a HAAUP inspector had written down an incorrect weld symbol on a drawing. Calculations were revised to reflect the findings and noted that they were inconsequential to the design. The NRC staff responded to the letter on October 18, 1993, and noted that the violation was still valid. The staff noted, however, that the corrective action is satisfactory and the "safety significance of the items cited in the violation may not be highly significant; however, the Staff was concerned that data taken from the HAAUP walkdowns was not accurately depicted on design output documents." That letter also makes additional reference to the ASRR findings which were discussed earlier in this letter.

The principal technical finding in Inspection Report 93-45 was a tube steel member which was incorrectly verified by visual inspection, to be 1/4" thick while it was actually 3/16" thick. As can be seen in the later discussion on margins, this error would be offset by the built-in design and materials margins. The ASRR walkdown discussion earlier in this response pointed out the extremely low rate of error found by the ASRR re-verification program (0.31% for large bore and 0.26% for small bore). None of the discrepancies affected the ability of the support to perform its design function. In addition, none of the discrepancies caused any allowables to be exceeded. Nearly all of the discrepancies were minor in nature and over half were slightly undersized welds for greater than 25% of the weld with no credit taken for oversizing of the weld in the remaining portions. There was only one dimensional discrepancy and that was a 1-3/4" error. The original CAQR identified a brace dimension measured to be 13-1/4" whereas the as-constructed drawing shows 19-5/8" on support number 1031-A930-7-105. Further review by the engineering organization and a follow-up inspection requested by Engineering discovered that the support was tagged incorrectly and the HAAUP walkdown had already noted the dimensional discrepancy on that support and had revised the calculation to reflect this.

It can be seen from the error rate noted in the ASRR walkdown discussion (0.31% for large bore and 0.26% for small bore) that the WP-32 walkdown has proven to be very accurate in its effort to create as-built drawings for the Category I large bore pipe supports. It should also be noted that one of the ASRR's main functions was to check for existence of ANSI N45.2.5 records for these supports. Records were retrieved as required by the program.

A further verification of the program is noted in the discussion of the 11 inspections done by various NRC reviewers, including the Integrated Design Inspection (IDI) in inspection report 92-201 and a large 107 support review done by Inspectors R. W. Newsome and R. C. Chou on July 16-19, July 23-27, and August 24-September 7, 1990. The apparent discrepancies as described in the earlier section were all evaluated and found to have no effect on the design of the supports. The apparent discrepancy rate was 0.18% comparing them to the attributes on the 235 supports inspected.

In summary, TVA admits that the two discrepancies resulting from the walkdown occurred as stated in the violation. However, the inspections were in accordance with the WP-32 walkdown instructions since the visual inspection was the requirement and the inspector did perform that visual inspection for the member

thickness. Additional thickness measurements were taken by ASRR in their review of samples. Ultrasonic measurements were made in some cases and manual measurements were performed when possible. No member thickness discrepancies were found in these inspections. In TVA's response on August 19, 1993, it was pointed out why the weld symbol noted on the walkdown drawing was incorrect and that the calculation of record had evaluated the condition as it existed in the field. Based on the reviews noted above, the extent-of-condition review was accomplished without additional findings. Accordingly, TVA does not consider it necessary to conduct additional walkdowns of these supports.

Margins Evaluation

In order to evaluate the effect of an inspector verifying a wrong member thickness as found in NRC's Inspection Report 93-45 during the performance of the visual inspection portion of the WP-32 walkdown, TVA reviewed the margins in the material and the design. Since the error noted in Inspection Report 93-45 was a tube steel member, that commodity is discussed here in addition to other structural shapes.

Tube Steel

Watts Bar purchased tube steel using the ASTM specification ASTM A500 Grade B (minimum yield = 46 ksi) for structural applications; however, in a few cases, the drawing allows the use of ASTM A501 (minimum yield = 36 ksi) in lieu of the A500 Grade B. The HAAUP designers used the smaller allowable (36 ksi) for their design. The ASRR did a materials search and review of tube steel purchased at Watts Bar and found no records of ASTM A501 (the weaker material) ever being purchased at Watts Bar. Therefore, a margin of 28% (46 ksi vs 36 ksi) exists for tube steel.

Other Structural Shapes

Structural shapes other than tube steel used in pipe supports are ASTM A36. The design yield for A36 steel is 36 ksi while the actual yield ranges from 36 ksi to 58 ksi. Factored loads were used with normal allowables. Normal allowables are .60 Fy to .75 Fy depending on their shape and use. Factored allowables are .9 Fy. The margin when factored allowables are used is 25% to 50%.

Summary and Conclusions

	Material Margin	Margin Based on Allowable Stresses	Total Margin
Tube Steel	28%	25% to 50%	53% to 78%
Other Structural Shapes	0 to 61%	25% to 50%	25% to 111%

A sample of approximately 300 HAAUP supports was reviewed to identify the most frequently used members. The section modulus for the top three most used members for each shape (plates, tube steel, angles, I shapes, and miscellaneous others) was compared to the section modulus for the same size but next smaller thickness, if there was a smaller thickness. The maximum reduction of section modulus if the member was mistakenly identified as the larger member was 27%. A review of the supports analyzed for ASRR shows a minimum of 5% design margin. A comparison of margins for material, allowables, and design minimum margins is:

Tube Steel - 58% to 83% vs 27%
Other Shapes - 30% to 116% vs 27%

Therefore, even if a size was mistakenly identified as one size larger, the design margins would accomodate the misidentification of the member thickness.

