The SQN-GCTF report did not address directly the subject of anchor design or redhead type anchor suitability for nuclear plant use. However, the report proved the suitability and adequacy of redhead type concrete anchors by referencing the sampling program done in response to NRC OIE Bulletin 79-02. The positive results of this sampling program supported the adequacy of the TVA Anchor Program. In addition, failure rates of less than two percent were noted during in-process production tests where TVA General Construction Specification G-32 acceptance criteria was employed. The reports concluded by referencing historical information (i.e., construction pull test data, 79-02 responses and sampling program results) as additional supportive evidence to the adequacy of Sequoyah's concrete anchor program.

The WBN-ECTG element report addressed the unsuitability of redhead type concrete anchors by evaluating the same criteria reviewed in the NSRS report I-85-440-WBN. Specifically, the adequacy of TVA General Construction Specification G-32 was emphasized with respect to the qualification requirements of redhead type concrete anchors at each plant site. This report also referenced nuclear industry experience, and NRC allowed practices to further support the suitability of redhead type anchors.

Conclusion

Three independent reviews have been performed, the findings/conclusions of each being basically the same with respect to redhead type concrete anchor suitability in nuclear plant applications. It should be noted that adequacy of concrete as well as honeycombing is addressed in the Construction Category, Subcategory Report 10200 and section 4.2.2.3 of this report.

Therefore, this evaluation concludes that this issue can not be verified as factual.

4.1.2 Plant-Specific Applicability

None

4.2 Damage to Concrete/Rebar

4.2.1 Generic Applicability

Four of the concerns addressed in this issue identify events or locations that made the concerns generic to other plants.

However, the design of BFN as well as the timeframe in which BFN was constructed precluded the evaluation of this issue at BFN. It was determined that adequate reinspection programs were in place to fully address the parameters of this issue at BFN. These programs are described in section 4.3.2.3.

4.2.2 Plant-Specific Applicability

The following findings are applicable to the issue addressed and apply to all plants where the issue was evaluated:

The expurgated employee concern files for the subject concerns contained no additional information pertinent to this issue.

A review of TVA General Construction Specification G-32 revealed no requirements for the removal of abandoned anchors. However, Section 5.2.1.2 of G-32 does allow abandoned expansion shell anchors to be dry-packed or grouted full. By rendering the abandoned anchor useless, allowance is made for reducing the distance between the abandoned anchor and a working anchor to the diameter of the hole of the larger anchor as stated in Section 3.7.3.6 of G-32. Furthermore, this section allows the distance to be reduced to one-half the diameter of the hole of the larger anchor if the abandoned anchor is removed and the hole is grouted or dry-packed.

4.2.2.1 Watts Bar Nuclear Plant

A detailed review of the QTC/ERT investigation report on concern IN-85-469 002 revealed the following:

1. It could not be verified that rebar had been cut or damaged as described in the subject concern. Inspections performed and witnessed by QTC failed to verify whether anchors installed in the Control Rod Drive (CRD) equipment rooms were in contact with rebar. Using a pachometer and an ohmmeter, four anchors were determined to be "suspect" with respect to being in contact with rebar.

   These anchors, as well as two others in one of the baseplates, were inspected by Nuclear Service Branch (NSB) personnel and the plug (cone expander) depth, thread engagement and shell surface condition were verified as being acceptable. Three anchors were proof tested and each was determined to be acceptable.

2. Further conversation between QTC and the concerned individual revealed this to be the only occurrence of drilling through rebar without proper documentation in the subject area that he was aware of.

3. The drilling was performed with the self-drilling (SSD) shells only, i.e., drill bits were not used to aid in cutting into rebar.

A detailed review of NSRS investigation report I-85-384-WBN on concern PH-85-003-021 revealed the following:

A detailed NSRS review of WBN's Rebar Cuts - Books I and II was performed. These books include design calculations and marked-up master prints showing cut rebar locations. The NSRS concluded that OE's evaluation process was "comprehensive to the extent possible with the information available."

No further action was recommended because the effects of cutting rebar without engineering approval had been mitigated by OE's past evaluation and the present FCR/NCR process.

It was learned by the interviews conducted:

CEU and HEU personnel verified the facts described in the QTC/ERT investigation report on concern IN-85-469-002 and the NSRS investigation report I-85-384-WBN for concern PH-85-003-021. Also discussed was concern IN-85-232-001. It was learned that CEU is now and always has been responsible for the evaluation of all rebar damage. While any group or craft drilling/chipping concrete could potentially cut or damage rebar, CEU was ultimately the responsible organization for evaluating and documenting all cut or damaged rebar. Therefore, if a NCR was required to document cut or damaged rebar, CEU would have been the unit responsible for initiating the NCR.

It was learned by reviewing documentation on the subject issue:

1. A review of a written, informal document by Howard Hutchinson, DNE CEB Civil Engineer, dated April 18, 1986, revealed detailed explanation of the process employed by DNE to evaluate past and present rebar cuts. It was stated that DNE realized documentation did not exist for every instance of cutting or damaging rebar. This was based on the fact that over the years a very large amount of drilling and/or chipping had been done by several different crafts. It was unrealistic to assume that every instance of drilling/chipping had been documented. However, DNE expressed confidence that they were aware of the majority of damaged/cut rebar since day one of construction because of the existing construction records. Further comments were made concerning the conservatism in the design of Category I structures, i.e., the amount of rebar installed versus the amount of rebar required to provide complete structural integrity. DNE's attitude is now and always has been, "don't cut rebar unless it is absolutely necessary." Furthermore, all FCR's on cut/damaged rebar (317) initiated since 1982 have been approved. Only three of 130 NCRs (2.3 percent) initiated to document damaged rebar since day one of construction have been dispositioned such that repair was required. Final comments were that the rebar cuts or damage which DNE was not aware of would be of no consequence with respect to the cumulative effects.

2. A review was performed of a memorandum from John R. Lyons to J. A. McDonald (B26 861027 012) concerning the NRC's inspection items discussed for WBN, including SQN Item D4.3-1, "Evaluation of Structures for Reinforcing Bar Cuts." The analysis of applicability revealed the following:

   - The original calculations for various structures have not been revised for WBN but new calculations or technical justification

has been prepared for all known rebar cuts/damages. This is documented in the following manner:

REBAR CUTS, BOOK I, Auxiliary and Associated Buildings (WBP 830923 027)

REBAR CUTS, BOOK II, Reactor, Control, DG & ADG Buildings (WBP 830923 028)

REBAR CUTS, BOOK III, Auxiliary and Associated Buildings (B41 860425 950)

3. A review was performed of OE Calculation Package B41 860522 954 which details a step-by-step explanation of the program for documenting rebar cuts and damage. This document outlined the steps employed by WBN to obtain approval, document, report and evaluate rebar that had been or required cutting during the construction process. Emphasis was placed once again on the fact that sufficient construction records were available to document and evaluate cut and damaged rebar from construction day one through mid 1982. However, the cumulative effects had not been considered. This was verified by the NRC who performed a detailed review of WBN's program for cut and damaged rebar in mid 1982. Therefore, OE employed a complete master set of prints to detail all cut and damaged rebar prior to 1982. The cumulative effects for all cut and damaged rebar through August of 1983 were evaluated and calculations were microfilmed as part of the permanent records.

   Criteria were established for evaluating the structural acceptability of each rebar cut in Category I reinforced concrete structures. Acceptance criteria were also established. Rebar cuts made after 1982 were and continue to be fully documented on design drawings by FCR, ECN or NCR. It should be noted that the one specific area where the WBN program for evaluating rebar cuts was deficient prior to 1982 was in determining the "cumulative effects" of the cuts. Construction documentation and records existed for cut or damaged rebar and each instance was noted on individual sets of design drawings by the responsible design

engineer. However, a "master set" of drawings for recording each cut or damaged rebar did not exist. Therefore, the cumulative effect of individual cuts on a specific structure were not adequately evaluated. In 1982, either new calculations or technical justification was provided for all known rebar cuts.

Existing construction documentation and records were used to evaluate rebar cuts prior to 1982. There was sufficient information to establish the areas where rebar had been cut as well as the size and orientation of the affected rebar.

- The original calculations for determining rebar requirements in various structures were not invalidated due to rebar cuts and damages. The amounts of rebar supplied (installed) were compared to the amount required by the original calculations; the difference being the surplus amount not needed in a specific area. This was the basis for determining the amount of rebar that could be cut. The cumulative effects of rebar cuts were also considered in the evaluation of rebar cuts or damage.

- All known rebar cuts and rebar damage have been documented in calculation packages as well as on the applicable drawings.

4. Further evaluation revealed that all seismic Category I structural concrete for both WBN units had been placed. Therefore, future rebar cuts should occur only during concrete anchor installations or modifications to existing sleeves, penetrations, etc. These facts were verified with site CEU personnel.

Conclusion

Based on the findings for the issue of Damage to Concrete Rebar, this issue is factual and identifies a problem, but corrective action for the problem was initiated before the employee concerns evaluation of this issue was undertaken. The WBN program for documenting, tracking and evaluating cut and/or damaged rebar has been determined to be fully adequate. No further action is required on this issue.

4.2.2.2 Sequoyah Nuclear Plant

It was found by reviewing NSRS Report I-86-120-SQN and related documents that:

The NSRS sample program of WR 144789 included the use of a ground fault indicator (GFI) device to determine if rebar was contacting the SSD anchor shell. Three anchors were found to be contacting rebar, one of which appeared to be in an area not approved for cutting by OE. The NSRS recommendation (I-86-120-SQN-4) was to recreate rebar sketch sheets and appropriately document, evaluate and correct the potentially cut rebar.

