

TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM

REPORT NUMBER: 19100

REPORT TYPE: Subcategory - Construction

REVISION NUMBER: 3

TITLE: Electrical Equipment

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REASON FOR REVISION:

Incorporate SRP comments	Revision 1
Incorporate SRP comments, Executive Summary, and additional evaluation resulting from NRC comments	Revision 2
Incorporate SRP comments and Finalize Report	Revision 3

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CONCURRENCE (FINAL REPORT ONLY)

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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 (terms formed from the first letters of a series of words).

Additionally, at the end of each subcategory report the reader will find at least two attachments. The first is a Subcategory Summary Table that includes the following information: the concern number, a brief statement of the concern, and a designation of nuclear safety-related concerns. The second attachment is a listing of the concerns included in each issue evaluated in the subcategory.

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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.

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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).

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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

Electrical Equipment

Report Number: 19100

### ISSUE ASSESSMENT

This subcategory report addresses four safety related employee concerns pertaining to the adequacy of material substitution, electrical equipment installation practices and the perceived existence of obsolete hand switches in the main control room panels. One issue noted that the as constructed configuration of the vendor drawings for the 480V Shutdown Board panels did not reflect the as-designed TVA issued configuration drawings. This issue was WBN specific and was not evaluated at any other site. One issue questioned the acceptability of using galvanized steel as a junction box material at WBN. This issue pointed to an implied definition of acceptable materials as shown in the WBN QCP-3.03. One issue was raised by individuals who perceived that TVA was using obsolete hand switches in the main control room panels.

### MAJOR FINDINGS

The configuration discrepancies documented by WBN NCR W-205-P showed that terminal block strip labeling and wire labeling did not conform to the existing as-constructed configuration vendor drawings available at that point in time. Prior to initiating the NCR, there were no inspection criteria available to require or control labeling on vendor supplied equipment wiring. The discrepancies were factual but all functional tests had been completed on the control panels. No Conditions Adverse to Quality had been identified and the equipment operated as designed. The issue was deemed to be factual, but the condition had been identified and addressed before the concern was registered. Site procedures for WBN are being revised to incorporate inspection requirements for interface terminal labelling and updating vendor drawings.

The junction box material substitution issue was considered to be not factual. Had the concerned employee referenced G-40 for a list of acceptable junction box materials, he would have found that galvanized steel is an acceptable material. The issue was evaluated at all four nuclear sites. Procedural clarification was undertaken at WBN, but no corrective action was required at any of the other sites. The perceived obsolete hand switches questioned at WBN were of the Westinghouse Type W-2 configuration. In 1980, NRC issued bulletin No. IE 80-20. This bulletin identified a shortcoming in the design of the switches which left some uncertainty as to the position of the switch during operation of its controlled equipment. NRC gave each utility utilizing the switches an option to either replace or modify the switches. TVA took the modification option and added a position indication circuit to the switches which met the intent and requirements of the NRC bulletin. SQN took the same option and modified their W-2 handswitches. The issue was deemed to be not factual.

## COLLECTIVE SIGNIFICANCE

The major issue identified during evaluation of the concerns was the lack of General Construction Specification control for vendor supplied equipment. Existing policy limited DNC's inspection requirements to TVA wiring connections at the termination points at the vendor supplied component. Configuration control mandates that vendor drawings and TVA drawings shall reflect the same configuration, and inspection procedures should incorporate this requirement. DNE, DNC, and ONP management effectiveness in ensuring configuration control, as-constructed drawing control, work scope control, group responsibility assignment coordination, and ECN accountability has been proven to be short sighted considering the findings and resultant rework documented by this subcategory report and the data package associated with NCR WBN W-205-P. The technical adequacy of the equipment was never compromised. The operability of the safety-related equipment and the adequacy of the documentation was found to be acceptable.

CATDs issued by Operations in their 30804 report and by Construction in their 11200 report and the revisions to WBN-QCP-3.06-2 and QCP-3.06-3 as a result of NCR 7225, Revision 1, will assure that the procedural controls necessary to implement the inspection requirements for vendor supplied equipment interfaces will be in place. Updating of vendor supplied drawings necessary to maintain the as-designed configuration control necessary for effective plant operation and maintenance of plant systems and equipment will be controlled with the Administrative Instructions AI-4.3 and 4.4.

