

TVA EMPLOYEE CONCERNS
SPECIAL PROGRAM

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TITLE: Anchorages

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To incorporate TAS and SRP comments and line management response. Revision 1

To incorporate NRC and SRP comments, line management response(s) and finalize report. Revision 2

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3091T and 3248T

Preface, Glossary, and List of Acronyms
for ECTG Subcategory Reports

HISTORY OF REVISION

REV NUMBER	PAGES REVISED	REASON FOR CURRENT REVISION
3	i	To clarify that one or more attachments will help the reader find where a particular concern is evaluated

Preface

This subcategory report is one of a series of reports prepared for the Employee Concerns Special Program (ECSP) of the Tennessee Valley Authority (TVA). The ECSP and the organization which carried out the program, the Employee Concerns Task Group (ECTG), were established by TVA's Manager of Nuclear Power to evaluate and report on those Office of Nuclear Power (ONP) employee concerns filed before February 1, 1986. Concerns filed after that date are handled by the ongoing ONP Employee Concerns Program (ECP).

The ECSP addressed over 5800 employee concerns. Each of the concerns was a formal, written description of a circumstance or circumstances that an employee thought was unsafe, unjust, inefficient, or inappropriate. The mission of the Employee Concerns Special Program was to thoroughly investigate all issues presented in the concerns and to report the results of those investigations in a form accessible to ONP employees, the NRC, and the general public. The results of these investigations are communicated by four levels of ECSP reports: element, subcategory, category, and final.

Element reports, the lowest reporting level, will be published only for those concerns directly affecting the restart of Sequoyah Nuclear Plant's reactor unit 2. An element consists of one or more closely related issues. An issue is a potential problem identified by ECTG during the evaluation process as having been raised in one or more concerns. For efficient handling, what appeared to be similar concerns were grouped into elements early in the program, but issue definitions emerged from the evaluation process itself. Consequently, some elements did include only one issue, but often the ECTG evaluation found more than one issue per element.

Subcategory reports summarize the evaluation of a number of elements. However, the subcategory report does more than collect element level evaluations. The subcategory level overview of element findings leads to an integration of information that cannot take place at the element level. This integration of information reveals the extent to which problems overlap more than one element and will therefore require corrective action for underlying causes not fully apparent at the element level.

To make the subcategory reports easier to understand, three items have been placed at the front of each report: a preface, a glossary of the terminology unique to ECSP reports, and a list of acronyms.

Additionally, at the end of each subcategory report will be a Subcategory Summary Table that includes the concern numbers; identifies other subcategories that share a concern; designates nuclear safety-related, safety significant, or non-safety related concerns; designates generic applicability; and briefly states each concern.

Either the Subcategory Summary Table or another attachment or a combination of the two will enable the reader to find the report section or sections in which the issue raised by the concern is evaluated.

The subcategories are themselves summarized in a series of eight category reports. Each category report reviews the major findings and collective significance of the subcategory reports in one of the following areas:

- management and personnel relations
- industrial safety
- construction
- material control
- operations
- quality assurance/quality control
- welding
- engineering

A separate report on employee concerns dealing with specific contentions of intimidation, harassment, and wrongdoing will be released by the TVA Office of the Inspector General.

Just as the subcategory reports integrate the information collected at the element level, the category reports integrate the information assembled in all the subcategory reports within the category, addressing particularly the underlying causes of those problems that run across more than one subcategory.

A final report will integrate and assess the information collected by all of the lower level reports prepared for the ECSP, including the Inspector General's report.

For more detail on the methods by which ECTG employee concerns were evaluated and reported, consult the Tennessee Valley Authority Employee Concerns Task Group Program Manual. The Manual spells out the program's objectives, scope, organization, and responsibilities. It also specifies the procedures that were followed in the investigation, reporting, and closeout of the issues raised by employee concerns.

ECSP GLOSSARY OF REPORT TERMS*

classification of evaluated issues the evaluation of an issue leads to one of the following determinations:

- Class A: Issue cannot be verified as factual
- Class B: Issue is factually accurate, but what is described is not a problem (i.e., not a condition requiring corrective action)
- Class C: Issue is factual and identifies a problem, but corrective action for the problem was initiated before the evaluation of the issue was undertaken
- Class D: Issue is factual and presents a problem for which corrective action has been, or is being, taken as a result of an evaluation
- Class E: A problem, requiring corrective action, which was not identified by an employee concern, but was revealed during the ECTG evaluation of an issue raised by an employee concern.

collective significance an analysis which determines the importance and consequences of the findings in a particular ECSP report by putting those findings in the proper perspective.

concern (see "employee concern")

corrective action steps taken to fix specific deficiencies or discrepancies revealed by a negative finding and, when necessary, to correct causes in order to prevent recurrence.

criterion (plural: criteria) a basis for defining a performance, behavior, or quality which ONP imposes on itself (see also "requirement").

element or element report an optional level of ECSP report, below the subcategory level, that deals with one or more issues.

employee concern a formal, written description of a circumstance or circumstances that an employee thinks unsafe, unjust, inefficient or inappropriate; usually documented on a K-form or a form equivalent to the K-form.

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evaluator(s) the individual(s) assigned the responsibility to assess a specific grouping of employee concerns.

findings includes both statements of fact and the judgments made about those facts during the evaluation process; negative findings require corrective action.

issue a potential problem, as interpreted by the ECTG during the evaluation process, raised in one or more concerns.

K-form (see "employee concern")

requirement a standard of performance, behavior, or quality on which an evaluation judgment or decision may be based.

root cause the underlying reason for a problem.

*Terms essential to the program but which require detailed definition have been defined in the ECTG Procedure Manual (e.g., generic, specific, nuclear safety-related, unreviewed safety-significant question).

Acronyms

AI	Administrative Instruction
AISC	American Institute of Steel Construction
ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BFN	Browns Ferry Nuclear Plant
BLN	Bellefonte Nuclear Plant
CAQ	Condition Adverse to Quality
CAR	Corrective Action Report
CATD	Corrective Action Tracking Document
CCTS	Corporate Commitment Tracking System
CEG-H	Category Evaluation Group Head
CFR	Code of Federal Regulations
CI	Concerned Individual
CMTR	Certified Material Test Report
COC	Certificate of Conformance/Compliance
DCR	Design Change Request
DNC	Division of Nuclear Construction (see also NU CON)

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DNE Division of Nuclear Engineering
DNQA Division of Nuclear Quality Assurance
DNT Division of Nuclear Training
DOE Department of Energy
DPO Division Personnel Officer
DR Discrepancy Report or Deviation Report
ECN Engineering Change Notice
ECP Employee Concerns Program
ECP-SR Employee Concerns Program-Site Representative
ECSP Employee Concerns Special Program
ECTG Employee Concerns Task Group
EEOC Equal Employment Opportunity Commission
EQ Environmental Qualification
EMRT Emergency Medical Response Team
EN DES Engineering Design
ERT Employee Response Team or Emergency Response Team
FCR Field Change Request
FSAR Final Safety Analysis Report
FY Fiscal Year
GET General Employee Training
HCI Hazard Control Instruction
HVAC Heating, Ventilating, Air Conditioning
II Installation Instruction
INPO Institute of Nuclear Power Operations
IRN Inspection Rejection Notice