The SQN response to this the NSRS recommendation (memorandum from H. L. Abercrombie to R. P. Denise dated May 30, 1986 on the NSRS Report I-86-120-SQN) noted that SQN Mechanical Modifications Section had also inspected the area to determine if any rebar had, in fact, been cut. The results indicated that no rebar had been cut or damaged and recreating the rebar sketches was not justified based on these results. The reinspection was verified with the SQN Mechanical Modifications responsible engineer who indicated that his reinspection of the identified areas had been performed using a Geophysical Survey Systems instrument which was more accurate than the GFI unit. The Subsurface Interface Radar System he used had provided results which indicated that no rebar had been cut or damaged and the unit was equipped to provide a printout of the inspection results. This evaluation agrees that the results of the rebar inspection performed by SQN Modifications was considerably more accurate than the NSRS inspection which used a GFI unit.

However, this evaluation does not agree with the SQN response that recreating the rebar sketches is not justified. The fact that SQN Modifications verified no rebar was cut or damaged does not justify the inability of the site to provide the color-coded sketches which established the areas where rebar cutting was allowed without written approval by the Office of Engineering (OE). These sketches (Office of Civil Engineering sketches IZ-11-8-76-0 thru -16), as a minimum, provided documentation for the

areas, if not each specific instance, where rebar could be cut without written approval. The NSRS investigation was able to retrieve the memorandum (R. M. Pierce to G. G. Stack dated September 15, 1976) which transmitted the aforementioned sketches to the site, but the sketches were not found. Therefore, this evaluation agrees with the NSRS report findings that SQN may, in fact, be in violation of 10 CFR 50, Appendix B, Criterion XVII (CATD C011305-SQN-2).

4.2.2.3 Bellefonte Nuclear Plant

The BLN Employee Concern Investigation Report revealed that observations of the location (A2 (S), elevation 610) stipulated by concern BNP QCP 10.35-8-7 showed concrete repairs had been made in the general vicinity. The investigation report also stated that BLN's past history has shown a minimum amount of honeycomb exists in safety-related structures. When required, it is repaired and documented as required by BNP-QCP-5.4, "Concrete Curing and Repairing." It appears that if unacceptable concrete existed in this area, it has now been repaired acceptably.

Memorandum B41 851028 004 from R. O. Barnett, Chief Civil Engineer to J. W. Coan, Project Manager, Watts Bar Engineering Project, explained that honeycombing of concrete is a serious and obvious condition that is easily identifiable. Small placing voids and entrapped voids are common in concrete placement but are not considered to be honeycomb and do not affect the integrity of anchors.

If an anchor was installed adjacent to a seriously honeycombed area with significantly reduced strength, the edge of the honeycombed area would provide inadequate lateral confinement and would therefore be the same as a free concrete edge.

The corrective action for an anchor installed next to honeycombed concrete would be to repair the concrete according to General Construction Specification G-2.

The aforementioned memorandum from R. O Barnett to J. W. Coan also addresses the affect of an abandoned anchor with the shell grouted on an adjacent loaded anchor.

Spacing requirements for abandoned and working anchors were intended to assure that the confinement of the anchor would not be significantly affected by the adjacent hole.

Based on the judgment of engineers with significant experience in anchor testing and behavior, the spacing limitation of one clear hole diameter would provide assurance that anchor performance would not be degraded.

Some anchors that have been abandoned and grouted may not be easily identified. For this reason, it is possible that a working anchor may be installed closer than the G-32 minimum to an abandoned anchor. DNE expressed confidence that this would not significantly affect the capability or operation of any support or system because: The probability of this occurrence is low, the reduction in ultimate anchor capacity would be relatively small, very few anchors are loaded near the maximum allowable, and a large conservative factor of safety is applied to expansion anchor installations.

Interviews were conducted with cognizant BLN craft personnel (steamfitters, sheet metal workers and electricians) and the process described below was found to be used by each craft:

- When rebar is encountered during the drilling process, i.e., installation of self-drilling concrete anchors, work is immediately halted.

- Drilling is not resumed until the appropriate quality control or engineering personnel are contacted and the required inspections, documentation and/or corrective action(s) are initiated.

It should be noted that the Engineering Category, Subcategory Report 25000 addresses the subject of Cut Rebar Control from a generic standpoint at BLN. |R2

Conclusion:

This issue is factually accurate, but what it describes is not a problem. No procedural violations or conditions adverse to quality were identified.

4.3 Testing of Anchors

4.3.1 Generic Applicability

Two of the concerns addressed in this issue (IN-85-285-002 and IN-83-347-007) question the adequacy of the testing program utilized by TVA for anchorages. Therefore, this issue was evaluated at all TVA nuclear plants.

4.3.2 Plant-Specific Applicability

4.3.2.1 Watts Bar Nuclear Plant

The expurgated employee concern file contained no additional information.

NCR 2803R was initiated for expansion anchor test reports for pipe supports not being prepared in accordance with General Construction Specification G-32 "Bolt Anchors Set in Hardened Concrete" (hereafter referred to as G-32). Responsible foremen were instructed in advance that their next normal anchor installation activity would be tested and would be used as the basis for constructing a lot. Lots were then constructed by adding supports to the Attachment C of WBN-QCP-1.14 from that foreman's progress reports which listed previously installed supports. The progress reports used may have been up to two years old.

NCR 2803R was dispositioned by DNE to perform a random sample of 30 baseplates from the 139 lots identified. Using the sampling criteria given in NRC-OIE Bulletin 79-02, perform a 79-02 inspection on a minimum of four anchors per baseplate. If the results of this sample was similar to that of the original 79-02 sample, no further action would be required.

A total of 127 anchors were inspected, 14 of which did not meet plug depth criteria, 36 did not meet thread engagement criteria, and seven anchors did not meet allowable recess/protrusion criteria. The 14 anchors not meeting plug depth were proof load tested with two anchors failing, giving a 1.57 percent failure rate. These two anchor failures were corrected according to G-32. Of the 36 anchors that did not meet thread engagement requirements, none failed to develop the factored loads (i.e., the actual load on the anchor including the applicable factor of safety). There were seven of these anchors that would not fully develop the anchor (that is, the required minimum ultimate tensile strength of the anchor given in G-32). Of the seven anchors that did not meet recess/protrusion requirements, none failed proof load testing.

The 1.57 percent failure rate of this sample compared favorably to the pull test data for WBN which documented a 2.92 percent failure rate. Since the failure rate of this sample was less than two percent, DNE accepted the anchors identified on this NCR as installed.

NCR 2873R identified 925 pipe supports in the Diesel Generator Building (DGB) and 435 pipe supports at the Intake Pumping Station (IPS) that were not proof loaded according to G-32.

The NCR was dispositioned by DNE to perform a random sample of 30 baseplates using the sampling criteria given in NRC-OIE Bulletin 79-02. Performance of 79-02 inspections on all the anchors in the 30 baseplates was required with a minimum of 100 anchors being inspected for each building. If the results of this sample were similar to that of the original 79-02 sample, no further action would be required.

A total of 281 anchors were tested, 40 of which did not meet plug depth criteria, 60 anchors did not meet thread engagement criteria, and 15 anchors did not meet recess/protrusion criteria. The 40 anchors that did not meet plug depth requirements were proof load tested according to G-32 with one anchor

- If any anchor fails this inspection, all anchors for that baseplate will be inspected. Any anchor not meeting the acceptance criteria will be proof load tested and reset or replaced as necessary.

- Select a quantity of anchors according to G-32 to be proof load tested. If anchors fail proof load testing, corrective action according to G-32 shall be taken.

- Reactions from tripod legs may be delivered as close to the anchor as desired, if the baseplate cannot be removed. If the baseplate is removed, the normal requirements of G-32 apply.

- If the support is not removed to perform pull testing, the baseplate must be shimmed to assure that the anchor shell does not contact the baseplate while proof load testing.

- The results of the tests and inspections shall be maintained and evaluated in accordance with G-32. If more than three anchors from each successive group of 50 anchors fail proof load test, all remaining anchors in the lots will be inspected for plug depth and those not meeting the requirements of G-32 will be proof load tested. Any anchor that fails proof load testing shall be unacceptable and must be corrected according to G-32.

Lots containing new support installations as well as those previously installed before proof load testing.

- These may be handled as described above.

- If the lot contains only new support installations, the current requirements of G-32 apply.

WBN-QCP-1.14 was revised (Revision 9) to incorporate the disposition of NCR 3747 R. Inspections were performed as required and the results reflected a 95 percent plus confidence level. All engineering, craft and inspection personnel involved with installation and/or inspection of anchors were formally trained to Revision 9 of WBN-QCP-1.14. NCR 3747R was then closed.

NSRS Report I-85-657-WBN addressed inadequate inspection of expansion shell anchors after attachment installation. This report made three recommendations concerning the inspection of expansion shell anchors.

NSRS Recommendation I-85-657-WBN-01 identified five items of NCR 3747R that were not correctly incorporated into WBN-QCP-1.14.

The first item was that the altered lot definition was not included in WBN-QCP-1.14. This definition was only applicable to anchors installed before January 25, 1982 that had not been proof load tested. This definition is in WBN-QCP-1.14 Revision 19, Section 6.3.18.1.

The second item identified was that Section 6.3.18 of WBN-QCP-1.14 indicated that the disposition of NCR 3747R was optional rather than required. This section addresses anchors installed before January 25, 1982 that had not been proof load tested. This section allows these anchors to be inspected by requirements that are less stringent than current requirements. Either type inspection is acceptable for anchors of this type.

The third item stated that WBN-QCP-1.14 did not make it clear that proof load testing (five percent minimum) was required. Section 6.3.18.2 of WBN-QCP-1.14, Revision 19, states that a minimum of 25 percent of the anchors on each baseplate must be inspected for perpendicularity, plug depth and recess for anchors installed before January 25, 1982 that had not been proof load tested. Requirements for new anchor installations are given in Section 6.3.3 of this procedure.