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1.0 CHARACTERIZATION OF ISSUES

1.1 Introduction

This subcategory report for Electrical Equipment in the Construction Category addresses four safety-related employee concerns.

The concerns were site specific to Watts Bar Nuclear Plant (WBN) and pertain to the adequacy of material substitution, installation of electrical equipment, and electrical hand switches. These problems were perceived to exist in electrical panels, junction boxes and handswitches, and the concerns were categorized for evaluation into three issues as follows:

Panels

WBP-85-016-003

Hand Switches

HI-85-045-001

HI-85-093-N02

Junction Boxes

IN-85-913-001

1.2 Description of Issues

1.2.1 Panels

One concern reported the 480V shutdown board panels have a potential nonconformance that has not been documented and, therefore, not in accordance with as-constructed and as-designed drawings.

1.2.2 Junction Boxes

One concern questioned the acceptability of material substitution for electrical junction boxes. The junction boxes were not manufactured from sheet metal and painted as required by General Construction Specification G-40 and applicable electrical standard drawings. The boxes were constructed of galvanized steel, and may have been installed throughout the plant.

1.2.3 Hand Switches

The concerns in this issue stated that hand switches in the main control room were declared obsolete and, rather than change the switches, nameplates and labels were changed.

## 2.0 SUMMARY

### 2.1 Summary of Issues

Perceived issues addressed by this subcategory consisted of concerns addressing the configuration control of the 480V shutdown board panels, the use of "obsolete" hand switches in the main control room panels and the acceptability of material substitution for electrical junction boxes. The concerns addressed were site-specific to WBN, but the junction box issue was evaluated at all four nuclear plant sites.

### 2.2 Summary of the Evaluation Process

The evaluation methodology consisted of a thorough review of the applicable procedures, documents, and standards to determine if the issues raised were adequately addressed. Listings of nonconformance reports (NCRs) were checked to determine if previous documentation existed on the subjects.

Quality Technology Company (QTC) files were reviewed for any additional information that would assist in identifying specific items related to the concerns.

Walkdowns were performed to determine compliance with plant procedures.

Interviews were conducted with cognizant personnel to obtain information leading to a conclusion for the concerns.

### 2.3 Summary of Findings

Of the three issues addressed, only one was determined to be factual. The configuration control discrepancies for the 480V shutdown board panels were substantiated, but the concerns addressing the substitute junction box material and the "obsolete" hand switches proved to be not factual. Procedural clarification has been implemented to specifically authorize galvanized material usage. The W-2 hand switches had been modified prior to the issuance of the two concerns independent from the concern evaluation. The concerned individuals were misinformed about the hand switch requirements.

The summary of the individual issues follows:

### Panels

Configuration discrepancies for the 480V shutdown board panels were identified and addressed by NCR W-205-P. Of the 3675 discrepancies identified, over 3,400 were terminal block and wire labeling discrepancies.

Preoperational functional testing verified the installed configuration as being correct. The documentation and operability of the equipment was never questioned and no nuclear safety problem was ever identified.

### Junction Boxes

The concern that galvanized steel junction boxes were not acceptable per DNE General Construction Specification G-40 is not valid.

Though G-40 did not specify galvanized steel was an acceptable junction box material, it implied, by way of referencing a nationally recognized standard, that the material was acceptable. The National Electric Code does recognize galvanized steel as an acceptable corrosion resistant material. The controlling site procedure, WBN QCP-3.03, has been clarified to reflect galvanized steel's acceptability.

### Hand Switches

Discussions with cognizant Modifications Engineering personnel revealed that NRC IE Bulletin Number 80-20 required certain hand switches in the main control room to be replaced or modified. TVA DNE issued Engineering Change Notice (ECN) 3306 in April of 1982 to modify the applicable hand switches by rewiring them. This work was completed in 1984. The concern was voiced in 1985. Memorandums were issued scoping the changes required as a result of human factor concerns, NRC regulations, and control panel nameplate and label changes. Some of the label and nameplate changes were for the modified hand switches.