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L/R	Labor Relations Staff
M&AI	Modifications and Additions Instruction
MI	Maintenance Instruction
MSPB	Merit Systems Protection Board
MT	Magnetic Particle Testing
NCR	Nonconforming Condition Report
NDE	Nondestructive Examination
NPP	Nuclear Performance Plan
NPS	Non-plant Specific or Nuclear Procedures System
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission
NSB	Nuclear Services Branch
NSRS	Nuclear Safety Review Staff
NU CON	Division of Nuclear Construction (obsolete abbreviation, see DNC)
NUMARC	Nuclear Utility Management and Resources Committee
OSHA	Occupational Safety and Health Administration (or Act)
ONP	Office of Nuclear Power
OWCP	Office of Workers Compensation Program
PHR	Personal History Record
PT	Liquid Penetrant Testing
QA	Quality Assurance
QAP	Quality Assurance Procedures
QC	Quality Control
QCI	Quality Control Instruction

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QCP	Quality Control Procedure
QTC	Quality Technology Company
RIF	Reduction in Force
RT	Radiographic Testing
SQN	Sequoyah Nuclear Plant
SI	Surveillance Instruction
SOP	Standard Operating Procedure
SRP	Senior Review Panel
SWEC	Stone and Webster Engineering Corporation
TAS	Technical Assistance Staff
T&L	Trades and Labor
TVA	Tennessee Valley Authority
TVTLC	Tennessee Valley Trades and Labor Council
UT	Ultrasonic Testing
VT	Visual Testing
WBECSP	Watts Bar Employee Concern Special Program
WBN	Watts Bar Nuclear Plant
WR	Work Request or Work Rules
WP	Workplans

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EXECUTIVE SUMMARY

11300 - Anchorages

SUMMARY OF ISSUES

There are a total of 57 concerns in this subcategory which were grouped into six issues. These issues are categorized as follows: Design of Anchors, Damage to Concrete/Rebar, Anchors Cut Off, Testing of Anchors, Installation of Anchors and Visual Failure of Anchors. The summary of the issues, as categorized, is that concrete expansion type anchors are inadequate for use at TVA nuclear plants, concrete and/or rebar has been damaged during the anchor installation process and anchors have been altered in various ways to give the appearance of an acceptable installation. Also, concrete expansion type anchors have been incorrectly installed and tested as well as having been allowed to rust and/or corrode after installation. Each of the issues was determined to be nuclear safety-related. The number of concerns expressed by issue is as follows: Design of Anchors - 2, Damage to Concrete/Rebar - 10, Anchors Cut Off - 29, Testing of Anchors - 8, Installation of Anchors - 7, and Visual Failure of Anchors - 2.

MAJOR FINDINGS

The evaluation revealed corporate deficiencies in upper-tier criteria and site procedures with respect to the tightening of bolts installed in self-drilling expansion shell anchors (SSDs). Concrete anchor bolt installation and inspection methodology was determined to be inadequate and bolt overtightening may have resulted. Also revealed was insufficient and ineffective training, especially at the craft level, on the applicable bolt tightening procedure(s). Another corporate deficiency was identified in that upper-tier criteria did not contain specific requirements to insure SSD anchor shells did not contact the base plate during proof load testing although the necessary methodology was a standard recognized practice at each nuclear plant.

At BFN, major programs are in progress to address the requirements of NRC OIE Bulletin 79-02. Concrete anchor inspections are still being performed and deficient anchors are being repaired, replaced or qualified. However, a deficiency was identified with respect to there not being an independent verification of inspections performed on anchorages under the scope of 79-02. At WBN, a 100-percent review is required for all concrete anchor calculations performed for unit 1 in response to Bulletin 79-02.

At SQN, it was found that the cumulative effects of cut and/or damaged rebar had not been evaluated. Also, documentation for cut/damaged rebar in specific areas was found to be inadequate. However, this issue is being evaluated from a generic standpoint by the ECTG Engineering Category. Therefore, no further evaluation was performed on this issue by the Construction Category. A side issue was identified with respect to the qualification and use of R1w1 self-drilling anchors at SQN. The specific details of this deficiency are addressed in the Construction Category, Subcategory Report 10400 on Embeds.

4349T

It should be noted that corrective actions had already been initiated or were being developed in almost every instance where an employee concern had identified a deficiency.

COLLECTIVE SIGNIFICANCE OF MAJOR FINDINGS

Due to the deficiencies identified in upper-tier criteria on bolt tightening, plant safety is indeterminate because a potential unanalyzed condition exists with respect to the effects of overtightened bolts on the anchor installation.

For the upper-tier criteria deficiency on anchor shells contacting the baseplate during proof load testing, the evaluation determined plant safety was not affected.

For BFN, completion of the current inspection/qualification programs for concrete anchors is required before plant safety can be effectively evaluated. Additional inspections may be required as a result of the deficiency on the lack of independent verification. At WBN, it was determined that the 100-percent review of anchorage calculations did not represent a potential condition that would be adverse to plant safety.

Significant improvements have been made in all aspects of concrete anchor installation, testing and inspection, especially since the issuance of NRC OIE Bulletin 79-02. For a program that has been subject to an evolutionary process in the nuclear industry, TVA has exhibited the ability to install, test and inspect concrete anchorages effectively. With the exception of the deficiencies noted, the evaluation served to verify the overall adequacy and effectiveness of the TVA concrete anchor program.

CAUSE OF MAJOR FINDINGS

The evaluation concluded that the upper-tier criteria and program document deficiencies represent either procedural inadequacies or, on a larger scale, a managerial failure to recognize inadequate procedures. In addition, the evaluation revealed a failure by management to recognize both insufficient and ineffective training programs.

CORRECTIVE ACTION ON MAJOR FINDINGS

It was found that corrective actions had already been completed for the large majority of problems and corrective actions were in process on other identified problems.

For the deficiency on concrete anchor bolt tightening, the applicable upper-tier criteria is being revised to clarify and improve bolt installation and inspection criteria. Laboratory tests will be performed to evaluate the effect of bolt overtightening on the anchor installation. More comprehensive employee training programs will also be implemented. For the deficiency identified on anchor shells potentially contacting the base plate during proof

load testing, the applicable upper-tier criteria will be revised to specifically require pull tests to be performed before base plate installation whenever possible and shimming of the base plate when through-the-plate proof tests are performed. Also, a review will be performed on existing installations to evaluate the condition identified by this potential deficiency. For the BFN deficiency on the lack of independent verification, the necessary corrective actions are still under consideration.

Note: See Executive Summary Table #1 for Issue Evaluation.