The fourth item was that WBN-QCP-1.14 did not describe an adequate method for proof load testing of anchors with the attachment installed. This requirement was in Revision 9 of this procedure but was later omitted. This requirement was added back to WBN-QCP-1.14 in Revision 18. No corrective action was required for past installations due to inspectors requiring shimming of the attachment to ensure the anchor shells did not bear against the back of the attachment, even though it was not a procedural requirement.

The fifth item was that WBN-QCP-1.14 did not require additional inspection and testing if more than three anchors from a group of 50 anchors failed the proof test. NCR 6651 was initiated for pipe supports and civil features for this deficiency. The affected lots were reviewed and no group of 50 anchors with more than three failures were found. WBN-QCP-1.14 was revised (Revision 18) to incorporate this requirement.

NSRS Recommendation I-85-657-WBN-02 recommended a review of electrical and instrumentation inspection documentation to determine the extent of supports that had received an insufficient number of anchor measurements (a minimum of 25 percent per plate). Initiate NCRs and perform inspections as required. It should be noted that pipe support and civil feature inspection documentation was adequate with respect to this requirement.

The Instrumentation Engineering Unit initiated NCR 6649 to document this problem. The investigation required for this NCR revealed the affected lots were for unit one. Accordingly, NCR 6649 was voided and all applicable information was given to the Watts Bar Modifications Group.

This group initiated NCR W-519-P to document this problem, as well as the problem of three failures in each group of 50 anchors. This NCR is still open (CATD 11300-WBN-05).

The Electrical Engineering Unit initiated NCR 6674 to identify lot numbers which did not have the required inspections performed. The affected lots were identified and appropriate inspections were performed. The NCR was then closed. However, the deficiency involving three failures in each group of 50 anchors was not included in this NCR. Furthermore, the disposition of this NCR stated that a list of the affected lots would be included with the NCR at closure. This was not done. This NCR also falls under the scope of SCR 6649-S. This SCR will remain open until the discrepancies found for NCR 6674 are resolved. (CATD 11300-WBN-03).

NSRS Recommendation I-85-657-WBN-03 questioned the justification for testing only five percent of expansion shell anchors. This was addressed in NSRS Report I-85-439-WBN. This report concluded that sampling per G-32 is an acceptable technique endorsed by industry standards and the NRC in OIE Bulletin 79-02.

NCR 5182 Revision 2 was initiated to document 673 anchors for instrument panels that had not been proof load tested. A total of 106 anchors were proof load tested of the 673 identified, with zero failures. DNE stated that this provided adequate assurance of anchor acceptability and no further testing was required.

One specific concern was expressed dealing with an improper gauge being used. The perceived problem was a 3000 pound gauge was used during a proof load test which required a proof load of 3200 pounds.

Hydraulic Ram and Gauge Calibrations are performed per procedure to identify minimum gauge pressures that will result in anchors meeting Construction Specification G-32 requirements for pull test. Due to previous problems with achieving minimum G-32 proof loads, Hanger QC inspectors, on their initiative, have been pulling anchors approximately five percent over the requirement to assure minimum

load is reached. For the largest SSD anchor utilized at Watts Bar, a 7/8 inch Ø SSD, the minimum gauge pressures needed are 2900 - 2975 psi. Cognizant personnel could not recall a case where minimum required gauge pressure exceeded 3000 psi. A cursory review of ram/gauge calibration records confirmed that, since 4000 psi and 5000 psi gauges are now available, a 7/8" Ø anchor is routinely pulled to 3200 pounds to avoid having to use a different gauge pressure for each ram/gauge combination. Previously, ram/gauge recalibrations caused anchors to have to be retested. Use of a 3000 pound gauge is acceptable even for a "3200 pound" pull test since 3200 is not the required reading, but rather the recommended reading.

Another specific concern was expressed dealing with procedures not requiring instrument panel bolts to be torqued.

Torquing of bolts in SSDs is not a requirement in G-32 or WBN-QCP-1.14. Torquing requirements are detailed only if wedge bolt anchors are installed. Both G-32 and WBN-QCP-1.14 are specific with respect to the torquing method to be used for wedge bolts. Both G-32 and WBN-QCP-1.14 require all wedge bolts to be torqued, regardless of the feature for which anchorage is being provided.

The WBN-PMO response to this concern concluded that the subject bolts were installed in accordance with applicable G-32 criteria which did not require torquing of the bolts.

Conclusion

The findings of this evaluation show that this issue is factual and presents a problem for which corrective action has been and is being taken as a result of this employee concern evaluation. It should be noted that many problems had been identified and corrected before this evaluation was undertaken. Furthermore, this evaluation shows that some perceived problems were actually misunderstandings of standard practices and procedures.

4.3.2.2 Sequoyah Nuclear Plant

The SQN-GCTF Report addressed the subject of this issue as well as the parameters of the anchor installation process. With respect to anchor testing, the report referenced sampling programs performed to satisfy NRC OIE Bulletin 79-02 as well as SSD reinspection and replacement exercises initiated as a result of employee concern XX-85-023-001. Although not specifically referenced in the GCTF report, Nonconformance Report (NCR) 72D and Nuclear Regulatory Commission (NCR) inspection item 328/78-01-14, along with Employee Concern XX-85-023-001, were the basis for the initiation of a Special Maintenance Instruction (SMI-2-317-24R2) to review anchor bolt/baseplate installations for the SQN unit 2 shield building wall.

The report concluded that existing historical information from pull test data, 79-02 inspections, and the SMI-2-317-24R2 anchor survey produced results that supported the adequacy of SQN's anchor installation/inspection program. The status of the open issues addressed by the SQN report will be addressed further in this section.

The WBN-ECTG Element Report for Testing of Anchors did not identify any specific issues generic to SQN. Specific instances of conditions adverse to quality (CAQ) at WBN were documented and corrected according to site NCRs. The report identified no CAQ with respect to the use of sampling programs for proof loading of SSDs.

A detailed review of the NSRS Investigation Report I-85-439-WBN was made to evaluate the issue of using sampling techniques to test SSDs. It was discovered that all aspects of the NSRS report were applicable to SQN, except where specific WBN procedures were referenced. The conclusion of the report indicated that "determination of adequacy of the anchors based on sampling is an acceptable technique endorsed by industry standards, TVA procedures and the NRC in OIE Bulletin 79-02." This conclusion was based on a detailed review of American National Standards Institute (ANSI) and American Society of Testing and Materials (ASTM) Standards, TVA Design Standards, and TVA General Construction Specifications.

The WBN-PMO response to the concern on instrument panel bolts (IN-85-347-007) was reviewed and determined to be generic to SQN with respect to tightening requirements for bolts in SSDs even though the response was directed to the concern as expressed at WBN. The same criterion governing the tightening of SSD bolts at WBN (General Construction Specification G-32, section 3.2.5) is applicable to SQN. The report concluded that the subject bolts were installed in accordance with applicable G-32 criteria which did not require torquing of the bolts. Therefore, no procedural violation was identified. This evaluation agrees with that determination.

A detailed review of the DNE response to recommendation 03 of NSRS Investigation Report I-85-657-WBN was made to evaluate the applicability of defined anchor installation lots at SQN. TVA General Construction Specification G-32 provides the procedural criteria for all TVA nuclear plants for the number of anchors selected and the testing frequency required to prove acceptable anchor installations. However, G-32 was not intended to provide evidence of anchor acceptability based on individual lot test results. The results of proof load tests are evaluated monthly by DNE, where they are categorized by anchor type and size, not by lot. The defect rate is then determined for each group of anchors, and the results provide the means for evaluating whether the proof load failure rate is acceptable. A failure rate of greater than five percent for any group of anchors requires additional action(s) and a failure rate close to five percent requires further evaluation to determine if trends exist. This methodology recognized the high rate of proof test failures in the SQN unit 2 annulus area and eventually led to identifying the understrength surface concrete problem addressed by NCR-72D. It should also be noted that the statistical sampling plan employed was a recommended method in NRC OIE Bulletin 79-02.

A review was made of TVA General Construction Specification G-32, R10, M&AI 9, R7, and M&AI 10, R10 with the following results:

1. The criterion which addresses the designation of anchor lots in M&AI 10 is taken directly from G-32 and provides adequate definition and

description of anchor installation lots. This review also determined that no specific criterion existed to require proof testing (pull testing) of SSDs before baseplate installation (although G-32 implied this method) nor were there specific criteria for shimming baseplates when "through the plate" testing was performed. This subject is addressed further in this section.

2. The criterion which addresses the tightening requirements for bolts in SSDs at initial installation is section 3.2.5 of G-32. Section 4.6.2 details tightening requirements for bolts in SSDs during inspection for bolt thread engagement. For initial installation, tightening the bolt 1/8 to 1/4 turn after the bolt head contacts the attachment is required. For bolt inspection to verify tightness, the installation is acceptable if the bolt cannot be turned with the fingers. SQN M&AI 9 also contains specific bolt inspection criteria similar to G-32 in that section 6.2.3 requires verification that, as a minimum, the bolt is hand tight. Torquing of bolts in SSDs is not a requirement in G-32 nor M&AI 9.

3. Torquing requirements are detailed only if wedge bolt anchors are installed. Both G-32 and SQN M&AI 10 are specific with respect to the torquing method to be used for wedge bolts. Specific torque values are given for each bolt size as well as how to apply the specific torque correctly. Both G-32 and M&AI 10 require all wedge bolt anchors to be torqued, regardless of the feature for which anchorage is being provided.

The responsible engineer in SQN/Modifications Unit was interviewed to obtain information on mechanisms employed to address NSRS recommendation Q-85-023-001-01.

The results of this interview are as follows:

1. NCR-72D was originally issued by DNE to document continual failure of anchor pull tests in the SQN unit 2 annulus area. The corrective action for this NCR was to replace all 1/2-inch

diameter and larger self-drilling (SSD) anchors in the affected area with equivalent size wedge bolts.