## 2.4 Summary of Collective Significance

Collectively, inadequacies were pinpointed in the upper-tier General Construction Specifications and site-implemented installation and inspection procedures. There were no controlling

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documents addressing configuration control requirements for vendor supplied equipment. The coordination effort between design groups responsible for modifications to vendor supplied equipment needs to be strengthened to preclude the issue of scope of work documents (Impact and Justification sheets for ECNs) that are labeled "documentation only" but actually require physical work on equipment. Misinformation also significantly affected the perception of employees who voiced concerns about the Westinghouse W-2 hand switches in WBN's main control room and the material acceptability for junction boxes.

#### 2.5 Summary of Causes

The causes identified for configuration discrepancies for the WBN 480V shutdown board panels are:

- (1) No DNE or DNC procedures governing installation configuration control for terminal wiring labeling.
- (2) Lack of coordination between design groups before issuance of scope of work documents for ECNs.
- (3) Inadequate site Project Control review for scope of work on ECNs designated as "for documentation only."

The concerns addressing the W-2 hand switches displayed the CI's lack of knowledge of the events leading to the NRC IE Bulletin 80-20 and the options available to TVA for modifying or replacing the switches to comply with the bulletin. Information was available delineating the historical facts behind the requirement to increase the efficiency and reliability of the switches.

The concern related to the acceptability of galvanized steel electrical junction boxes resulted from the site procedure's failure to list acceptable junction box materials or at least reference the applicable G-40 section addressing junction boxes.

#### 2.6 Summary of Corrective Action

Corrective action had already been taken relating to the employee concern which dealt with the 480V electrical panels in unit 1 at WBN. Vendor wiring for the unit 2 main control room panels at WBN is scheduled to be inspected. Corrective action is not required for the employee concern associated with hand switches. Additional corrective action is not required for the concern on electrical junction boxes, since the WBN site procedure has been revised to preclude any future misinterpretation of the material acceptability.

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### 3.0 EVALUATION PROCESS

#### 3.1 General Methods of Evaluation

The evaluation methodology at each nuclear plant site consisted of a review of applicable design standards and specifications and site implemented installation and inspection procedures related to the issues. ECNs, NCRs, QTC files, and other related documents were reviewed for issue applicability.

Walkdowns were performed with cognizant personnel to verify procedural compliance of issue-related components.

Interviews were conducted with personnel directly involved with each issue to obtain additional information. These included discussions about previously accepted practices and standards associated with the issues addressed by the concerns.

#### 3.2 Requirements or Criteria Established for Individual Issues

##### 3.2.1 Panels

The requirements for the 480V shutdown electrical panel installation, and the associated problems, were summarized in the nonconforming report NCR W-205-P, revision 1. This NCR documented the violation of the requirements, evaluated the condition, and proposed corrective action. The corrective action has been completed for WBN unit one. Because of the

extensive nature of this NCR, (3675 documented deficiencies), documentation of the as-constructed and as-designed condition was available. Further investigation was unnecessary to evaluate if any other potential installation violations existed, since the employee concern was determined to be factual as established by NCR W-205-P.

##### 3.2.2 Junction Boxes

TVA Construction Specification G-40 and Electrical Standard Drawing SD-E13.6.3 established TVA requirements for junction boxes. WBN Site Procedure WBN QCP-3.03, revision 18, established current requirements for material acceptance criteria for junction boxes. The requirements of these documents were used to evaluate the acceptability of the material used in the final installation, as questioned by the concerned employee. These documents were also compared to accepted practices established at the site, as related by EEU

personnel during interviews. TVA Nuclear Safety Review Staff Report No. I-85-524-WBN was evaluated to compare its conclusions and the consistency of the findings with this report. A draft of the revision to WBN QCP-3.03 was reviewed to evaluate the effectiveness of clarifying the materials acceptable for use in junction boxes.