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	NS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Design of Anchors	X		3 separate evaluations were conducted and each concluded that the concern was not factual based on industry standards and historical G-32 pull test data.	N/A	None	N/A	Deficiencies exist in upper-tier criteria, site procedures and employee training.
Damage to Concrete/ Rebar	X		WBN and BLN have fully adequate programs in place to identify and repair as necessary damage to concrete or rebar. SQN has no program to evaluate cumulative effect of rebar cut/damage. Also, no documentation was retained by the site to evaluate specific areas designated by DNE for cutting rebar. This issue is being addressed by the Engineering Category from a generic standpoint.	Failure to retain applicable drawings and/or documentation.	No corrective action is required by this evaluation. Any corrective action will be handled by the Engineering Category.		It should be noted, however, that TVA's concrete anchor program has been an evolutionary process and vast improvements have been made during what can be described as a constantly changing environment. This is supported by the fact that many corrective actions by the sites were complete or in process for the majority of problems

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	NS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Testing of Anchors	X		<p>Many problems were identified and corrected before the ECTG evaluation at WBN. The current problems identified by this evaluation had already been identified by site personnel and corrective action had already been initiated.</p>	<p>Failure by DNC to correctly implement upper-tier criteria in site procedures.</p>	<p>Revise NCR 6674, complete action required by NCR W-519-P, complete and close SCR 6649S.</p>	<p>Problems identified during this evaluation were either previously identified and corrected or corrective action was being performed.</p>	<p>identified by this evaluation. Improvements are still being made and the program enhanced as required but</p>
			<p>This issue was factual at SQN and understrength surface concrete in the annulus area was identified by NCR 72D. The disposition of this NCR was not implemented correctly.</p>	<p>Failure to follow procedure in correctly implementing disposition of NCR 72D.</p>	<p>SMI-2-317-24 and work plan 11963 were written to correctly implement the disposition of NCR 72D. 1130 anchors were proof load tested and bad anchors were replaced.</p>	<p>The NCR was closed when the disposition had not been fully implemented.</p>	<p>further improvements in upper-tier criteria and site procedure specificity as well as</p>
			<p>This issue was factual at BFN and 100% inspection of anchors under the scope of NRC OIE Bulletin 79-02 and sampling program BFEP20431 for anchors not under the scope of 79-02 are currently being performed. Problems with the 79-02 program were identified during a QA audit.</p>	<p>Lack of adequate installation and inspections criteria during BFN plant construction. Failure to follow procedures.</p>	<p>100% inspection of 79-02 anchors per PI 86-05 and SMMI 5.1-A. Sample programs for non-79-02 anchors per 86-01 and MMI-159. Anchors for small bore piping will be sampled per PI 86-29. Completion of BFN-CAR-86-214 will resolve discrepancies identified during the QA audit.</p>	<p>Upper-tier criteria and site specific procedures were not in place during the majority of plant construction at BFN.</p>	<p>training is needed. The deficiency identified with respect to bolt tightening was the only area that would cause plant suitability for service to be indeterminate.</p>

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	INS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Testing of Anchors (continued)			This issue was factual but did not identify problems at BLN. No programmatic deficiencies or conditions adverse to quality were identified.	N/A	None	None	
Anchors Cut-Off	X		This issue was factual at WBN. Numerous NCRs had previously been written and corrective action completed. The current problems identified by this evaluation had already been identified by WBN and corrective action was in process.	Failure to follow procedure and lack of training of craftsmen.	Completion of NCR 6578, completion of NCR W-334-P, and 100-percent review of design calculations for supports under the scope of NCR OIE Bulletin 79-02.	Problems identified during this evaluation were either previously identified and corrected or corrective action was being performed.	
			Various discrepancies were identified in the anchor program at SQN. However, none of these discrepancies were generic or identified significant program breakdowns. The 79-02 program is complete and accepted by the NRC.	Inadequate procedures, and lack of upper tier criteria.	Rev. of spec. drawings to preclude the future use and document the past use of leveling nuts. Revise M&AI 10 to fully incorporate all G-32 criteria.	The fact that discrepancies existed in SQN's anchor program did not impact the overall adequacy of concrete anchor installations as evidenced by NRC acceptance of SQN's 79-02 program.	

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	NS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Anchors Cut-Off (Continued)			This evaluation did not specifically address altered anchors on past installations because of the timeframe of construction at BFN. See Testing of Anchors for detailed information on current programs for verifying the existing anchorages. Currently, M&AI-4 is adequate to ensure proper anchor installation.	N/A	N/A	N/A	
			Only one instance of altered anchors was found at BLN. Corrective action, up to and including disciplinary action, had already been completed. No other instances of altered anchors were identified. BLN's site procedures are fully adequate to insure proper anchor installation.	Failure to follow procedures by the specific craftsman. This was an isolated case.	N/A	N/A	

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	NS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Visual Failure of Anchors	X		This issue was found at WBN, BLN, and BFN. These three plants identified a potential problem with rusty anchors. Although DNE does not feel this is a significant problem, this issue needs to be addressed, possibly from a maintenance perspective, at all TVA sites.	Anchor exposure to high humidity, standing water, & by hypochlorite cause corrosion and/or rusting.	DNE will evaluate this condition at the corporate level.	Even though testing and analysis have verified bolt integrity a potential problem exists from a maintenance/modification stand point (i.e. a rusty bolt seizing in a SSD shell, causing the shell to be replaced).	
Installation of Anchors	X		This issue was factual at all plants. Two corporate problems as well as site specific problems were identified.				
			Inconsistencies were identified at all plants with respect to bolt tightening into SSDs. Upper tier criteria and site procedures do not require proof load tests prior to baseplate installation or shimming of the baseplate when thru-the-plate proof load tests are performed.	Craftsmen overtightening bolts in SSDs and revision of G-32. Inadequate procedures and upper tier criteria.	Lab tests and engineering evaluation on the effect of overtightening bolts in SSDs and revision at G-32. Additional training will be conducted. Revision of G-32 and site procedures.	This problem was previously identified by PIR WBN-CEB 8644 and not properly evaluated.	

ANCHORAGES

Executive Summary Table #1

ISSUES	SR	NS	FINDINGS	CAUSE	CORR ACT.	SIGNIFICANCE	COLLECTIVE SIGN.
Installation of Anchors (Continued)			NCR GEN QAB 8203 R1 was written to identify potential anchor spacing violations at all sites. All sites except BFN have performed samples and any required corrective action has been performed.	This NCR has been open for five years and BFN has still not performed the required corrective action(s).	Sample program will be performed at BFN and any corrective action required will be completed and the NCR can then be closed.	Ineffective coordination/communication and disregard for timeliness in resolving documents deficiencies.	

1.0 CHARACTERIZATION OF ISSUES

1.1 Introduction

This subcategory report of the Construction Category addresses 57 employee concerns which contain issues involving concrete anchorages. These concerns were grouped into the following six issues:

- Design of Anchors
- Damage to Concrete/Rebar
- Testing of Anchors
- Anchors Cut Off
- Visual Failure of Anchors
- Installation of Anchors

Each of the employee concerns addressed by this subcategory are either directly related to or associated with nuclear safety issues.

1.2 Description of Issues

1.2.1 Design of Anchors

Two concerns were expressed that questioned the overall adequacy, suitability, and safety of redhead type concrete anchors (concrete expansion shell anchors-Shell Self Drilling (SSD)). Concern IN-86-200-003 stated that potential honeycombing of concrete around redhead type anchors would render the installation unsafe. Concern PH-85-002-009 questioned the suitability of redhead type anchors for nuclear plant use because these type anchors had been replaced at other TVA non-nuclear sites.

1.2.2 Damage to Concrete/Rebar

Ten concerns were expressed which identified areas and/or instances where steel reinforcing bar (rebar) was cut or damaged, where abandoned anchors/anchor holes were not grouted or repaired, where drilling of concrete was done and in some cases, rebar was encountered but required documentation was not initiated. Concerns IN-85-232-001,

PH-85-003-021, IN-85-469-002 and IN-85-520-004 each address issues concerning the cutting/damaging of rebar without proper documentation or without evaluation being performed on the installation. Concern IN-85-680-001 addressed a specific instance in a specified location where rebar was cut. Concerns IN-85-625-002, IN-85-664-001, IN-86-221-001 and SQP-5-005-002 each address installations where abandoned anchors were not removed before the holes were grouted or anchors were removed and the abandoned holes were not grouted (Note: At SQN, the issue of Damage to Concrete/Rebar is being addressed from a generic standpoint by the Engineering Category, Subcategory Report 25000). Concern BNP QCP 10.35-8-7 identified an instance at Bellefonte Nuclear Plant (BLN) where concrete pulled out of the wall when redheads were removed from a specific location.