Excluded from this replacement were 1/4-inch and 3/8-inch diameter SSDs installed in specific conduit supports. The QTC investigation of concern XX-85-023-001 revealed these corrective actions had not been fully implemented. In response to NSRS recommendation Q-85-023-001-01, initiated as a result of the aforementioned QTC investigation, SQN agreed that the corrective action of NCR-72D had not been fully implemented as detailed in a letter from H. L. Abercrombie to R. K. Siberling dated April 24, 1986.

2. Further discussion revealed that the SQN Modifications Unit had initiated SMI-2-317-24 on January 15, 1986 to conduct a field survey of anchor bolt/baseplate installations in the unit 2 shield building wall. This SMI included a sampling program for all anchorages on the vertical interior and exterior wall at all elevations using the following selection process:

   a. System 67 (ERCW) in the annulus only

   b. Systems 30 and 65 (HVAC ductwork) in the annulus only

   c. System 26 (fire suppression) in the annulus only

   d. Electrical systems conduit 2-1/2-inch diameter and greater (including some junction boxes and cable trays on the interior/exterior wall)

   e. Unistrut attached to wall surfaces that supports pipe or tubing on the interior/exterior wall

   f. Cantilever type supports for tubing and conduit 2-inch diameter and smaller

   g. The thirty supports previously identified in the QTC investigation report on the subject concern (XX-85-023-001).

The results of this exercise are as indicated in the letter from C. R. Brimer to H. L. Abercrombie of November 20, 1986 concerning the SQN-GCTF recommendations, and reflect an overall acceptance rate of greater than 95 percent. The final number of supports inspected was 1281 (1193 was referenced in the aforementioned letter). The total number found unacceptable was 43, all of which have been or will be reworked as required by specific Maintenance Requests (MRs). Initially, 1/4-inch and 3/8-inch diameter SSDs had been excluded from the inspection under certain conditions (MEMO SWP 781013 005). However, since that time, conduit loads have been increased so the referenced memo is no longer applicable except in some isolated instances such as aluminum conduit and small junction box installations. Workplan 11963 was written to address this issue and to act as a mechanism for correcting problems found during performance of the SMI.

Subsequently, SQN Modifications initiated a test program to qualify the existing anchorages to greater loads. Therefore, per Appendix L of G-32 (Site Revision Notice (SRN)-G-32-15) and section 8.8 of SMI-2-317-24 R3, pull tests were performed on 1/4-inch and 3/8-inch diameter SSDs originally exempted from replacement in the corrective action of NCR-72D. The following is an excerpt from section L.4.1 Acceptance Criteria of Appendix L:

L.4. EVALUATION OF EXISTING COMPLETED ATTACHMENTS

L.4.1 Acceptance Criteria

All existing attachments to the unit 2 shield wall which do not conform to section L.2 shall be evaluated. The acceptability of existing completed attachments shall be determined in accordance with sections L.4.2 and L.4.3 or L.4.4.

Evaluation is not required for 3/8-inch "long" wedge bolts and 1/2-inch "regular" length wedge bolts that have attachment thicknesses of 3/8 and 3/4-inches, respectively. (Wedge anchors with these reduced maximum attachment thicknesses will have pretightening embedment that equals or exceeds the minimum wedge bolt embedment of 4-1/4-inch for full wedge bolt capacity.

The results of the inspection and testing on an attachment may be applied to adjacent attachments within a 20-foot by 20-foot area centered on the inspected attachment. (The measurement shall be based on the clear distance between the attachments). If an attachment does not meet all specified requirements, all attachments in the defined area shall be inspected and tested. (The basis for this requirement is that the deficiency relates to the quality of the surface concrete and not the installation of the anchor. Also, a 50-percent reduction in allowable design load has been implemented by TVA Civil Design Standard DS-C1.7.1. The 20-by 20-foot area will provide adequate data to allow identification of any elevations or areas where the concrete surface condition is significantly affecting anchor performance.)

The required inspections are related to the condition of the concrete. Should problems with other attachment installation parameters be identified, they should be handled as separate conditions adverse to quality.

If an attachment is inaccessible, the support may be accepted by DNE based on evaluation of the results of inspection and tests on adjacent attachments.

The results of the pull tests performed were further proof of the adequacy of the anchor installations in the unit 2 shield building wall. A total of 1130 anchors were pull tested, the majority of these pull tests being performed with the base plates removed. Thirty-six anchors (3.2 percent) failed pull test and four of these failures were directly attributed to the understrength surface concrete.

In addition, the inspection revealed no SSD anchors to be installed in any of the mechanical systems in the inspected areas - all had been replaced as required by the SQN Final Report for NCR-72D.

3. The responsible engineer in SQN Project Services Section (Site Services) who was also involved in the unit 2 annulus inspection was interviewed. He provided the following information.

   a. The strategy behind choosing the System 67, 30, 65 and 26 supports for inspection was that these supports encompassed a very large percentage of the installations in the annulus area.

   b. M&AI 10 R10 (Testing of Expansion Anchors Set in Hardened Concrete), section 3.3 states, "no 1/2 inch diameter or larger SSD type anchors are to be installed in the SQN unit 2 shield building wall." M&AI 11 R12 and G-32 (SRN-G-32-15) Appendix L, section L.2, also preclude the use of SSD type anchors as well as detailing specific wedge bolt anchors for installation in the affected area. These statements provide procedural means of assuring future anchor installations will not violate the criteria of the NCR-72D Final Report.

4. The implications of concern IN-85-285-002 were discussed with the responsible DNE-Civil Engineering Branch (CEB) Central Staff engineer with respect to SQN. He stated that the inspection criteria of 79-02 were sufficient to prevent the anchor shell from contacting the baseplate during "through the plate" proof testing. He also stated that when anchor reinspection required proof testing as a result of a NCR, the reinspection process would require plate shimming if "through the plate" proof loading was performed. However, neither G-32 nor M&AI 10 specifically state the proof testing is to be done before base plate installation. It was stated, however, that proof testing

before base plate installation was standard practice at all plants and shimming of the plate for "through the plate" testing was also a standard, recognized practice. At this point, the positive results of SQN's 79-02 inspection program were discussed as well as the 79-02 inspection procedures for both units which required verification that the anchor shell was not contacting the base plate. The final comments were that a revision to G-32 could be made to include specific statements addressing proof test before base plate installation and shimming when through the plate testing was performed but he did not feel as though a revision was necessary.

5. G-32 and M&AI 10 were further discussed with the SQN Modifications responsible engineer. He agreed with the comments made in the preceding section by the DNE-CEB engineer that pull testing before base plate installation was a standard, recognized practice even though not a specific requirement. He also stated that during reinspections the base plate was removed in many cases instead of using shims which would allow "through the plate" proof testing.

6. Also discussed concern IN-85-347-007 with the responsible DNE-CEB Central Staff engineer. He stated that there never has been, nor is there now a requirement to torque bolts installed in SSD type anchors. Bolt tightness in SSDs is achieved and verified by methodology other than torquing as detailed in previous sections of this report. He also verified that G-32 was very specific with respect to the requirement that all wedge bolt anchors installed were to be torqued to a specified torque value regardless of what features they were providing anchorage for.

Conclusions

1. This evaluation is in agreement with, and verified the SQN-CCTF report on the subject of this issue. It was concluded that SQN's 79-02 reinspection program, the reinspection program initiated according to SMI-2-317-24, and the reinspections performed as a result of the QTC investigation of concern

XX-85-023-001 served as mechanisms that prove the overall adequacy of SQN's concrete anchor installations. The recommendations in the SQN-GCTF report on Incorrect Installation and Inspection of Anchors addressed 2 other issues:

a. Base plate flexibility - this issue is addressed fully in the WBN-ECTG report 10400 Embeds.

b. Overtorquing - before outlining the details that relate to this issue, it should be pointed out that overtorquing is not the proper terminology to be used. The concerned individual used the word overtorquing in describing the concern on expansion anchors. However, since expansion shell anchor bolts are "tightened" with a wrench of some type, and not "torqued", the appropriate terminology is "overtightened." The terminology overtorquing and overtightening is not interchangeable in this application.

   This issue was initially raised at WBN by employee concern IN-86-115-001. NSRS Investigation Report I-85-659-WBN substantiated the concern and recommended a program to verify anchor integrity based on bolt tightening practices. The WBN-ECTG Element Report on Installation of Anchors further verified the NSRS report and indicated that PIR-WBNCEB8644 had been initiated to evaluate the deficiency.

   Interviews with responsible personnel in SQN Site Services, Modifications, Compliance, Site DNE and CEB Central Staff revealed no evidence to indicate the anchor overtightening issue had ever been addressed by SQN. It is conceivable that sufficient data exists from G-32, 79-02 and other reinspection programs to adequately address this issue. However, SQN should initiate an exercise to evaluate possible anchor

overtightening using methodology that will sufficiently answer this potential generic problem (CATD C011306-SQN-01 and CATD 11300-NPS-02).

2. This evaluation did not attempt to verify whether pull tests were bypassed as stated in concern XX-85-023-001. SMI-2-317-24 R2 and Workplan 11963 adequately addressed all anchorages installed in the unit 2 annulus area where understrength surface concrete was identified and documented by NCR-72D. In addition, specific procedural mechanisms have been implemented to control future installations in this area. The SQN Modifications Unit is performing the aforementioned evaluations.

3. This evaluation is in agreement with and verified the WBN-ECTG Element Report findings as well as the NSRS investigation report I-85-439-WBN findings with respect to the use of sampling programs being acceptable. Agreement with the DNE response to NSRS Investigation Report I-85-657-WBN-03 was also determined according to this evaluation. The sampling program issue has been adequately addressed in all cases and no deficient areas were identified. G-32 is adequate with respect to lot definition and testing frequency of concrete anchors.

4. This evaluation determined that torquing of instrument panel bolts is not a requirement when SSD type anchors are installed. Tightening of SSD bolts is accomplished using a method other than torquing as detailed in this report. It was also determined that if wedge bolt anchors are installed, fully adequate procedural mechanism exists in the applicable upper-tier criteria (G-32) and at the site level (SQN-M&AI 10) to require torquing of wedge bolts regardless of the features for which they are providing anchorage.

