TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

July 13, 1982

WBRD-50-390/81-14
WBRD-50-391/81-13

U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - IMPROPERLY INSTALLED SUPPORT ANCHORS - WBRD-50-390/81-14, WBRD-50-391/81-13 - NINTH INTERIM REPORT

The subject deficiency was reported to NRC-OIE Inspector H. Dance on June 8, 1981 in accordance with 10 CFR 50.55(e) as NCR 3311R. NCR 3311R concerns improperly installed support anchors for the Watts Bar unit 2 reactor building. This is the same type of deficiency and corrective action program as NCR 2789R, which was initially reported to NRC-OIE Inspector M. Thomas on January 7, 1981. NCR 2789R was written for units 1 and 2, and interim reports were submitted on February 6 and June 23, 1981. Since these deficiencies are closely related, TVA has combined both NCR's into one report. Combined interim reports were submitted on July 8, August 13, September 27, and November 24, 1981 and January 25 and March 30, 1982. Enclosed is additional information. We expect to submit our next report by September 9, 1982.

If you have any questions, please get in touch with R. H. Shell at FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

James A. Domer
for L. M. Mills, Manager
Nuclear Licensing

Enclosure
cc: Mr. Richard C. DeYoung, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

OFFICIAL COPY

IE 27

ENCLOSURE
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
IMPROPERLY INSTALLED SUPPORT ANCHORS
WBRD-50-390/81-14
WBRD-50-391/81-13
10CFR50.55(e)
NINTH INTERIM REPORT

Description of Condition

In at least two previous nonconformance reports (NCR) (CAQR E5 and CAQR M31) on Watts Bar Nuclear Plant (WBN), TVA reported deficiencies associated with the installation of support anchors used on cable trays and seismically qualified piping. The final reports on these NCR's (CAQR E5 and CAQR M31) were transmitted from J. E. Gilleland to J. P. O'Reilly on July 10, 1979, and May 15, 1979, respectively. The problem with support anchors is not, however, limited to cable tray and pipe supports. Any support installation that uses surface mounted plates and self-drilling expansion anchors is suspect. Recent nonreportable NCRs have been written on conduit supports and HVAC duct supports. There have also been a large number of nonsignificant NCRs written on specific areas of the plant. The repeated occurrence of NCRs indicates that the overall problem may not have been adequately identified by TVA.

The common installation deficiencies that have been identified include:

(1) Anchors that have been cut short. (NCRs 3311R, 2901R, 2789R).

(2) Cut off bolts or improper length bolts which may result in insufficient thread engagement. (NCRs 3624R, 3311R, 2789R)

(3) Anchors not set to the proper depth (a common but nonsignificant problem).

(4) Improperly enlarged base plate holes (NCRs 3311R, 2789R).

(5) Removal and relocation of conduit supports without the site Electrical Engineering Unit's approval (NCR 3311R, unit 2 reactor building, conduit supports in annulus area only).

(6) Anchors installed without proper pull test documentation (NCR 3409R).

An inspection program was initiated in response to IE Bulletin 79-02 for testing anchors on safety-related pipe supports, but this program did not address other support installations that use surface-mounted plates and self-drilling anchors such as supports for cable trays, conduit, and HVAC ducting.

Interim Progress

TVA completed an NRC-OIE Bulletin 79-02 type inspection at WBN for unit 1 and common anchors for cable tray supports, conduit supports, and duct supports in the auxiliary building and control building. An inspection was also completed for conduit supports in the diesel generator building, reactor building 1, and reactor building 2.

The inspection resulted in the evaluation of 1825 randomly selected self-drilling expansion shell anchors (SSD).

A minimum sample of 100 anchors was inspected for cable tray supports, conduit supports, and duct supports in the auxiliary building, control building, reactor building 1 and 2, and diesel generator building. If 100 accessible anchors could not be found, all accessible anchors were inspected (i.e., in the control building, cable tray support sample a total of 129 anchors were inspected). In the control building conduit support sample and the auxiliary building cable tray support sample, an additional number of anchors were inspected above the minimum 100 anchors that were required. The supports inspected in the auxiliary building and control building involve supports that are common for both units 1 and 2, but are required for unit 1. Therefore a system in the control building or auxiliary building with inspection data for a unit 1 sample of 100 anchors and unit 2 sample of 100 anchors was combined to make a 200-anchor sample of common anchors for both units 1 and 2. The results of the combined 200-anchor sample must be acceptable to qualify unit 1 for a system in that building. The only place a sample was not taken is where self-drilling expansion shell anchors were not used. An example would be in the reactor building where cable tray supports utilized embedded plates or in the diesel generator building where wedge bolts or embedded plates were used. The samples were chosen primarily with the intention of identifying if anchor cutting to avoid reinforcing steel was a critical problem at WBN. Although all size anchors from 3/8-inch to 7/8-inch were inspected, a larger portion of the anchors were 5/8-inch or larger. The 5/8-inch anchor is usually the smallest size anchor that penetrates the second layer of reinforcing steel and the probability of interferences with reinforcing steel would increase with the larger size anchors. The sample also required all anchors on each support base plate to be inspected that were accessible. This increases the chances of spotting cut anchors in a sample.