1.2.3 Testing of Anchors

Eight concerns were expressed on issues which related to the testing of concrete anchors. Concerns IN-85-285-002 and IN-86-190-003 address the fact that concrete (SSD) anchors are tested by methods which allow less than 100 percent of the anchors to be tested. Concerns IN-85-339-003, XX-85-023-001 and IN-85-339-004 address specific instances where craftsmen were instructed to bypass or ignore pull test requirements and/or hold points assigned for anchor test purposes or pull tests were bypassed by the responsible QC organization. Concern IN-85-947-004 addressed a specific incident where an improper size pull test gauge was used.

Concern IN-85-347-007 addressed the fact that there was no procedural requirement to torque bolts installed in instrument panels and concern IN-85-947-002 addressed torque verification methods for redheads. The issue of anchor testing has also been addressed by the QA/QC category.

1.2.4 Anchors Cut Off

Thirty concerns were expressed on issues which were related to concrete expansion shell (SSD) anchors. In most cases, the allegations addressed the fact that the anchor(s) had been altered in some fashion. Concerns BNP QCP-10.35-3, HI-85-020-N02, HI-85-073-N04, IN-85-020-001, IN-85-037-001, IN-85-055-002, IN-85-246-003, IN-85-285-001, IN-85-285-003, IN-85-339-001, IN-85-439-001, IN-85-982-001, IN-86-140-002, IN-86-177-001, IN-86-219-001, IN-86-294-002, PH-85-054-N03, SQP-5-005-001, SQP-5-005-003 through SQP-5-005-007, WI-85-011-001 and XX-85-010-001 were expressed on installations where concrete anchors had been altered to fake

acceptable anchorage. Concern PH-85-035-007 was expressed on undersize anchors being used on a specific WBN system. Concerns WI-85-004-002 and XX-85-010-N02 were expressed on some aspect of TVA's program to answer the NRC Office of Inspection and Enforcement (OIE) Bulletin 79-02.

One concern was expressed which identified altered unistrut installations in one specific system at Watts Bar Nuclear Plant (WBN). This concern, IN-85-845-001, specifically addressed altered anchorages in unistrut supports on sampling system 43. The concern further states that this system was rerouted and the problem corrected but questions the installations in other plant systems.

1.2.5 Visual Failure of Anchors

Two concerns were expressed on concrete expansion shell anchors where the bolts were rusted/corroded. Concern IN-85-020-001 addressed deteriorated and rusted installations in the unit 2 annulus area at WBN. Concern BNP QCP-10.35-8-8 addressed a specific location at BLN where rusted redheads were removed.

1.2.6 Installation of Anchors

Seven concerns were expressed on the parameters that govern concrete expansion anchor installation. Concerns HI-85-113-002 and PH-85-002-026 were expressed in general terms, each stating that concrete anchors had been improperly installed throughout WBN. Concern IN-86-115-001 addressed the overtightening of redhead anchors during the installation process to close gaps behind baseplates. Concern IN-86-262-005 addressed potential inadequate thread engagement on SSD bolts installed in cable tray supports. Concern BNP QCP-10.35-8-23 addressed spacings between SSDs, specifically, old anchors installed before more stringent General Construction Specification (G-32) spacing requirements were implemented. Concern BNP QCP-10.35-8-29 addressed the drilling of holes for SSDs and wedge bolts before obtaining the proper documentation to control the work. Concern BFN-IESC-85-01, a Browns Ferry Nuclear Plant (BFN) specific concern, was expressed on embedment of replacement wedge bolts detailed on an identified BFN drawing.

2.0 SUMMARY

2.1 Summary of Issues

The overall perceived problem expressed by the employee concerns in this subcategory is that concrete expansion anchors have been incorrectly installed and tested, altered in various ways to fake acceptable installation and allowed to rust/corrode after installation. Also addressed is damage to concrete and rebar during the installation process, altered anchors installed in unistrut and redhead type anchors being inadequate for use in TVA nuclear plants.

The issues raised by the employee concerns contained in this subcategory report are summarized as follows:

- a. Redhead type concrete anchors are unsuitable and potentially unsafe for use at TVA nuclear plants. The concern expressed with respect to redheads being unsafe was based on potential "honeycombing" of concrete (concrete with voids, air pockets, etc.) around the expansion plug portion of the anchor. The concern expressed on the suitability of redhead type anchors was based on the fact that these type anchors had been declared unsuitable for use and replaced at other TVA non-nuclear sites.
- b. Holes for installation of concrete expansion anchors have been drilled without appropriate documentation. Several cases were identified where rebar was cut during the drilling process but was not documented as required. Also identified was a lack of consistency with respect to the documentation required and process employed when rebar was cut during the drilling process. In addition, several instances were identified where abandoned SSDs were filled with grout without removing the expansion shell portion of the anchor. One specific instance was addressed where concrete pulled out of the wall when redheads were removed.
- c. Pull tests for concrete expansion shell anchors were not performed properly and were bypassed in some cases, to include the bypassing of inspection hold points for pull tests. Other issues include conflict between the wording of criteria which governed specific anchor testing practices and the manner in which these criteria were applied in the field during the anchor testing process. The gauge used to verify the amount of pressure applied during a specified pull test operation registered only 3000 pounds but the required test pressure in

improperly trained to the applicable G-32 criteria. Bolt thread engagement for cable tray supports where only one or two threads on the bolt were engaged was addressed. These bolts may have already been torqued. At Bellefonte Nuclear Plant (BLN), the spacing requirements between installed anchors and adjacent anchors, unistrut, embedded plates, etc., were questioned. Specifically, the spacings of older SSDs installed prior to minimum spacings being implemented into G-32. In addition, the drilling of holes to install anchors was being completed before initiation of the appropriate paperwork (Work Releases). At BFN, wedge bolts installed in accordance with details on drawing 48W1241-1 could have insufficient embedment.

- f. Rusted and deteriorated anchors is the subject addressed under the heading of Visual Failure of Anchors. Redhead type anchors were identified in a specified location as being rusted and deteriorated. Also, rusted anchors were removed from a specified location.

2.2 Summary of Evaluation Process

The issues under the heading of Anchorages were evaluated by reviewing information contained in the expurgated employee concern files, site procedures, the applicable upper-tier criteria governing the installation/testing of concrete expansion anchors, NRC OIE Bulletin 79-02 and the sampling, qualification and inspection programs subsequent to this bulletin. Field evaluations were performed as required to verify generic and specified anchor installations. Nuclear Safety Review Staff (NSRS) investigation reports and Quality Technology Corporation (QTC) investigation reports were reviewed for content and findings as well as the responses to these investigation reports by the responsible organization(s). Employee interviews were conducted as required to evaluate the issues raised by the employee concerns. When required, applicable drawings/drawing notes, tolerance drawings and inspection reports were also reviewed to obtain specific information.