Therefore, the concern has not identified a condition adverse to quality nor a procedural deficiency.

5. This evaluation addressed specifically the issue of anchor shells contacting base plates during pull tests (concern IN-85-285-002) and determined:

   a. No specific criteria in G-32 nor M&AI 10 address this issue but 79-02 reinspection programs were governed by mechanisms to verify no contact existed both before and upon completion of the proof test. Since that time; sufficient sample, review and reinspection programs have been performed to reveal generic deficiencies with respect to this issue. None have been identified; therefore, this evaluation does not recommend additional reinspection for this condition.

   b. This evaluation did identify that DNE-CEB should review existing G-32 criteria to determine if specific requirements should be implemented which would:

      (1) require pull tests to be performed before base plate installation (CATD C011306-NPS-01 and CATD C011306-SQN-01).

      (2) require shimming of the base plate when reinspection causes through the plate proof tests to be performed (CATD C011306-NPS-01 and CATD C011306-SQN-01).

   c. SQN Modifications Unit should review M&AI 10 to determine if specific requirements should be implemented to address recommendations 1 and 2 above (CATD C011305-SQN-1 and CATD C011306-SQN-01).

4.3.2.3 Browns Ferry Nuclear Plant

Historical

SSD type anchors were selected for use at BFN at a very early stage of the design and construction process. Installation and inspection criteria were virtually nonexistent. Further details on this subject are detailed in a memorandum from T. G. Campbell, O.M.G. Supervisor to D. B. Bowen, T.P.D. Project Manager of May 15, 1979. BFN concrete anchorages and response to NRC OIE Bulletin 79-02 were discussed. It was stated that concrete anchors were installed in accordance with vendor instructions using the same type of equipment used to perform pull tests later in the program. This fact was verified during conversations with former BFN construction employees who indicated vendor information as well as the skill of the craftsmen were the mechanisms employed to accomplish anchor installation. Prior to the issuance of G-32 and BFN Construction Procedure BF-107, no tests were performed and no documentation was initiated for concrete anchor installations. Visual inspections were performed but only by engineering personnel to "as-construct" drawings.

During the performance of inspections implemented per 79-02, construction installation practices were identified which directly affected anchor capacity. Specifically, anchors had been modified where interference with rebar was encountered, usually in cases where minor relocation adjustments were not possible. Instead of relocating anchors, they were modified to miss the rebar. The modification of anchor shells was not an acceptable solution because the ability of the anchor to perform its intended function was jeopardized. No actual violation of procedure had occurred in most cases however, because no installation procedure existed until 1972. These discrepancies were identified during the 79-02 sampling program which was considered to be only partial resolution to address the immediate concerns of the bulletin. By October of 1979, TVA had committed to performing an inspection of all accessible anchors. This information is found in a memorandum from G. R. Hall to J. L. Ingwersen dated August 8, 1985, the subject of which was a status update on NRC OIE Bulletins 79-02 and 79-14.

BFN Evaluation Philosophy

Several factors had to be considered by the ECTG as issues at BFN were evaluated. These factors were generally not a valid consideration during the evaluation process at the other three nuclear plants.

1. There was only one concern expressed specific to BFN. The other issues were determined to require evaluation based solely on the current generic use of SSDs, wedge bolts and grouted anchors as well as the existing criteria which govern the installation and inspection of these anchors at each of the four nuclear plants. A large majority of the concerns address issues either directly or indirectly related to G-32 and the enhancements and/or the changes to the criteria which govern TVA's concrete anchor program. Since a major portion of BFN plant construction was accomplished prior to the issuance of G-32, the changes and enhancements to G-32 and the TVA anchor program did not affect BFN during the construction process.

   The age of BFN was a factor, especially when the fact that plant construction was started in 1967 is considered and startup of the last unit (unit 3) was accomplished in 1976. These dates are especially significant when it is realized that TVA General Construction Specification G-32, considered to be the upper-tier criteria for concrete anchorages at all plants, was not issued until September of 1972.

   Therefore, the WBN-ECTG evaluation of the concrete anchorage issues at BFN were concentrated toward current programs being performed to evaluate and qualify existing concrete anchor installations. Historical aspects of BFN's anchor installation's during plant construction were, for the most part, not included in the evaluation process.

   SAMPLING PROGRAM BFEPC20431

   The expurgated employee concern file contained no additional information.

   CAR BFN-85-058 was initiated June 27, 1985 to identify potentially generic concrete expansion shell anchor deficiencies observed during walkdowns for NRC OIE Bulletin 79-14. These deficiencies included anchors pulling out of the wall, broken concrete and improper baseplate gaps.

As corrective action for this CAR, Sampling Program BFEPC20431 was initiated. Design Criteria BFN-50-795, "Browns Ferry Nuclear Plant Design Criteria for Evaluating Expansion Shell Anchors" was generated to provide instructions for engineering evaluation of expansion shell anchors installed to different criteria than the current requirements given in TVA General Construction Specification G-32. Since the current requirements of G-32 were not in place for the construction phase at BFN, existing anchor installations were not expected to meet the current requirements. Therefore, this acceptance criteria was used in evaluating existing anchors. This criteria only applies to anchors which are outside the scope of NRC-OIE Bulletin 79-02 and which were installed prior to the implementation of revision 6 to G-32.

The sample population was selected per BFN Engineering Project Instruction BFEP PI 86-01, "Selection of the Sample Population for the Concrete Expansion Shell Anchor Sampling Program." Sixty-four primary and 21 alternate safety-related Class I and Class II items (non 79-02) which were installed prior to February 27, 1981 were selected. These features are broken down as shown:

Mechanical Equipment	3 primary and 3 alternate
Electrical Equipment	3 primary and 3 alternate
Miscellaneous Steel	3 primary and 3 alternate
Conduit Supports	17 primary and 2 alternate
HVAC Duct Supports	8 primary and 2 alternate
Cable Tray Supports	8 primary and 2 alternate
Pipe Supports	14 primary and 6 alternate

These items were selected to provide a sampling of the various anchor sizes available (1/4-inch diameter through 7/8-inch diameter). This population contained wall, floor and ceiling installations.

These items were inspected per BF-MMI-159, "Sampling Inspection Program for Verifying Correct Installation of Concrete Expansion Shell Anchors." The items were inspected for baseplate gap, baseplate hole size, bolt

hole baseplate edge distance and concrete spalling. The anchors were inspected for bolt tightness, cone expander depth, shell recess, shell protrusion, bolt and shell thread engagement and spacing. Lead anchors were also identified per this inspection.

A total of seventy-one items were inspected, containing 315 total anchors. Nine 1/4-inch diameter anchors, 96 3/8-inch diameter anchors, 96 1/2-inch diameter anchors, 34 5/8-inch diameter anchors and 80 3/4-inch diameter anchors were inspected.

The results of this sample inspection program show 268 deficiencies identified. No items were found to have unacceptable baseplate gaps and no anchors were found to be undertightened. Thirty-three anchors were found to have unacceptable cone expander depth. Nine anchors had unacceptable shell projection and eight anchors had unacceptable shell recess. Thirty-four anchors were identified with improper thread engagement and fifty-one spacing violations were identified. Sixty-seven baseplate bolt holes were identified as being oversized. Forty-five cases of spalling concrete were identified. Twenty-one deficiencies were identified concerning baseplate edge to bolt hole distances.

These deficiencies are currently being evaluated by DNE. Lead anchors are also being evaluated by DNE. The DNE evaluation process is described below on a step-by-step basis for a worse case condition. If, after any step, the anchor is found to meet the requirements of that step, the anchor will be considered acceptable. These steps are as follows:

1. A reduced load capacity will be calculated for the anchor. The deficiency(s) identified for the anchor will be evaluated and the results used to reduce the load capacity.

2. The reduced load capacity will be used with the safety factor to determine anchor acceptability. BFN DNE onsite has requested CEB Central Staff to provide a safety factor which is less than the factor currently required. If this request is denied, a safety factor of five will be used.

3. The actual loading for each discrepant anchor for an item will be calculated. This actual loading will be used with the safety factor to determine anchor acceptability.

4. If all anchors for an item are unacceptable, then the total support scheme will be analyzed. If this analysis shows that the system functionality will not be affected by the failure of the support, the support and anchors will be determined to be acceptable.

5. If, after performance of the above calculations, the item and its anchors are still unacceptable, the initial sample will be expanded, as required by CAR 85-058. This will be done by category (mechanical equipment, pipe supports, conduit supports, etc.).

6. If this expanded sample cannot verify the acceptance of an item and its anchors, a 100-percent inspection/evaluation/repair (if necessary) will be performed on that specific category.

The completion of this process will assure the adequacy of the identified items and their anchors. Additional deficient anchor installations identified will be evaluated and dispositioned on a case-by-case basis. The results of the discussed sampling program will be justification to proceed in this manner as they will provide a statistical basis for the acceptance of the population and any deficiencies can be concluded as acceptable statistical deviations.

It was revealed by this evaluation that the sampling program discussed was to inspect anchor diameters 1/4-inch through 7/8-inch. However, no 7/8-inch diameter anchors were inspected. Conversation with responsible DNE engineers revealed that this occurrence was totally coincidental. The organizations responsible for supplying drawings for the sample simply did not include any drawings that contained 7/8-inch diameter anchors. These engineers also revealed that they were corresponding with the responsible organizations to acquire drawings that show 7/8-inch diameter anchors for inclusion in the sample. (CATD 11300-BFN-03)

This evaluation also revealed that concrete expansion anchors in nonsafety-related items were not included in any reinspection or reverification sample programs. Conversations with responsible DNE engineers revealed that no safety-related systems are located in the Turbine Building. The systems in the

Turbine Building are also non-seismic and non-QA. In the case of a seismic event, the Turbine Building and the systems contained therin are not required to assure a safe shutdown of the plant. Therefore, if the anchor installations in the Turbine Building are not 100-percent adequate, the resulting failures would be of no safety consequence.