Industry Precedence

A number of commercial nuclear power stations have conducted re-inspection/evaluation programs in the piping and pipe support areas for the purpose of evaluating safety and licensing concerns prior to receiving operating licenses. A comparison of a number of these programs, including programs at Comanche Peak Steam Electric Station, Clinton Power Station, and Braidwood Nuclear Power Station, was conducted by Texas Utilities (TU) Electric as part of the prudency evaluation for Comanche Peak Unit 1.

Although the terminology varied, the same methods for counting re-inspections (inspection points) and discrepancies were used by the ASRR evaluation described above and the re-inspection conducted at Comanche Peak, Clinton, and Braidwood.

For detailed comparison purposes, the re-inspection attribute for weld size can be compared between the ASRR program and the Comanche Peak program. The following were the results of the re-inspections at Comanche Peak for weld size:

Large Bore Supports - Rigid	1191 Inspection Points and 32 Discrepancies (2.6%)
Large Bore Supports - Non-Rigid	3708 Inspection Points and 54 Discrepancies (1.5%)
Small Bore Supports	1494 Inspection Points and 13 Discrepancies (0.9%)

The weld discrepancies at Comanche Peak were considered to be insignificant. Based on this sample re-inspection, no further actions were identified in regard to weld size and this attribute was accepted for the entire population of pipe supports. No adjustments or changes to design output documents were required. The discrepancy rate for weld size identified by the ASRR re-inspections was 1.3% for large bore supports and 0% for small bore supports.

The following table shows a comparison of the discrepancy rates for pipe supports identified by these four re-inspection programs.

PROGRAM	COMMODITY	ATTRIBUTES/ INSPECTION POINTS	DISCREPANCIES	PERCENT DEVIATING
WBN ASRR	Large Bore Supports	3600	11	0.31
WBN ASRR	Small Bore Supports	1152	3	0.26
Comanche Peak	Large Bore Supports - Rigid	25886	344	1.3
Comanche Peak	Large Bore Supports - Non-Rigid	36891	493	1.3
Comanche Peak	Small Bore Supports	14131	128	0.9
Clinton	Mechanical Supports	178435	4115	2.3
Braidwood	Large Bore Supports - Rigid	22300	197	0.9
Braidwood	Large Bore Supports - Non-Rigid	27100	246	0.9
Braidwood	Small Bore Supports	15100	83	0.5

References:

Clinton Power Station, Illinois Power Company, "Results of Quality Programs for Construction of Clinton Power Station," dated February 1985;

Braidwood Nuclear Power Station, Commonwealth Edison, "Report on the Braidwood Construction Assessment Program (BCAP)," dated November 1985; and

Comanche Peak Steam Electric Station, TU Electric, "Comanche Peak Response Team Results Report for ISAP VII.c, Construction Reinspection/Documentation Review," dated December 1987; the Comanche Peak Response Team Collective Evaluation Report dated December 1987; and the Comanche Peak Response Team Collective Significance Report dated February 1988.

In summary, hardware commodities were accepted by re-inspection programs at Comanche Peak, Braidwood, Clinton, and other nuclear power stations with discrepancy rates equal to or higher than those identified by the ASRR re-inspections. No changes or actions in regard to design output documents were required when such commodities were accepted.

Commitments

The Nuclear Quality Assurance Plan, Section 7.2.7, "Design Changes," commits that; measures to ensure that drawings and other design output accurately depict plant configuration shall be established and implemented.

Watts Bar is in compliance with this commitment as evidenced by:

1. Pre-1989 installed supports (prior to HAAUP CAP issuance)

   a. WP-32 HAAUP CAP walkdowns collected actual data on attributes (HAAUP CAP Section 4.1.1)

   b. WP-32 data was incorporated into support drawings through the DCN process (HAAUP CAP Section 6.0)

   c. Drawing plus DCNs for a given support represent existing plant configuration

2. Post-1989 installed supports (after HAAUP CAP issuance)

   a. The HAAUP CAP recurrence controls strengthened construction specifications for installing pipe supports (HAAUP CAP Section 4.2.1)

   b. Changes to supports were facilitated through the DCN process as controlled by Site DCN procedures (presently EAI 3.05)

   c. Drawings plus DCNs for a given support represent the existing plant configuration

Summary

TVA walked down approximately 8500 large bore pipe supports with more than 375,000 attributes during the WP-32 walkdowns. This program was monitored during the implementation by Bechtel Engineering, TVA QA, and by the NRC. The program was reviewed by NRC for accuracy and completeness in their 11 reviews as noted in the previous sections. The Additional Systematic Records Review group did another independent review of the records and hardware. These reviews found minor discrepancies in the data produced; however, design hardware changes were not required. Discrepancies were reviewed and drawings or calculations were revised when required. No major location deficiencies (i.e., supports not located per the drawings), or the absence of quality records were found. The reviews are consistent with industry practice and the results exceed those of recent Near Term Operating Licensing (NTOL) plants reviewed. Based on the results of the statistical sampling analysis and the items discussed above, the small bore and large bore support hardware populations are acceptable for the safe operation of Watts Bar.