2.3 Summary of Findings

The concerns relating to concrete anchorages that were determined to be factual encompassed approximately 70 percent of the total number of concerns expressed. A number of the concerns could not be verified as factual (approximately 30 percent) and others were verified as factual but did not identify a condition adverse to quality (CAQ) or specific deficient area (approximately 19 percent). Approximately 49 percent of the concerns expressed were verified as factual and identified a quality related deficiency of

some type on concrete anchorages. However, of this 49 percent, only 11 percent (approximate) identified quality related deficiencies that had not been previously identified. Therefore, corrective action had already been assigned or was being determined by the responsible organization(s) for the majority of the concerns identifying a deficient area on concrete anchorages.

Summary of Findings by Issue

2.3.1 Design of Anchors

The issues were determined not to be factual. The evaluations provided fully adequate answers for this issue and were applicable to all TVA Nuclear Plants.

2.3.2 Damage to Concrete/Rebar

This issue was factually accurate, but what it describes was not a problem. For one concern, the condition described was determined to be true and potentially identified violation of a site procedure. However, procedural QC requirements were sufficient to have prevented the occurrence of a condition adverse to quality. Other concerns expressed could not be verified as being factual.

2.3.3 Testing of Anchors

This issue was factual and presents a problem for which corrective action has been, or is being taken as a result of this employee concern evaluation. However, some concerns were factual but corrective actions had already been initiated as required. Other concerns were factually accurate but did not identify a condition adverse to quality.

2.3.4 Anchors Cut Off

This issue was factual and presents a problem for which corrective action has been, or is being taken as a result of this employee concern evaluation. However, some concerns were factual but corrective actions had already been initiated as necessary. Other concerns were factually accurate but did not identify a problem while others were determined not to be factual.

2.3.5 Visual Failure of Anchors

The concerns addressed in this issue were found to be factual. Corrective action is required as a result of this evaluation.

2.3.6 Installation of Anchors

The evaluation for this issue revealed that problems exist in this area at all TVA nuclear plants and corrective action has been or is being taken. This includes a corporate problem on tightening bolts installed in SSD anchors. It also includes problems specific to BFN.

2.4 Summary of Collective Significance

2.4.1 Management Effectiveness

The following comments are specifically directed toward TVA's concrete anchor program, and; therefore, TVA's handling of issues both directly and indirectly related to NRC OIE Bulletin 79-02.

This evaluation revealed DNC and ONP management's positive performance in recognizing the need for and implementing employee training on specific subjects. However, a deficiency was identified in that management failed to recognize less than effective training programs as well as inconsistent field application of specific inspection parameters presented in training classes. This resulted in less than effective job performance.

DNE, DNC, and ONP management's performance was positive in recognizing the need for documenting nonconforming conditions, even conditions that could be defined as suspect and proving field installation adequacy through reinspection exercises. This positive aspect is somewhat offset by management's occasional failure to address all identified deficient conditions, regardless of the significance and generic implications.

DNE, DNC and ONP management's continual willingness and ability to recognize the need for upgrading site procedures as well as upper-tier criteria to improve the concrete anchor program revealed definitive performance. However, failure to correct conflict between upper and lower tier procedures as well as management neglect in recognizing the need to procedurally implement all necessary instructions and standard practices to insure overall integrity of the concrete anchor program is indicative of less than adequate performance. Consequently, job performance in many areas of the program was less than adequate.

Finally, DNE, DNC and ONP management's performance in implementing anchor sample programs and specific criteria enhancements to address the requirements of NRC OIE Bulletin 79-02 was exemplary. This statement is made because the ECTG

evaluation revealed a pronounced lack of communication as well as a failure to expedite issues on the subject bulletin with the NRC. TVA management was able to be reasonably effective in evaluating 79-02 issues even though the policy in communicating with the NRC was apparently, "no news is good news."

However, this positive performance was negated by DNE management's failure to insist on better communication, to include positive feedback and definitive, timely response on 79-02 Bulletin issues from the NRC. In addition, the decision to justify the existing methodology being used during that timeframe as opposed to making changes as required to insure compliance with an industry wide bulletin was reprehensible.

The findings with respect to TVA management's performance on NRC OIE Bulletin 79-02 are significant to the point of warranting a generic appraisal at the Category and Final Report level of TVA's method for handling NRC Bulletins on other issues.

2.4.2 Employee Effectiveness

Current DNC, DNE and ONP employees were found to be fully competent as well as responsible in their abilities, commitment to quality, and job performance. Isolated instances of failing to follow procedure were discovered at each plant but in almost every case, no premeditated or blatant instances of procedure violation were identified.

In the past, however, especially during the time period of three to ten years ago, these positive aspects were not as obvious or prevalent.

The present caliber of work performed was found to be of a high quality. This finding is offset only by isolated instances of sloppy work which were obviously performed by a very small percentage of individuals. This finding is also true for past performance except that sloppy work and the percentage of individuals performing such work was higher.

Existing employee effectiveness has been enhanced considerably by specific training performed to improve field performance. This was not the case in the past because of a generic attitude which seemed to categorize formal training as unnecessary and a waste of time. Training has improved as well as employee attitudes toward training, but each of these areas need further improvement.

2.4.3 Technical Adequacy

From a historical perspective, the lack of specific upper-tier criteria, especially in the time period beginning in the early 1970's, was discovered by this evaluation. During this timeframe, adequate site procedures were almost nonexistent. This evaluation revealed that as the concrete anchor program evolved, more adequate site procedures were developed and upper-tier criteria was improved. Subsequently, the major problem was discovered to be conflict between the upper-tier criteria and site procedures. Upper-tier criteria and site procedures were independent from each other in that site procedures were controlled and revised at the site level while upper-tier criteria was handled at the DNE (corporate) level. This problem continued as recently as late 1986. Technical adequacy has improved tremendously with respect to upper-tier and site criteria. This evaluation revealed specificity could still be improved at the upper-tier criteria level.

This evaluation has revealed that plant safety is indeterminate because a potentially unanalyzed condition may exist in the area of bolt tightening. Otherwise, plant safety was not compromised with respect to the issues evaluated.

2.5 Summary of Causes

2.5.1 Damage to Concrete/Rebar

It is apparent from the findings of this evaluation that many employees associated with the installation and inspection of concrete anchorages have a lack of knowledge and/or understanding of the requirements found in site procedures and upper-tier criteria. In some cases, this resulted in a failure to follow procedures. Also revealed was that many employees have a lack of knowledge and/or understanding of responsibilities of respective engineering units.

Other conditions revealed by this evaluation show a failure to recognize the need to retain pertinent information to establish proper evaluation and documentation records.

2.5.2 Testing of Anchors

The results of this evaluation revealed a lack of knowledge and/or understanding of site specific procedures and upper-tier criteria. This caused procedural requirements to

be violated as well as inadequate procedures and conditions adverse to quality to exist. In addition, this evaluation revealed a lack of upper tier and site-specific criteria during the early stages of TVA's Nuclear Construction Program.

2.5.3 Anchors Cut Off

The problems identified by the evaluations performed for this issue were caused by craftsmen receiving inadequate training for anchor installation or from violations of procedures due to unprofessional workmanship. It should be noted, however, that anchor installation has been subject to an evolutionary process and upper-tier criteria did not begin to adequately address this issue until 1981.

2.5.4 Visual Failure of Anchors

The findings for this issue at WBN, BLN and BFN were caused by either DNE's failure to consider all environmental conditions to which the anchors would be exposed or DNE's failure to identify the need for a preventative maintenance/surveillance program for anchors installed in a corrosive environment.