BFN NRC OIE Bulletin 79-02 Program

The expurgated employee concern files contained no additional information.

Special Mechanical Maintenance Instruction (SMMI) 5.1-A was originally initiated in 1980 as the plant work instruction for verifying correct installation of concrete expansion anchors in units 1, 2 and 3. The scope of this instruction was to, "establish an inspection and repair program for concrete expansion anchors on all safety-related components and to provide a means of corrective action for those systems identified by NRC OIE Bulletin 79-02." This instruction included all inspection parameters required by 79-02 as well as an inspection data sheet for recording the inspection results for each baseplate and anchors. The SMMI also contained mechanism for correcting anchor installations where anchor integrity could not be verified. The 48W1241 series of drawings allowed additional anchors to be installed through plate straps and the original, unacceptable anchor left in place.

Browns Ferry Engineering Procedure-Project Instruction (BFEP-PI) 86-05 was initiated January 29, 1986 as the upper-tier program document for BFN resolution of NRC OIE Bulletins 79-02 and 79-14. Section 2.2 of PI 86-05 states, "inspection and reconciliation will be performed on all safety-related piping (TVA Class 1 Seismic) 2 1/2-inch in diameter and greater and to all safety-related piping regardless of size which was dynamically (rigorously) analyzed by computer. Those systems not covered under the scope of this program are those covered by the Long-Term Torus Integrity Program (LTTIP), the Control Rod Drive (CRD) insert and withdraw piping (ECNs P0880, P0859 and P0881) and

the CRD scram discharge piping (ECN P0392 and SMMI 14.4.1.3-L). Discussions with responsible DNE engineers at BFN revealed the reasons for excluding the Torus attached piping (LTTIP) and CRD piping from PI 86-05 were due to NRC OIE Bulletin 79-14 considerations.

The Torus attached piping is covered under the LTTI Program, Design Criteria BFN-50-D707 and DSC-1.7.1. Qualification of the piping system supports and anchors is not an interim qualification to a safety factor of 2, but qualification for full code compliance to safety factors of 4 for wedge bolts and 5 for SSDs. The same philosophy is true for CRD supports and anchors which are covered under the scope of Design Criteria DSC-1.7.1 and BFN-50-724. However, the anchors for these systems are, in fact, being inspected under the PI 86-05 program and SMMI 5.1-A. Therefore, the PI 86-05 program document is discrepant because it specifically excludes the LTTIP and CRD system from the scope of the program.
(CATD 11300-BFN-06)

The methodology being employed for concrete anchors installed in the torus attached piping system(s) and the CRD system(s) is as follows:

- The information detailed on the SMMI 5.1-A data sheets for the anchors in each support baseplate is transmitted to the DNE engineers in the LTTIP and CRD groups. These data sheets include the information for each anchor, as installed. Anchors found unacceptable per current G-32 installation/inspection criteria are repaired, as required, to comply with G-32. Therefore, the engineers can assume full anchor adequacy during their reanalysis.

- Because the 79-14 walkdowns have identified increased loadings for many supports, the anchors, as installed, may be inadequate with respect to qualification to a safety factor of 4 for wedge bolts and 5 for SSDs. In these cases, the support and/or anchors are modified as required or a completely new support is designed to be installed so as to achieve the required factor of safety.

Anchorages in pipe supports for other safety-related plant systems under the scope of 79-02 are also receiving 100-percent inspection as required by PI 86-05 and SMMI 5.1-A. The difference between the methodology being applied to these systems versus the Torus attached piping and CRD systems is the factor of safety. For the other safety-related plant systems, interim qualification of the support anchorages to a factor of safety of 2 is being performed. This interim qualification is described in the memorandum from G. R. Hall to J. L. Ingwersen dated August 8, 1985 (R25 850808 860). This document describes the BFN scope of work for resolution of NRC OIE Bulletins 79-02 and 79-14. It states that if the factor of safety on an anchorage was determined to be less than 5 but equal to or greater than 2, corrective action would be required as soon as practical. The "as soon as practical" was defined by BFN-DNE engineers as during the first outage after restart of unit 2 and prior to restart of units 1 and 3. These statements were based on NRC OIE Bulletin 79-02, Revision 1, Supplement 1, which states, "The design margins of four or five (factors of safety) are intended to be final design and installation objectives but systems may be classified as operable on an interim basis with some lesser margin providing a program of restoration to at least the Bulletin factors of safety has been developed. For the following two cases, plant operation may continue or may begin:

- For the support as a unit, the factor of safety compared to ultimate strengths is less than the original design but equal to or greater than two.

- For the anchor bolts, the factor of safety is equal to or greater than two and for the support steel, the original design factor of safety compared to ultimate strength is met.

For support anchorages on all safety-related piping systems under the scope of 79-02 equal to or less than 2-inch diameter, a sample program will be executed as required by BFEP PI 86-29. This sample will include 64 supports and qualification to a safety factor of 4 for wedge bolts and 5 for SSDs will be performed.

This is not a sample for interim qualification to a safety factor of 2. This sampling program will satisfy SCR BFNCEB 8520 recommendations for a walkdown of 2 inch and smaller seismic Class I field-routed pipe support installations. This SCR identified some baseplate and concrete anchor qualifications in the typical support details of design criteria BFN-50-712 that could not be verified. The SCR also addressed deficiencies which were not applicable to concrete anchorages. For statistical sampling purposes, zero failures in a population of 60 supports provides a 95 percent confidence level that less than five percent are defective. A detailed review of BFN Scope-of-Work Document BFPSWD 86-010, Evaluation of Baseplates/Anchorages of Piping Systems Installed to BFN-50-712, revealed the DNE assumption that if any of the sampled supports fail the analysis and acceptance criteria, a decision will be made to either expand the sample size or go to Phase II work. Phase II includes a consultant review of support configurations for qualification based on actual earthquake experience. If this effort fails to qualify the supports, Phase III work will be initiated. This phase includes modifications to the applicable supports as required.

A detailed review was performed of PI 86-29 (Procedure for Sampling of Class I Small Bore Piping). It was learned that this instruction addressed selection of the sample population, the areas to be sampled, alternate items for sample and qualification of walkdown personnel only. Discussions with site DNE engineers revealed that PI 86-29 was criteria only for selection of the sample population and did not address technical aspects such as inspection/acceptance criteria, independent (QC) verification, etc.. A SMMI/MMI is to be initiated by the site to detail the inspection and acceptance parameters of the sample program per PI 86-29. (CATD 11300-BFN-05)

Conversations with responsible DNE engineers at BFN revealed several significant facts as listed below:

- Browns Ferry Corrective Action Report (BF-CAR) 86-0214 was initiated October 23, 1986 to document existing deficiencies in walkdown instruction SMMI 5.1-A, Instruction and Repair Program for Verifying Correct Installation of Concrete Expansion Anchors, Units 1,2 and 3. This instruction was determined not to meet requirements for equipment, inspection and verification walkdowns. Specifically, SMMI 5.1-A did not specify minimum qualification or required training for walkdown personnel. No documented training existed for walkdown personnel as required by the American National Standards Institute (ANSI). The SMMI did not specify a requirement for independent or second party verification as required by ANSI. Also, the SMMI did not specify a requirement that each walkdown inspection package be uniquely numbered and each page subsequently numbered and the package validated as a lifetime QA record as required by ANSI. The CAR also identified two very minor discrepancies on specific anchor data sheets where anchor spacing dimensions on the data sheets were 1/4 inch and 3/16 inch, respectively, different from the as-installed dimension.
(CATD 11300-BFN-07)

The subject CAR was escalated to the Director of Nuclear QA on January 20, 1987, because BFN did not reply within the required 30 day time period.

- For the 100 percent reinspection exercises being performed per PI 86-05 for LTIIP and CRD system anchorages, obvious anchor deficiencies were repaired on a case-by-case basis. Because of frequent problems where repair was not possible due to support/anchor inaccessibility; new, redesigned supports were usually installed.

- For the 100 percent reinspection being performed per PI 86-05 on anchors in systems other than torus attached and CRD piping, two methodologies were employed. Prior to May, 1985, the data for anchors found to be deficient was evaluated by EN DES (DNE) to determine if the anchor would meet

interim acceptance criteria (safety factor of 2). If the anchor met the interim criteria the data was included in the applicable data package for further evaluation during Phase II of the program. Phase II will establish full code compliance with factors of safety of four for wedge bolts and five for SSDs. If the anchor did not meet interim qualification criteria, BFN Mechanical Modifications was notified and the anchor repaired/replaced. After May, 1985, the methodology changed so that anchors found to be deficient were repaired/replaced as they were identified. The philosophy was, "if you find a bad anchor, fix it."

- Modifications and Additions Instruction (M&AI) four (Bolt Anchors Set in Hardened Concrete), M&AI-23 (Support of Piping Systems in Category I Structures) and General Construction Specification G-32 are the criteria used to install and inspect supports/anchorages being installed, repaired and/or replaced as a result of the 100 percent reinspection programs.