Reviewed conduit and grounding drawing 45N810-7, Revision 35, entitled "Conduit and Grounding, Floor Elevation 669.0, Ceiling Plan", and the Master Bill of Material for electrical equipment to determine the numbering scheme used by DNE to identify and describe those junction boxes specified for installation at SQN.

SQN Workplan number 12292 related to the implementation of ECN 6823 was reviewed to determine the control method utilized to ensure the proper installation of junction (splice) boxes.

SQN Electrical Maintenance Planning personnel were contacted to discuss the controls established or utilized during the maintenance request (MR) or work-release (WR) process related to junction box replacement.

SQN Procurement personnel were contacted to ascertain the documentation/certification requirements for procuring and receiving electrical junction boxes and a review of the affected documents was performed.

### 3.2.3 Hand Switches

Discussions with selected EEU and Modifications personnel and a subsequent document review established the criteria for evaluation of the perceived problem with hand switches. The evaluation was supported by scoping review of the work associated with modification of the main control room switches including replacement of the labels and nameplates. Documents showed modification of hand switches was required by DNE ECN 3306. This modification was required as a result of the NRC IE Bulletin number 80-20, which established criteria requiring either replacement or modification of Westinghouse W-2 hand switches. The option given to all utilities utilizing the W-2 hand switches was to replace or modify the switches. ECN 3306 revealed TVA elected to modify the hand switches. Workplan review showed the modification work was a result of the ECN and the NRC 80-20 bulletin.

A document review produced evidence that nameplates and labels were changed on the hand switches in the main control room. This work was a result of Human Engineering Related Changes and NRC regulations.

It was concluded through interviews that no obsolete hand switches had ever been installed in the main control room.

#### 4.0 FINDINGS

##### 4.1 Findings on Panels

###### 4.1.1 Generic

###### Discussion

Not applicable.

###### Conclusion

The issue raised by the concern on Electrical Panels was determined to be WBN site-specific and, therefore, not generic to any other TVA site.

###### 4.1.2 Site Specific - WBN

###### Discussion

The review of previously documented NCRs on the 480V shutdown panels revealed that 3675 discrepancies were documented on NCR W-205-P, Revision 1, initiated on November 20, 1984. NCR W-205-P was initiated independent of the employee concern. The NCR grew out of what was originally intended to be an ONP configuration walkdown covering Browns Ferry, Sequoyah, and Watts Bar. The closure requirement of the NCR consisted of completing a large scale configuration verification walkdown for electrical panels in the Main and Auxiliary Control rooms at WBN. These discrepancies had been evaluated, corrective action established, verified complete, and the NCR closed on April 22, 1985. For a complete discussion on NCR W-205-P, see Subcategory Construction Report 11200. Terminal block and wire labeling accounted for 92.8 percent of the problems.

Inspection procedures now require label verification for vendor supplied electrical equipment. Previously, no procedure addressed the inspection requirements necessary to confirm the labeling of terminal blocks and internal wiring for vendor supplied equipment. Vendor wiring in unit 2 main control room panels at WBN is scheduled to be inspected. Also, the electrical engineer now in charge of the main control room unit 2, reviews all ECNs, regardless of category, for change requirements including labeling changes.

The following is a summary of factors contributing to configuration control discrepancies:

1. Inspection requirements for labeling of terminal block strips were nonexistent when the panels were installed. In the early phase of construction, an agreement was made between Construction and ONP that Construction would wait until just before system transfer to install or update terminal block identification strips. This was an accepted practice free of any procedural control. The electrical inspectors were required only to verify that each wire was attached to the appropriate terminal (e.g., one through 12).

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NCR 7225 Revision 1 documents the fact that the existing procedures WBN-QCP-3.06-2 and QCP-3.06-3 are inadequate for sufficiently establishing acceptance criteria for inspection of vendor and TVA interface terminal blocks.

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2. The majority of the wire labeling discrepancies were on vendor wiring (commonly referred to as internal wiring). Most field wiring is color coded and not labeled with tags. In the early construction phase of the project, a policy was established stating that DNC would not inspect vendor wiring since each vendor had a certified QA program. Thus, TVA never inspected vendor wire labeling before this walkdown.