2.5.5 Installation of Anchors

The problems identified by the evaluation of this issue were caused by DNE's failure to provide adequate tightening requirements for bolts installed in SSDs as well as DNC's and ONP's failure to provide adequate training to craftsmen involved in the installation of anchor bolts. For BFN, the cause was DNE's failure to address all installation and inspection considerations and provide adequate criteria specific to the installation process.

2.6 Summary of Corrective Action Taken

2.6.1 Damage to Concrete/Rebar

A potential problem was indentified at SQN relative to this issue, and documented per CATD No. CO11305-SQN-02. However, it was found that the subject of this CATD is being addressed by the Engineering Category from a generic standpoint in SQN Element Report numbers 215.2 (b) and 215.6 (b).

2.6.2 Testing of Anchors

The following was identified as requiring corrective action by this evaluation:

Completion of corrective action and closure of NCR W-519-P is required for WBN (CATD 11300-WBN-05). Completion of corrective action and closure of SCR 6649-S is required for WBN to resolve the discrepancies for NCR 6674 (CATD 11300-WBN-03). Corporate problems for tightening of bolts installed in expansion shell anchors are to be resolved per (CATD-11300-NPS-02).

A corporate problem was identified concerning pull tests being performed after baseplate installation (CATD CO11306-NPS-01 and CO11306-SQN-1). Modification and Addition Instruction (M&AI) 10 needs to be reviewed to insure applicable G-32 anchor installation/inspection criteria has been implemented (CATD CO11305-SQN-1).

Several drawings were identified at SQN that require revision to preclude the use of leveling nuts (CATD CO11305-SQN-3).

For BFN, completion of sampling program BFEP20431 on non 79-02 anchorages (CATD 11300-BFN-03), completion of reinspection program(s) to answer NRC OIE Bulletin 79-02 (CATD 11300-BFN-04) and completion of the proposed sample program per Browns Ferry Engineering Project-Project Instruction (BFEP-PI) 86-29 (CATD 11300-BFN-05). Resolution of discrepancies in BFEP-PI 86-05 (CATD 11300-BFN-06 and CATD 11300-BFN-08) and Special Mechanical Maintenance Instruction (SMMI) 5.1-A (CATD 11300-BFN-07).

2.6.3 Anchors Cut Off

During evaluations at WBN it was found that anchors designated as EA (that is, anchors where reduced allowable loads are designated by DNE) may not have had all required inspections performed (CATD 11300-WBN-02). Discrepancies were identified during walkdown inspections of instrumentation lines for WBN unit 1 (CATD 11300-WBN-01). DNE is to perform a 100 percent review of all calculations associated with the WBN 79-02 program (CATD 11300-WBN-04).

During evaluations at SQN, two damaged bolts were identified for which corrective action is required (CATD CO11305-SQN-04). Sixteen anchors were identified with unacceptable plug depth and three with questionable plug depth per work request (WR) 114789. These anchors require pull (proof) testing (CATD CO11305-SQN-05). WR 114789 also identified one undersize anchor. This anchor needs to be replaced (CATD CO11305-SQN-06).

Corrective actions taken at BFN are addressed in section 2.6.2, Testing of Anchors.

For BLN, CATD 11300-BLN-01 was initiated to document the fact that the evaluation of 79-02 issues has not been completed. Initial field inspections are complete but DNE has not reviewed the results.

2.6.4 Visual Failure of Anchors

The issue was found to be a problem at WBN, BLN and BFN. The significance of rusted and/or corroded concrete anchor bolts needs to be addressed from a generic point of view at the corporate level. Also, a review of site maintenance and surveillance criteria should be performed with respect to concrete anchor bolts installed in high moisture/humidity and/or corrosive environment. (CATD 11300-NPS-03)

2.6.5 Installation of Anchors

The corporate problem relating to the tightening of bolts in expansion shell anchors, stated in section 2.6.2 is applicable to this issue (CATD-11300-NPS-02).

At BFN, correction of discrepancies on drawing 48W1241-1 (CATD 11300-BFN-01) and completion of corrective action required as a result of NCR-GENQAB-8203, R1 (CATD 11300-BFN-02) are required. (Note: NCR GENQAB 8203 is addressed from a design perspective in the 10400 subcategory report on Embeds).

3.0 EVALUATION PROCESS

3.1 General Methods of Evaluation

The issues of this subcategory were evaluated by reviewing NSRS/QTC/ERT reports and responses, construction specifications and site specific procedures, memorandums, Nonconformance Reports (NCRs), Significant Condition Reports (SCRs), Problem Identification Reports (PIRs), Condition Adverse to Quality Reports (CAQRs), Corrective Action Reports (CARs), NRC OIE Bulletin 79-02 and associated TVA responses, SQN Generic Concerns Task Force (GCTF) reports, ECTG Element Reports, inspection documentation, TVA design standards and Corrective Action Tracking System (CATS) documentation. Interviews were conducted with knowledgeable personnel and field walkdowns were performed.

- c. Interviews were conducted with cognizant individuals as follows: two site Civil Engineering Unit (CEU) engineers, one DNE-Civil Engineering Branch (CEB) engineer, two site Hanger Engineering Unit (HEU) engineers.
- d. Reviewed applicable documentation and procedures as required.

3.2.2.2 Sequoyah Nuclear Plant

Reviewed NSRS report I-86-120-SQN and related documents.

3.2.2.3 Bellefonte Nuclear Plant

- a. The BLN Employee Concern Investigation Report was reviewed for content and adequacy.
- b. Memo B41 851028 004 from R. O. Barnett, Chief Civil Engineer, to J. W. Coan, Project Manager, Watts Bar Engineering Project, dated October 28, 1985, was reviewed for applicability to BLN.
- c. Informal memorandum from H. Hutchinson to M. Bailey dated April 18, 1986 was reviewed for applicability to BLN.
- d. Interviews were conducted with steamfitter, sheetmetal worker and electrician foremen.

3.2.3 Testing of Anchors

3.2.3.1 Watts Bar Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. Reviewed General Construction Specification G-32, R12 "Bolt Anchors Set in Hardened Concrete"
- c. Reviewed WBNP QCP 1.14 "Inspection and Testing of Bolt Anchors Set in Hardened Concrete and Control of Attachments to Embedded Features," Revision 9 and later.

- d. Reviewed NCRs 2803R Revision 2 (initiated February 9, 1981), 2873R (initiated January 9, 1981), 3409R (initiated June 26, 1981), 3747R (initiated October 30, 1981), 5182 Revision 2 (initiated January 18, 1984), 6649 (initiated February 10, 1986), 6651 (initiated March 12, 1986), 6674 (initiated February 26, 1986), and NCR W-519-P (initiated November 24, 1986).
- e. Reviewed WBN-PMO Response for content
- f. Reviewed NSRS Reports I-85-657-WBN and I-85-439-WBN for content

3.2.3.2 Sequoyah Nuclear Plant

- a. Reviewed the Sequoyah Nuclear Plant (SQN) Generic Concerns Task Force (GCTF) Report on Incorrect Installation and Inspection of Anchors for overall content, adequacy, and findings with respect to the subject concerns.
- b. Reviewed the Watts Bar Nuclear Plant (WBN) Employee Concerns Task Group (ECTG) Element Report on Testing of Anchors (CO11306) for content and generic applicability to SQN.
- c. Reviewed Nuclear Safety Review Staff (NSRS) Investigation Report I-85-439-WBN to determine the methodology used in addressing the sampling program issue, the findings and the adequacy of the report with the respect to the answering of the subject concern.
- d. Reviewed the WBN-Project Manager's Organization (PMO) response to concern IN-85-347-007 for content, findings, and applicability to SQN.
- e. Reviewed the Division of Nuclear Engineering's (DNE) response to NSRS Investigation Report I-85-657-WBN with respect to anchor lot designations/definitions and justification for sampling methodology.
- f. Reviewed Nuclear Regulatory Commission (NRC) OIE Bulletin 79-02 R0, R1, and R2 to determine applicability and requirements with respect to the subject issue.