However, no timeframe definitions could be determined with respect to what <u>existing</u> anchorages are being inspected under the scope of 79-02 and what <u>existing</u> anchorages were installed and inspected in accordance with M&AI-4, M&AI-23 and G-32. For the reinspection programs on anchorages not under the scope of 79-02, (i.e., per BFEP PI 86-01, MMI-159, DC BFN-50-795), the design criteria and the sampling program document BFEPC20431 each state that the criteria are applicable only to those existing anchorages installed prior to implementation of G-32, Revision 6, in February of 1981. No statement or other reference could be found on this subject in any document governing the reinspections on anchorages under the scope of 79-02. (CATD 11300-BFN-08)

Conclusion

This issue is factual and identifies a problem, but corrective action for the problem was initiated before this employee concerns evaluation of this issue was undertaken. The findings of this evaluation show that anchor installation deficiencies exist at BFN. However, with the inclusion of 7/8-inch diameter anchors in and completion of the

Table 4.7

Number of Anchors in Lot	Minimum Number to be tested
Less than 5	1
5 to 15	2
16 to 60	3
More than 60	5 percent

Site-specific requirements for selection of expansion anchors for inspection and testing are found in BNP-QCP-2.8 R 19, section 6.4.7, and are as follows:

Selection of Expansion Anchors for Inspection and Testing

Anchors to be inspected and tested in accordance with sections 6.4.3 and 6.4.5 shall be randomly selected from a lot after installation of the lot. If there is more than one size of anchor in the lot, selection of anchors shall be made without bias toward any size of anchor. The minimum number of anchors inspected and tested in each lot shall be as given in Table 6.4.7.

Table 6.4.7

Number of Anchors in Lot	Minimum Number to be tested
Less than 5	1
5 to 15	2
16 to 60	3
More than 60	5 percent

Since the above table does not take into account the number of separate attachments in a lot, the following table shall be used as a guide in determining the number of attachments from which the required tests are to be made.

Table 6.4.7 (a)

Number of Attachments in Lot	Number of Attachments From Which Tests are to be Made
1 - 4	1
5 - 15	2
16 - 25	3
26 - 40	4
41 & Over	10% rounded up

The findings of the ECTG element report C011306-SQN are applicable to BLN because the reference document of the report is General Construction Specification G-32, which is applicable to all TVA sites. This report concluded, with respect to tightening requirements of bolts in instrumentation panels, that bolts were installed in accordance with applicable G-32 criteria. This criteria does not require torquing of bolts in SSDs in any applications. The only anchors that require torquing are wedge bolts anchors. Both G-32 and BNP-QCP-2.8 require all wedge bolt anchors to be torqued, regardless of the features for which anchorage is being provided.

Interviews with cognizant Quality Control and craft personnel revealed no instances of bypassing testing and inspecting of anchors. In fact, an electrician foreman interviewed knew of an instance where a permanent feature was removed to allow testing of anchors.

These interviews also revealed that special permission from the appropriate Quality Control supervisor is required to allow prooftesting of anchors with the baseplate installed. This requirement is specified in BNP-QCP-2.8, section 2.2. Furthermore, section 6.4.4 of this procedure gives specific instructions for performing prooftest with a surface mounted plate in place.

Conclusion:

This issue is factually accurate, but what it describes is not a problem. This evaluation could not identify procedural violations or conditions adverse to quality.

4.4 Anchors Cut Off

4.4.1 Generic Applicability

The concerns addressed in this issue originated at WBN or SQN. However, the wording in some of the concerns indicate this problem exists at all TVA nuclear plants, therefore, this issue was evaluated at BLN and BFN as well as WBN and SQN.

4.4.2 Plant-Specific Applicability

4.4.2.1 Watts Bar Nuclear Plant

The expurgated employee concern file contained no additional information.

CAQR-M31 was written to identify the improper installation of concrete anchors in seismic pipe supports. Some anchors had been cut off in an attempt to facilitate installation and some anchor bolts had been welded to the baseplate. This was caused by lack of concern on the part of some individual craftsmen.

The corrective action for this CAQR required nonconforming all pipe supports with improperly installed concrete anchors, providing additional instructions for craftsmen, and increasing the number of anchors given full inspection to at least one anchor per hanger. Pipe supports installed by the craftsmen responsible for the improper installations were 100 percent inspected and spot checks were made on hangers installed by other craftsmen.

Upon initiation of the CAQR, immediate corrective action by site management (prior to implementation of the recommended corrective action outlined by the CAQR) included removal of individuals involved in the improper installations from pipe support work, additional training for responsible pipe support personnel and increased surveillance of installation activities.

The Assistant Construction Engineer documented the progress and results of the corrective action for CAQR-M31 with two memorandums from himself to the WBN Plant Files. The first of the memorandums, dated March 5, 1979, stated that the two two-man crews identified as installing altered concrete expansion shell anchors had installed approximately 26 pipe supports. These were 100 percent inspected and no further examples of improper installations were found. In addition, approximately 100 pipe supports installed by other crews were inspected. Nine of these supports had evidence of grinding/cutting on the shell/bolt. In all cases the anchors would still perform their intended function as indicated by acceptable proof load tests on several examples. All nine improperly installed anchors were replaced. The second memorandum, dated May 2, 1979, stated that an additional 200 pipe supports had been 100 percent inspected and no faulty anchors were found. At the time of CAQR-M31, 14,451 pipe supports had been installed. 4,400 (estimate) of these supports were not safety-related and 40 percent of the remaining 10,051 (4,020) were welded to an embedded plate. This leaves approximately 6,000 pipe supports with concrete anchors, over five percent of which were 100 percent inspected. This memorandum recommended

closing of the CAQR, which was accomplished June 5, 1979. However, further review of anchor documentation by the ECTG revealed 14 NCRs were initiated for CAQR-M31. These 14 NCRs (1345R, 1346R, 1347R, 1348R, 1384R, 1385R, 1386R, 1387R, 1388R, 1389R, 1390R, 1391R, and 1410R) identified supports which were found to have altered anchors. These NCRs were dispositioned to replace the altered anchors per G-32.

NCR 1956R was written to identify a lot (M-86) of anchors that was found to contain altered anchors. The disposition of this NCR was to retest the anchors in this lot to obtain a 95 percent confidence level. This was accomplished by one of the following methods:

- The anchor was proof load tested;

- The anchor was tested by methods developed by TVA to implement NRC OIE Bulletin 79-02;

- Identifying the anchor as being transferred for testing and tracking to NCR 1433R (documented deficient 1/2" Ø SSDs received from the manufacturer); or

- Investigating the pipe support to see if Field Change Request or Engineering Change Notice changes had resulted in the hanger being relocated or altered so as to cause the anchors to be relocated or eliminated.

NCR 2738R was initiated to identify four pipe supports in the Diesel Generator Building which contained altered anchors. These supports were reworked to replace the faulty anchors.

NCR 2902R, R1, was initiated to identify two pipe supports in the Diesel Generator Building installed with modified anchors. The faulty anchors were replaced per G-32.

NCRs 2789R, R0, (unit 1) and 3311R (unit 2) were initiated to identify improper installations of electrical supports in the Reactor Building (modified anchors is the only portion of this NCR that will be discussed). Revision 1 of NCR 2789 was written to add supports to the scope of this NCR. Revision 2 was written to reference other NCRs.

It was verbally agreed by the responsible DNE and DNC personnel involved to expand the scope of these NCRs to include the Control, Auxiliary, and Diesel Generator Buildings. This was agreed to due to the probability of this condition existing plant wide.

The disposition recommended by DNC and approved by DNE was to reinspect 100 percent of the supports identified. The anchor portion of the support reinspection was accomplished by performing a NRC-OIE Bulletin 79-02 type inspection on all the subject anchors. Anchors not meeting the requirements of this inspection were to be proof load tested. If they failed the proof load test, they were replaced.

The results of this reinspection effort were submitted to DNE for evaluation. The data was within the limits of the NRC-OIE Bulletin 79-02 and was accepted. No additional inspection work with respect to the concrete expansion anchors was required.

During this timeframe, additional reinspection and evaluation was being performed to satisfy the requirements of NCR 3747R (see section 4.3.2.1 of this report) and other NCRs open at this time. Upon completion of these NCRs, a major revision was made to WBN-QCP-1.14 (revision 8) to bring it up-to-date with G-32.

After this revision was made, DNC conducted a major retraining of all craft, engineering and inspection personnel to the requirements of WBN-QCP-1.14, R9. This retraining was completed in early 1982.

NCR 3487R was initiated to identify one concrete anchor for a civil platform that had been modified. This anchor was removed and replaced per G-32.

NCR 3514R was initiated to identify four pipe supports which were installed with altered anchors. These anchors were replaced per G-32.

NCR 3623R was initiated to identify three pipe supports installed with modified anchors. These anchors were replaced per G-32.

NCR 3742R was initiated to identify a civil platform where 14 of the 44 anchors installed were modified. These anchors were replaced per G-32.

NCR 3756R was initiated to identify a civil platform where one of the eight anchors installed had been modified. This anchor was replaced per G-32.

NCR 5752R, R1 was initiated to document air return fan supports not installed properly. One portion of this improper installation was modified anchors. These anchors were 100 percent reinspected and replaced per G-32 as required.

NCR 6949 was initiated to identify one anchor for an electrical conduit support installed improperly. This anchor was replaced per G-32.

It should be noted that the seven NCRs written after R9 of WBN-QCP-1.14 became effective, identified improper installations that were made prior to October of 1981. Revision 9 of WBN-QCP-1.14 and the associated retraining was done in early 1982.

NSRS Report I-85-437-WBN addressed Employee Concern IN-85-845-001 which identified modified anchors on instrumentation supports. NSRS evaluated this concern by reviewing procedures, upper-tier requirements, drawings, documentation, NCRs, TVA informal memorandums, and by interviewing knowledgeable personnel.

This NSRS evaluation identified problems with the installation and documentation of instrumentation anchors and supports. One area in question was the requirements for EA anchors. EA anchors are anchors where reduced allowable loads were designated by DNE. The other major problem area identified was the lack of traceability of instrumentation supports installation and inspection documentation. NSRS made seven recommendations concerning these problems.

NSRS recommendation I-85-437-WBN-01 stated that the requirements and intentions of G-32 should be evaluated by DNC and DNE.

DNE reviewed section 4.0 of G-32, "Inspection and Tests," and determined that the intended inspection requirements of EA anchors were adequately addressed.

DNC initiated FCR I-2514 to add a note to the 47A050 drawing series stating that an anchor exempted from proof loading by a DNE approved drawing is to be considered an EA anchor.