The TVA wiring diagrams reflected the as-designed configuration of the terminal interfaces, but the vendor drawings had not been revised to reflect the as-designed terminal configurations. The Corrective Action Plans for CATD 11200-WBN-06 and 30804-WBN-02 provide assurance that vendor drawings will be configuration verified prior to being used for any maintenance or repair work. WBN Administrative Instruction AI-4.3 details vendor drawing configuration verification requirements.

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3. DNC has had, and continues to have a problem with Engineering Change Notices (ECNs) that are categorized "for documentation only." To fit this category, the ECNs must not require physical changes to plant features. After the 480-volt control panels were installed, we received many ECNs with terminal block strip label changes mistakenly categorized (by DNE) "for documentation only." These changes were not scoped for work requirements by the WBN Project Control Unit because of the "for documentation only" designation.

Preoperational Test TVA-13A results provided assurance that functional tests were complete for unit 1 480V shutdown boards. Several problems were identified as test deficiencies, but were resolved during the test.

#### Conclusion

The concern that a potential nonconformance existed on the 480V shutdown panels was factual. The completed corrective action on NCR W-205-P provided adequate documentation of the as-constructed, as-designed status of the unit 1 panels. This finding confirmed the employee's concern that the panels were potentially nonconforming. The extensiveness of the documentation and evaluation of the NCR, and the independently verified completed corrective action provided assurance the problem has been adequately addressed. Unit 2 panels will be subjected to similar configuration control walkdowns.

Revisions to WBN-QCP-3.06-2 and QCP-3.06-3 and adherence to AI-4.3 requirements will preclude any future configuration control problems with TVA/vendor interfaces on electrical equipment.

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## 4.2 Findings on Junction Boxes

### 4.2.1 Generic

#### Discussion

The upper-tier DNE specification did not specifically address junction box material, but only stated the material must meet the requirements of an approved recognized national standard. The National Electric Code, Article 370-20 (an approved recognized standard), stated that the use of galvanized steel is an acceptable practice as a corrosion resistant material for metal junction boxes. The WBN site procedure did not specifically list galvanized steel as an acceptable material along with the listing of other

materials. Review of Electrical Standard Drawing SD-E13.6.3 revealed the boxes shall be constructed of sheet steel. No specific mention was given for a corrosion resistant material. However, a requirement was given for painting surface mounted field fabricated boxes.

#### Conclusion

Because of a possible need for clarification in the DNE specifications, this issue was generic to all other TVA nuclear sites. Evaluations at other sites revealed that they were utilizing galvanized steel. Site procedures were determined to be adequate as were the DNE upper-tier procedure and drawings. The revision for clarification of the WBN site procedure should preclude future misinterpretation of the intent.

#### 4.2.2 Site Specific

##### WBN Discussion

The concern that junction boxes were not manufactured according to G-40 or standard drawings was not factual because the intent was not to exclude galvanized steel, but to address painted steel since some method of corrosion protection was required. A review of the DNE Electrical Construction Specification G-40 and Standard Drawing SD-E13.6.3 revealed junction box material was not specifically addressed but stated the material must meet the requirements of an approved recognized national standard. Review of the National Electric Code revealed galvanized steel, among other materials, was an acceptable corrosion resistant material for electrical junction boxes. A review of the WBN site procedure WBN QCP-3.03, revision 18, revealed that galvanized steel was not previously listed as an acceptable material. Discussions with DNC electrical engineers, Modification Unit engineers, and an electrical craft foreman confirmed that galvanized boxes could be found throughout the plant. Galvanized boxes were also used at other sites, but no other instances of questioning the galvanized steel acceptability were voiced. The WBN DNC Procedures and Training Unit was in the process of clarifying the acceptability of galvanized steel in the site procedure. The investigation completed by the NSRS (Report Number I-85-524-WBN) was consistent with the findings and conclusion of this report confirming that galvanized steel was an acceptable material for junction boxes. The NSRS report findings stated that the intent of G-40 and the electrical standard drawings was not to exclude galvanized steel, but to address painting because some method of corrosion protection is required.