The inspection of cable tray supports and conduit supports were limited to inspection and evaluation. Those anchors outside criteria that were judged unacceptable were proof tested. The evaluation criteria used to evaluate the cable tray supports and conduit supports was the criteria developed by TVA for the Browns Ferry Nuclear Plant (BFN) NRC-OIE Bulletin 79-02 inspection. This criteria was developed to provide a 95-percent confidence level on plug depth measurements and a 99-percent confidence level on thread engagement measurements. The inspection data for conduit supports and cable tray supports is shown in table 1. The results for the cable tray support and conduit support anchors were that less than 3.57 percent of the anchors would not be expected to develop their maximum design loads with a 95-percent confidence level. The NRC-OIE Bulletin 79-02 requires a 95-percent confidence level that less than 5 percent of the anchors are defective. Since the failure rates of the samples were less than required by the NRC bulletin, no further inspection work will be required. TVA considers the inspection data and results to be acceptable. The anchors that were determined to be unacceptable by inspection were proof tested and replaced if they failed.

The duct support samples were taken in the auxiliary building, control building, and reactor buildings 1 and 2. TVA proof tested all duct support anchors that were outside inspection criteria and replaced the anchors that failed proof test. The reason for proof testing was that duct supports in general are not as complex and massive as the cable tray supports or conduit supports and are easier to proof test.

The inspection data for the duct supports is shown in table 2. The inspection results for the duct support anchors were that less than 4.51 percent of the anchors would not be expected to develop their maximum design load with a 95-percent confidence level. Since the NRC-OIE Bulletin 79-02 requires a 95-percent confidence level that less than 5 percent of the anchors are defective, TVA considers the inspection data and results to be acceptable for unit 1 and common anchors for duct supports.

The inspection data was also reviewed for oversize bolt holes. Each base plate that was identified with oversize bolt holes was analyzed to determine if adequate shear transfer could be developed by the remaining anchors on the plate with proper hole size, without exceeding design allowables. The results of the evaluation was that no more than 3.5 percent of the base plates in any sample would be expected not to develop their maximum design loads with a 95-percent confidence level except for the control building cable tray support sample (3 defective plates in 24 for 12-1/2 percent). The control building cable tray supports will require further inspection of base plates for oversize bolt holes that could have potential shear transfer problems. The additional inspection will be restricted to expansion anchored base plates with two types of attachments: cantilever type with the distance from the back of the base plate to the center of applied load being less than twice the bolt spacing and baseplates with sloping members attached. These two types of supports would not have the ability to transfer shear if the bolt holes are oversized. TVA will repair all oversized bolt holes in the original inspection samples that results in the base plate having a shea. capacity less than required by Design Criteria DS-C6.1. If any oversized bolt holes are identified in the additional inspection, they will be repaired.

NCR 3311R identified a deficiency that is not common to the other NCRs in this report. The additional deficiency is, 'Supports were Removed and/or Relocated Without the site Electrical Engineering Units' (EEU) Approval.' This occurred only in the reactor building 2 annulus area. WBN field personnel originally recommended a 100-percent reinspection for unit 2 conduit supports inside the annulus area. The 100-percent reinspection will not be required on bolt anchors, but will be required to verify that the actual support location agrees with the drawings. This NCR also identified, 'Bolt holes in plates were enlarged beyond tolerance.' Further investigation revealed that the bolt holes were drilled larger than allowed by drawings.

One common deficiency identified with NCRs 3624R, 3311R, and 2789R is bolt thread engagement less than the one nominal bolt diameter required by General Construction Specification G-32 (this was determined from examination of the TER, Thread Engagement of the Bolt Removed). TVA has evaluated approximately 2000 self-drilling expansion shell bolt anchors at WBN and has found only three bolts with a thread engagement that would not be expected to develop the maximum designed load (factored load) with a 99-percent confidence level. The inspection data indicated that approximately 40 to 50 percent of the measured thread engagements were less than required by the WBN anchor bolt installation procedures. Although this is a violation of procedures, TVA does not consider thread engagement a structural problem at WBN.

NCR 2901R, was included with this group of NCRs in error. All corrective action has been completed.

The inspection results of the cable tray supports and conduit supports on a per-building basis are as follows:

TABLE NO. 1

Bldg.	Type Support	Total Anchors Inspected	Anchors Outside Criteria				No. of Anchors Bad	Failure Rate
			Deep Plug	Short Plug (Cut Anchors)	Deep Shell	Short TER		
Control Bldg. Unit 1 & Common	Conduit	280	13	10	12	170	5	1.79%
Reactor Bldg. 1	Conduit	104	5	2	2	60	3	2.88%
Auxiliary Bldg. Unit 1 & Common	Conduit	233	27	1	29	123	3	1.29%
Diesel Gen. Bldg.	Conduit	108	1	4	0	3	1	0.93%
Control Bldg. Unit 1 & Common	Cable Tray	129	1	17	13	60	2	1.55%
Auxiliary Bldg. Unit 1 & Common	Cable Tray	301	11	13	75	98	1	0.33%
Reactor Bldg. 2	Conduit	112	14	0	8	66	4	3.57%
Total Anchors		1267	72	47	139	380	19	1.50%

The inspection results of the duct support inspection on a per building basis are as follows:

TABLE NO. 2

Bldg.	Total Anchors Inspected	No. of Deep Plug	Outside Deep Shell	Criteria Short TER	No. of Anchors Proof Tested	No. Of Anchors Failed Proof Test	Failure Rate
Reactor Bldg. 1	102	39	4	25	45	1	0.98%
Control Bldg. Unit 1 & Common Anchors	224	37	6	63	51	11	4.91%
Auxiliary Bldg. Unit 1 & Common Anchors	229	15	19	118	54	7	3.08%
Reactor Bldg. 2	109	27	4	27	41	3	2.75%
Totals	664	118	33	233	191	22	3.32%