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- g. Reviewed SQN Modifications and Additions Instruction (M&AI) 10 (Testing of Expansion Anchors Set in Hardened Concrete), M&AI 11 (Fabrication, Installation and Documentation of Seismic Supports and Supports Attached to Seismic Category I Structures), M&AI 9 (Inspection of Bolted Connections), and General Construction Specification G-32 to determine requirements for anchor testing and identify criteria for designation of anchor lots. Also, reviewed other applicable procedures and documentation as required to obtain information relevant to the subject concerns.
 - h. Interviewed knowledgeable personnel in responsible units to obtain additional input applicable to the subject of this element.

3.2.3.3 Browns Ferry Nuclear Plant

The evaluation performed at BFN was performed in two parts. All concrete expansion shell anchors not under the scope of NRC OIE Bulletin 79-02 are being qualified by Sampling Program BFEP20431. All other concrete expansion shell anchors are being qualified as required by NRC OIE Bulletin 79-02.

Sampling Program BFEP20431

- a. The expurgated employee concern file was reviewed for additional information.
- b. Corrective Action Report (CAR) BFN 85-058 was reviewed for findings.
- c. Sampling Program BFEP20431, Design Criteria BFN-50-795, "Browns Ferry Nuclear Plant Design Criteria for Evaluating Expansion Shell Anchors," BFN Engineering Project Instruction BFEP PI 86-01, "Selection of the Sample Population for the Concrete Expansion Shell Anchor Sampling Program" and BF-Mechanical Maintenance Instruction (MMI)-159, "Sampling Inspection Program for Verifying Correct Installation of Concrete Expansion Shell Anchors".

- d. BFN-MAI-4, "Bolt Anchors Set in Hardened Concrete Structures," was reviewed for adequacy with respect to G-32.
- e. Responsible DNE engineers were interviewed to obtain additional information.
- f. TVA General Construction Specification G-32 (historial) was reviewed.

BFN NRC OIE Bulletin 79-02 Program

- a. The expurgated employee concern files were reviewed for additional information.
- b. Special Mechanical Maintenance Instruction (SMMI) 5.1-A, "Inspection and Repair Program for Verifying Correct Installation of Concrete Expansion Anchors, Units 1, 2 and 3," was reviewed for content.
- c. Browns Ferry Engineering Procedure-Project Instruction (BFEP-PI) 86-05, "NRC OIE Bulletin 79-02/79-14 Program Document for Browns Ferry Nuclear Plant," was reviewed for content.
- d. BFN Design Criteria BFN-50-D707, "The Torus Integrity Long-Term Program," and Design Standard Criteria (DSC) 1.7.1, "Civil Design Standard General Anchorage to Concrete," were reviewed for content.
- e. BFN Design Criteria BFN-50-724, "Class I Seismic Pipe Support Design," was reviewed for content.
- f. Memorandum (R25 850808 860) from G. R. Hall, Design Services Manager, BFN, to J. L. Ingwersen, Acting Site Services Manager, BFN, dated August 8, 1985 was reviewed for content.
- g. BFEP-PI 86-29, "Procedure for Sampling of Class I Small Bore Piping" was reviewed for content.
- h. SCR BFN CEB 8520 was reviewed for content.
- i. BFN Scope-of-Work Document BFPSWD 86-010 was reviewed for content.

- j. Interviews were conducted with responsible engineers at BFN.
- k. BF-CAR 86-0214 was reviewed for content.
- l. BFN M&AI 4, "Bolt Anchors Set in Hardened Concrete Structures," was reviewed with respect to requirements found in TVA General Construction Specification G-32.
- m. Reviewed TVA General Construction Specification G-32 (historial).

3.2.3.4 Bellefonte Nuclear Plant

- a. The expurgated employee concern file was reviewed for any additional information.
- b. General Construction Specification G-32, revision 11, was reviewed for applicable requirements.
- c. BLN QCP 2.8, Revision 19, "Bolt Anchors Set in Hardened Concrete" was reviewed for applicable requirements.
- d. ECTG element report CO11306-SQN was reviewed for applicability to BLN.
- e. Interviews were conducted with knowledgeable craft and Quality Control (QC) personnel.

3.2.4 Anchors Cut Off

3.2.4.1 Watts Bar Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. Reviewed Condition Adverse To Quality Report (CAQR) M31 (initiated January 3, 1979).
- c. Reviewed NRC OIE Bulletin 79-02 R0, R1, and R2 for applicability and requirements to the subject issue.

- d. Reviewed memorandums from Shelton Johnson, Assistant Construction Engineer, to WBN Plant Files dated March 5, 1979 and May 2, 1979.

- e. Reviewed NCRs 1344R (initiated December 22, 1978), 1345R (initiated December 22, 1978), 1346R (initiated December 22, 1978), 1347R (initiated December 22, 1978), 1348R (initiated January 2, 1979), 1384R (initiated January 24, 1979), 1385R (initiated January 29, 1979), 1386R (initiated January 29, 1979), 1387R (initiated January 29, 1979), 1388R (initiated January 29, 1979), 1389R (initiated January 29, 1979), 1390R (initiated January 29, 1979), 1391R (initiated January 29, 1979), 1410R (initiated February 26, 1979), 1956R (initiated December 4, 1979), 2738R (initiated November 8, 1980), 2789R Revisions 0, 1, 2 (initiated December 2, 1980, January 27, 1981, February 17, 1983), 2901R Revision 1, (initiated February 11, 1981), 3311R (initiated May 27, 1981), 3487R (initiated July 23, 1981), 3514R (initiated August 3, 1981), 3623R (initiated September 8, 1981), 3742R, (initiated October 26, 1981), 3756R (initiated November 4, 1981), 5752 Revision 1 (initiated August 10, 1984), 6578 (initiated January 15, 1986), and 6949 (initiated August 5, 1986).

- f. Reviewed NSRS Reports I-85-437-WBN, I-85-656-WBN, I-85-323-WBN, I-85-528-WBN, I-85-684-WBN, I-85-143-WBN and IN-85-037-001, QTC Report IN-85-020-001 and two memorandums: Rims L44 850220 689 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 and RIMS L44 850517 803 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.

- g. Performed field inspections of installed concrete expansion shell anchors.
- h. Reviewed WBN-QCP 1.14, R9 and later and TVA General Construction Specification G-32 (historical).