The investigation also concluded that the intent of the General Construction Specification G-40 was not to exclude galvanized steel from the list of acceptable materials for junction boxes.

#### Conclusion

Galvanized steel is an acceptable material for use in electrical junction boxes and the employee concern is determined to be not factual.

#### SQL Discussion

A cognizant Modifications engineer was contacted to determine if clarification was required in regard to material requirements for junction box construction. SQL Modification and Addition Instruction (M&AI)-6 "Installation of Conduit and Junction Boxes" Revision 6, was reviewed to determine if clarification was required pertaining to a definition of corrosive resistant material.

The Modifications engineer interviewed indicated junction boxes were either specific and procured by DNE or fabricated on site using DNE standard drawings. Notes on the drawings specify the material type as sheet metal and the corrosion protection used is paint. Problems or confusion had not been identified for the material requirements related to junction box construction.

A review of M&AI-6 revealed that junction box material was required to meet an approved recognized standard. No specific material requirements were given as examples to introduce error or confusion related to the material requirements for junction box construction.

Review of conduit and grounding drawing 45N810-7, Revision 35 revealed that junction boxes were given unique identification numbers with the appropriate mark number assigned by the Division of Nuclear Engineering (DNE). Each mark number was to be utilized by the constructor during the installation process in conjunction with "The Master Bill of Material for Electrical Equipment," to describe the type of junction box required at the specified location.

Review of the Bill of Material for various mark numbers revealed a general description of the affected junction box and included its size, type or NEMA rating, and other pertinent data such as contract and item number, etc. (Reference 45BM826 R4 SHT 16 of 45, and 45BM828 R3 SHT 14 of 45).

Reference to the "type" of junction box was DNE's method to specify which TVA standard drawing was to be utilized during fabrication and assembly.

Conclusion

The site procedure is adequate as written and consistent with the requirements of G-40 and the National Electric Code.

Program enhancement could be accomplished by DNE should a list of acceptable materials be compiled and injected into the governing design out-put document (G.C.S-G40).

BFN Discussion

Modifications personnel were contacted to determine if clarification was required in regard to material requirements for junction box construction. M&AI-27, dated July 16, 1986, was reviewed to determine if clarification was required pertaining to a definition of corrosive resistant material.

Conclusion

Modifications personnel indicated junction box types were specified by DNE. Fabrication was performed per the design specification which included provisions/requirements for painting to prevent corrosion. No deficiency was noted related to junction box material requirements.

M&AI-27, "Installation of Electrical Conduit and System Junction Boxes," stated that materials used for junction box construction shall meet the requirements of an approved national standard. An attachment to the procedure provided material specifications consistent with the National Electric Code and lists painted steel, galvanized steel, aluminum or stainless steel as being acceptable. Independent verification is required and no deficiencies were noted.

BLN Discussion

A review of site procedures BNP-QCP-3.2, revision 12, BNP-QCP-3.26, revision 6, BNP-QCP-10.5, revision 6, and BNP-QCP-3.13, Revision 13, "Equipment Installation," provided the acceptance criteria for corrosion protection of electrical junction boxes.

A walk-through of the plant was performed to determine if a hardware problem existed as a result of inadequate material selection for electrical junction boxes.

Discussions were held with Electrical Engineers at the site.

Conclusion

The site procedures did not list specific materials acceptable for electrical junction boxes. The BLN procedures provide assurance through unique number verification and shop inspections that the boxes installed meet DNE requirements.

All boxes observed during a walk-through of the plant were in good condition and free of corrosion.

Discussions with Electrical Engineering personnel revealed the only galvanized electrical junction boxes used are those supplied with vendor equipment.

No hardware problem exists in the plant and no confusion existed as to the acceptability of the galvanized steel junction boxes used. The site procedures are fully adequate as written and ensure the boxes installed meet DNE requirements.