NSRS recommendation I-85-437-WBN-02 stated that WBN-QCP-1.14 should be revised to clarify inspection requirements given in paragraph 6.1.4.4 and to ensure that anchors are not omitted without DNE approval.

Paragraph 6.1.4.4 of WBN-QCP-1.14 defines the requirements for proof load testing anchors in a lot. It does not apply to anchors exempted from proof load testing when designated EA. An anchor designated as EA by DNE is exempt from certain, but not all, inspection requirements. No anchor is to be omitted from any inspections delineated by G-32 without approval by DNE.

WBN-QCP-1.14 was revised (R18) to clarify the inspection requirements for EA anchors and ensure that no anchors are omitted from inspections without DNE approval.

NSRS recommendation I-85-437-WBN-03 states that misinterpretations of requirements should be evaluated for impact on past inspections of completed anchor installations. Documentation per WBN-QCP-3.11 and -3.11-1 for instrumentation anchor inspections should be evaluated for compliance with procedures.

NCR 6578 was generated by Instrumentation Engineering to document possible misinterpretation by Instrumentation Quality Control personnel of the inspection requirements for EA anchors on past installations. This NCR was dispositioned to incorporate all inspection requirements for EA anchors from G-32 into applicable site procedures. Also, a sample of 60 supports was chosen randomly by DNE for inspection by DNC. The results of the sample show that two supports inspected did not meet minimum spacing requirements of G-32. These violations were submitted to site DNE for approval (CATD 11300-WBN-02). WBN-QCP-3.11-1 was revised (R7) to provide a detailed checklist listing each of the inspections required on bolt anchors whether or not designated EA.

NSRS recommendation I-85-437-WBN-04 recommended inspector retraining to ensure compliance with specifications and procedures.

All instrumentation quality control personnel were retrained, retested, and recertified to the applicable procedures after the procedures were revised to clarify requirements for EA anchors.

NSRS recommendation I-85-437-WBN-05 states that a sampling program on instrumentation supports should be performed to ensure that no anchors were omitted without DNE approval.

The corrective action supplied by DNE for NCR 6578 was performance of a sampling program.

NSRS recommendation I-85-437-WBN-06 states that instrumentation support documentation should be reviewed and evaluated for completeness and accuracy against current revisions of isometric drawings.

NCR W-334-P was initiated to identify these deficiencies. Walkdowns and evaluations are being performed per this NCR. (CATD 11300-WBN-01)

NSRS recommendation I-85-437-WBN-07 states that NCR 4297 should be reviewed for compliance with site procedures.

NCR 4297 was written to document missing instrumentation anchor documentation. As attachment A of this NCR states, the lot numbers on the NCR data sheets were either never used or were otherwise accounted for, except for lot number I-524. The unit supervisor determined that a nonconforming condition did not exist and the NCR was voided. However, the review required for determination of significance was not done within the specified time period. DNC reviewed the mishandling and subsequent voiding of this NCR and determined it to be an isolated case. To prevent recurrence of this problem a method for monitoring the current status of NCRs has since been implemented.

NSRS Reports I-85-656-WBN, I-85-323-WBN, I-85-528-WBN and I-85-684-WBN were enveloped into a single report. This report references NSRS Reports IN-85-037-001, I-85-437-WBN, and IN-85-020-001 for conclusions and recommendations.

NSRS Report I-85-143-001 references QTC Report IN-85-020-001 for conclusions and recommendations.

QTC Report IN-85-020-001 addresses concrete expansion shell anchors being cut off and deteriorated/rusted in unit 2 Reactor. A follow-up interview by QTC with the CI revealed that the CI felt that the massive amount of rework in unit 2 would correct any problems, but still doubted installations in unit 1. QTC then performed an investigation for unit 1.

This investigation revealed a heavy concentration of rust and corrosion on anchor bolts in the floor of the annulus area. (See section 4.5.2.1 of this report). This investigation also revealed several instances of improper installations. Four recommendations were made by this report.

QTC recommendation Q-85-020-001-01 addresses rusty anchors, covered in section 4.5.2.1 of this report.

QTC recommendation Q-85-020-001-02 states that all installed expansion anchors for Category I supports shall be inspected for minimum length and excessive plug depth. A detailed review of this QTC report revealed the minimum length referred to in this recommendation was for bolt length, not shell length.

The discrepancies identified exist because requirements for thread engagement and plug depth were not placed in G-32 until 1981. NCRs 3409R and 2789R provided an evaluation of these deficiencies. The anchors were accepted based on tests performed with thread engagements less than the one nominal bolt diameter requirement currently given in G-32.

QTC recommendation Q-85-020-001-03 states that the stress problem with anchor bolt holes out of alignment needs to be addressed.

This alignment problem occurred because the support identified by QTC shifted during removal of the bolts for anchor inspection. This occurrence does not represent a deficient condition.

QTC recommendation Q-85-020-001-4 recommends an evaluation of the impact the substantiated concerns of the QTC report may have had on the 79-02 walkdown and closure of NCRs 3409R and 2789R.

These substantiations did not affect the NCRs or the 79-02 program. The NCRs were written to identify and evaluate the discrepancies that were found by QTC. These types of discrepancies were also addressed by the 79-02 program.

NSRS report IN-85-037-001 references QTC report IN-85-037-001 for conclusions and recommendations.

QTC report IN-85-037-001 addresses anchors that were cut off after rebar was encountered during installation. This report makes four recommendations.

QTC recommendation Q-85-037-001-01 states that the WBN PMO should develop, implement and document the results of a sample program which complies with the requirements and intent of NRC Bulletin OIE 79-02.

As discussed in section 4.4.2.2 of this report, the 79-02 program for SQN has been accepted by the NRC. This inspection and sampling program at SQN was basically identical to that performed at WBN.

Furthermore, as stated in memorandums from David M. Verrelli, Chief, Reactor Projects Branch 1, Division of Reactor Projects, to H. G. Parris, Manager of Power and Engineering, dated February 15, 1985 (L44 850220 689) and from J. W. Hufham, Manager of Licensing and Regulations, to Dr. J. Nelson Grace, Regional Administrator, U.S. Nuclear Regulatory Commission Region II, dated May 17, 1985 (L44 850517 803), the NRC was satisfied that TVA's design verification work had provided reasonable assurance that there were no OIE Bulletin 79-02 related safety concerns which would preclude issuance of an operating license.

However, in order to provide complete assurance that the requirements of Bulletin 79-02 are met for WBN unit 1, a 100 percent review of all affected support calculations should be performed. This review was initially scheduled for completion before restart, after the first refueling outage. However, due to scheduling considerations, TVA has committed to complete this review before fuel load for unit 1.

Watts Bar Engineering Project Procedure WBEP-SEP-8[illegible]-02 is currently being written to perform this review and necessary re-evaluation (CATD 11300-WBN-04). Unit 2 supports were designed for compliance with the requirements of OIE Bulletin 79-02 and do not require further evaluation.

QTC recommendation Q-85-037-001-02 states that WBN DNC should revise WBN-QCP-1.14 to provide programmatic assurance for identifying deficient anchors as opposed to overreliance on the degree of "excessive inspection" by QC inspectors. Also, inspectors were to be provided with tools necessary for accurate inspection.

CAQR M-31 addressed the condition of expansion shell anchors and anchor bolts being altered in a manner to appear acceptable, but were in fact, incapable of performing their designed function. The CAQR resulted in the implementation of additional inspection points for anchorages.

Various problems were identified in the concrete anchorage program after the CAQR. Corrective actions for these problems have varied and include: training; retesting/recertification of inspection personnel; reinspection; rework; sampling programs; addition/deletion of inspection requirements; revision of upper-tier criteria and/or inspection procedures; and the issuance of a stop work order. None of the subsequent problems were repetitive of those identified in CAQR-M31. Procedural requirements are in accordance with upper-tier documents. The instruction of some quality control units to inspect more anchors than required is an administrative decision to enhance a quality program.

The "zeroing" of pipe support inspections lends credence to the pipe support anchorage program, which accounts for at least half of all anchorages installed. On January 21, 1980, NCR 2019R was issued against pipe supports in general for deficiencies other than concrete anchors. This NCR's corrective action required invalidation of existing support documentation per WBN-QCP-4.8 and issuance of a new procedure for the inspection/reinspection and documentation of pipe supports. WBN-QCP-4.23 was written and all previously inspected pipe supports were reinspected (including anchorages) and redocumented.

DNC quality control inspection personnel have tools to accurately inspect anchorages. A protractor type device or a carpenters square and ruler are available for measuring anchor perpendicularity.

DNC is convinced that the inplace anchor inspection program is both adequate and in accordance with upper-tier documents. Additionally, corrective actions have established an overall program resulting in a quality facility with respect to safety. DNC has expressed confidence that no changes to the current program are in order, nor are any further corrective actions required for past conditions.

QTC Recommendation Q-85-037-001-03 states that DNE should evaluate the results of the QTC report to determine if it is potentially reportable to the NRC.

DNE and DNC agree that, based on the responses to the two previously discussed recommendations, this report is not reportable to the NRC. DNE and DNC functions with respect to concrete expansion anchors have been and are in compliance with procedural requirements, good engineering and good quality control practices.

All installed seismic pipe support anchors are documented in accordance with procedural requirements, or, when deficiencies are identified, on NCRs. Other discipline features are documented in the same manner.

QTC Recommendation Q-85-037-001-04 states that DNE should determine if a similar inadequate sample inspection program was used at SQN or BFN.

DNE denies that an inadequate sampling program was used at WBN. This report supports that denial.

The inspection and sampling program for 79-02 at SQN was basically identical to WBN. Both programs have been accepted (WBN's with the exceptions noted) by the NRC. BFN is performing a 100 percent inspection because G-32 had been in place for only a portion of plant construction. Some modified installations have been identified.