3.2.4.2 Sequoyah Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. Reviewed the Sequoyah Nuclear Plant (SQN) Generic Concerns Task Force (GCTF) Reports on Anchor Installation and Inspection for content with respect to the subject concerns, adequacy and findings.
- c. Reviewed the Watts Bar Nuclear Plant (WBN) Employee Concerns Task Group (ECTG) Element Report (Anchors Cut Off - C011305) for content and generic applicability to SQN.
- d. Reviewed Nuclear Regulatory Commission (NRC) OIE Bulletin 79-02 R0, R1, and R2 to determine what actions were required by SQN to verify adequacy of their concrete anchor program.
- e. Reviewed SQN (units 1 and 2) final response(s) and inspection reports(s) to NRC OIE Bulletin 79-02 to determine what methodology was used, to include sampling program(s) adequacy and what corrective actions were required (to include applicable nonconformance reports (NCRs), significant condition reports (SCRs), problem identification reports (PIRs) and other existing documentation) to insure compliance with the aforementioned bulletin.
- f. Reviewed Nuclear Safety Review Staff (NSRS) investigation report I-85-120-SQN to determine methodology used during the investigation, the findings, recommendations and overall adequacy with respect to the issues addressed by the concerns. Reviewed applicable Field Change Requests (FCRs), Engineering Change Notices (ECNs) and other relevant documentation as required to determine whether recommendations in

the NSRS report were implemented. Reviewed applicable SQN/TVA procedures and construction specifications as required to insure compliance with the 79-02 Bulletin.

- g. Interviewed knowledgeable personnel in responsible units as required to obtain information relevant to the subject of this element report.
- h. Performed field evaluation to determine if concerns expressed with respect to anchor removal in specified locations were valid.

3.2.4.3 Browns Ferry Nuclear Plant

This issue was evaluated with Testing of Anchors at BFN. See section 3.2.3.3 for specific evaluation criteria.

3.2.4.4 Bellefonte Nuclear Plant

- a. The expurgated employee concern file was reviewed for any additional information.
- b. The BLN Employee Concern Investigation Report for concern BNP QCP 10.35-3 was reviewed for content and adequacy.
- c. BLN's field inspection results for NRC OIE Bulletin 79-02 were reviewed for applicable information.
- d. Interviews were conducted with knowledgeable craft and QC personnel.

3.2.5 Visual Failure of Anchors

3.2.5.1 Watts Bar Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. NSRS report I-85-143-WBN was reviewed for content.
- c. Reviewed NCR 6370 (initiated September 13, 1985) and SCR WBN NEP 8513 (initiated July 17, 1985).

3.2.5.2 Sequoyah Nuclear Plant

- a. The expurgated employee concern file was reviewed for any additional information.
- b. The Potential Generic Condition Evaluation (PGCE) for NCR WBN 6320 was reviewed for content.
- c. Memorandum RIMS S53 860211 800 dated February 12, 1986 whose subject was NCR 6320, anchor bolt rust.

3.2.5.3 Bellefonte Nuclear Plant

- a. The expurgated employee concern file was reviewed for any additional information.
- b. The BLN Employee Concern Investigation Report for concern BNP QCP-10.35-8-8 was reviewed for content and adequacy.
- c. BNP-QCP-10.27, Revision 10, "Housekeeping" was reviewed for applicable requirements.
- d. The supervisor of the Site Preventive Maintenance Unit was interviewed.

3.2.5.4 Browns Ferry Nuclear Plant

- a. Reviewed the Expurgated Employee Concern File for additional information.
- b. Reviewed WBN-NCR-6320, R1, initiated September 13, 1985 for content and assigned disposition.
- c. Reviewed the Potential Generic Condition Evaluation (B41 851002 002 and B22 851021 013) performed for BFN per WBN-NCR-6320.
- d. Reviewed applicable correspondence on this issue (memorandums R25 860204 800, R36 860320 810, R25 860410 859, B22 860519 005) for content and action(s) taken.
- e. Interviewed responsible BFN-DNE engineer and Maintenance Superintendent to obtain information on the issue being evaluated.

3.2.6 Installation of Anchors

3.2.6.1 Watts Bar Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. NSRS Investigation Report I-85-659-WBN was reviewed for content, applicability and findings.
- c. PIR-WBN CEB-8644 (initiated March 28, 1986) was reviewed for content and responsible personnel were interviewed regarding this PIR.
- d. Field evaluations were performed.
- e. Responsible DNE engineers were interviewed.
- f. General Construction Specification G-32, Revision 11, was reviewed for applicable requirements as well as WBN-QCP 1.14, R9 and later.
- g. NCR GEN QAB-8203 (initiated May 5, 1982) was reviewed.
- h. NCR WBN SWP-8106 (initiated February 19, 1981) was reviewed.
- i. NSRS investigation Report IN-85-585-WBN was reviewed for content, applicability and findings.
- j. NCRs 1114R (initiated April 5, 1978) and 1158R (initiated April 9, 1978) were reviewed for content.

3.2.6.2 Sequoyah Nuclear Plant

The concerns and issues applicable to Anchor Installation were evaluated jointly with the concerns and issues related to Testing of Anchors. The methodology employed can be found in section 3.2.3.2.

3.2.6.3 Browns Ferry Nuclear Plant

- a. The expurgated employee concern files were reviewed for additional information.
- b. Drawings 48W1241-1 and -2 were reviewed for content.
- c. Problem Identification Report (PIR) BFN-CEB-8628 was reviewed for content.
- d. NCR GENQAB 8203 was reviewed for content and applicability to BFN.
- e. Interviews were conducted with cognizant DNE personnel.
- f. TVA General Construction Specification G-32 (historical) was reviewed for criteria applicable to this concern.

3.2.6.4 Bellefonte Nuclear Plant

- a. The expurgated employee concern file was reviewed for additional information.
- b. Two BLN Employee Concern Investigation Reports for concerns BNP QCP 10.35-8-29 and BNP QCP 10.35-8-7 were reviewed for content and adequacy.
- c. General Construction Specification G-32 was reviewed for applicable information and requirements.
- d. Reviewed NRC OIE Bulletin 79-02 R0, R1, and R2 for applicability and requirements to the subject issue.
- e. BNP-QCP-2.8 R19 was reviewed for applicable information and requirements.
- f. The 3GA0059-00, 4RA0560-Y2, and 4BA0892-X2 drawing series were reviewed for applicable requirements.

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- g. Interviews were conducted with cognizant QC personnel.
 - h. Reviewed BNP-QCP-3.13, 4.3, 3.7, 6.7, 2.15, and 6.17.
 - i. Interviews were conducted with cognizant craft personnel.

3.3 Justification of Evaluation Process

The methodology employed for the evaluations of this subcategory resulted in the concerns that identify specific installations being fully addressed and the findings being included in the evaluations that address concerns of a broader scope. The end result of this was that the evaluations fully address the specific, programmatic and generic issues for this subcategory.

4.0 FINDINGS

4.1 Design of Anchors

4.1.1 Generic Applicability

The concerns addressed in this issue questioned the overall adequacy, suitability and safety of redhead type anchors. Since this type of anchor has been used at all TVA nuclear plants and its use is allowed by a corporate document (G-32) this issue was addressed in a generic manner and evaluated for all TVA nuclear plants.

A review of the expurgated employee concern file provided no additional information.

- The NSRS Investigation Report I-85-440-WBN addressed a concern at WBN (IN-86-200-003) which also questioned the "suitability" of redhead type concrete anchors. This report referenced TVA General Construction Specification G-32 requirements for anchor qualification at each nuclear plant site as well as TVA General Construction Specification G-2. Random proof loading of anchors, test result evaluations, and anchor installation inspections were reviewed as well as site Quality Control Procedures (QCPs) to ensure that the upper-tier criteria of G-32 and G-2 had been fully implemented. The conclusion of this report was that no existing evidence of redhead type concrete anchor inadequacy could be verified, and the concern was determined to be unsubstantiated.