Note: Since galvanized junction boxes are constructed of a reactive metal similar to aluminum, and react with borated water to form hydrogen, the design basis calculations for hydrogen build-up inside containment should include these and other similar items in the inventory process. The control of such reactive metals within the confines of the containment is discussed in the WBN ECTG Construction Category, Subcategory Report 19200, "Conduit and Cable Tray." DNE provides the methods which will ensure that these materials are included in the design basis calculation for hydrogen build-up and that future updates to the calculation package will include these and other similar materials.

4.3 Findings on Hand Switches

4.3.1 Generic

Discussion

Not Applicable

Conclusion

The issue raised by the two concerns for hand switches was WBN site specific.

4.3.2 Site Specific

Discussion

Discussion with a Modifications supervisor and cognizant Modifications Electrical Engineering personnel revealed that Westinghouse Type W-2 hand switches were required to be replaced or modified as a result of NRC Bulletin No. IE 80-20, issued July 31, 1980. In response to this bulletin, TVA DNE issued ECN 3306 on April 7, 1982. This change required modification of approximately 60 W-2 hand switches in lieu of replacement. This work consisted of rewiring the hand switches and was considered complete on March 3, 1983.

Discussions also produced documents revealing labels and nameplates were required to be changed in the main control room. This change resulted from human engineering related concerns and NRC regulations. This work included changing labels and nameplates on hand switches, which was accomplished in 1984.

Conclusion

The concern that "hand switches in the room control room were declared obsolete, but rather than change the switches, only labels and nameplates were changed" is not factual.

Modifications of the Main Control Room hand switches were properly evaluated and completed as verified through discussions with cognizant personnel and a review of inspection documentation. This work consisted of rewiring the existing switches. Work was also scoped and completed on the changing of hand switch labels and nameplates in the main control room. There was no association between these work-related items since the requirements for the work originated from completely different considerations.

Note: A review of the G.C.T.F. preliminary evaluation at SQN on this concern, SQN Report No. HI-85-045-001 concluded similar findings. Since SQN and WBN have nearly identical main control room designs, the NRC Bulletin IB 80-20 was also applicable to switches at SQN. DNE issued ECN L5591 to modify type W-2 switches at SQN. The conclusions of the SQN report stating that no installed switches had been declared obsolete provides additional credence to the conclusions of this report.

## 5.0 COLLECTIVE SIGNIFICANCE

### 5.1 Significance of Each Issue

#### 5.1.1 Panels

The significance of the issue concerning electrical panel configuration occurred because inspection requirements for labeling of terminal strips was not procedurally addressed at any level when the panels were installed. Such inspections would verify label discrepancies with vendor wiring and design changes not scoped by the site Project Controls Unit for ECNs that are categorized "for information only." The findings concluded the concern was factual, but the perceived problems with configuration control had been documented and corrected for WBN unit 1 and inspections were planned for unit 2.

It is also significant to note that the requirements to maintain the as-designed status of vendor drawings existed in the Quality Assurance Program Description for Design, Construction, and Operation--Topical Report-TVA-TR75-1 part 17.2.6 and in WBN AI-4.3 but was not followed for the 480V shutdown board panels drawings. | R3

#### 5.1.2 Junction Boxes

This concern was determined to be not factual because the intent of G-40 was not to exclude galvanized steel and was inadequately interpreted by the WBN site procedures. Site procedures were being revised before this evaluation took place to emphasize the fact that galvanized steel was an acceptable junction box material.

#### 5.1.3 Hand Switches

This concern was determined to be not factual with regard to the perceived problem that installed hand switches were obsolete and rather than replace the switches, only nameplates were changed. The findings concluded that

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replacement or modification of W-2 hand switches was required, and TVA chose to modify the switches. This modification consisted of rewiring the switches to add a return to neutral indicator circuit, which may have gone unnoticed by the concerned employees. The employees were apparently aware of the need to address a problem with the switches but were not informed of the required corrective action.

When a later effort was initiated to correct human factor concerns which included the replacement of nameplates and labels on hand switches, the employees may have incorrectly perceived this work was related to the "obsolete" hand switch problem.

## 5.2 Collective Significance of the Subcategory

### 5.2.1 Generic

The major issue identified during evaluation of the concerns for this subcategory was the lack of General Construction Specification control for vendor supplied equipment as identified in the 480V panel configuration control issue. Site procedures derived from G-specs depend on the adequacy of the G-specs to maintain design basis, control the quality, assure the operability and maintain the as constructed configuration of all system components. Existing policy limited DNC's inspection requirements to TVA wiring connections at the termination interface points at the vendor supplied component. Configuration control mandates that vendor drawings and TVA drawings shall reflect the same configuration, and inspection procedures should incorporate this requirement.

The requirement to verify the vendor drawings' as-designed status prior to installation, repair, or maintenance of vendor supplied equipment has been emphasized in the Topical Report TVA-TR75-1 Part 17.2.6 "Quality Assurance Program Description for Design, Construction, and Operation" and in Site Administrative Instructions for Drawing Control of Unlicensed Units.

Site implemented procedures at WBN are being revised to incorporate interface inspection requirements as a result of CATDs issued by the Operations Category Report and the Work Control Subcategory Report evaluations.

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|R3  
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5.2.2 Site Specific - WBN

DNE, DNC, and ONP management effectiveness in ensuring configuration control, as-constructed drawing control, work scope control, group responsibility assignment coordination, and ECN accountability has been proven to be short sighted considering the findings and resultant rework documented by this subcategory report and the data package associated with NCR W-205-P. Employees (Engineering, QA, and Craft) have been consistent in their application of installation/documentation criteria as supplied by the governing procedures. When considering vendor supplied equipment, employees did not question the lack of label identification on the terminal blocks. It is just another case of "It's always been done this way." Responsibility for documentation, inspection, and configuration control for vendor-supplied equipment must be addressed procedurally to prevent recurring inconsistencies in the configuration control process. The technical adequacy of the equipment was never compromised. The operability of the safety-related equipment and the adequacy of the documentation was never in question.

6.0 CAUSE

6.1 Panels

The causes identified for configuration discrepancies for the WBN 480-volt shutdown board panels are as follows:

1. No DNE or DNC procedures governing vendor supplied equipment relating to the installed configuration/issued drawing configuration for terminal wiring labeling .
2. Lack of coordination between design groups when issuing scope of work documents for ECNs.
3. Inadequate Project Control review for scope of work on ECNs designated as "documentation only."

Note: Detailed evaluation of panel configuration discrepancy control is reported in the Construction Category, Subcategory report number 11200, "Work Plan/Work Control."

Operations Report 30804 also details findings proving that vendor drawings which are not as-designed are being used to make repairs to CSSC plant equipment.

| R3

Discussion

The identified cause for the 480-volt panel termination configuration discrepancies was traced to the initiating design organization's identification of work required in the field before issuing the scope of work documents (I&J-sheets for ECNs) and their lack of providing updated vendor drawings to reflect the scope of design changes as part of the ECN process.

| R3

For example, when a circuit is modified to perform a different function than what it was originally designed to perform, the design group responsible for that portion of the specific circuit issues a scope of work document. The design group responsible for the termination end of the circuit (different from the group responsible for the function end of the circuit) reviews the scope of work document and revises the labeling portion of the drawing to agree with the new function of the circuit and issues their scope of work document showing that there is no construction work required. When the ECN cover sheet is prepared, the category designation is controlled by the details shown on the I&J-sheets from each group involved in the change. If the cover sheet is prepared using the information on the I&J-sheet from the group assigning a "documentation only" category for their area of responsibility, then the ECN gets designated as "documentation only" upon issuance to DNC. When the site Project Controls group receives an ECN designated as "documentation only," their representative files the ECN away without doing a required work scoping. When the drawing showing the physical work required arrives onsite, the responsible EE scopes the work and writes a workplan to do the work. Labeling changes on vendor supplied terminal blocks do not fall within the scope of any site or design procedures presently in effect. Therefore, if the physical work is performed on the TVA wiring and is documented as being complete, the circuit is considered (by all groups involved) as being complete as shown the newest issued drawings and is documented as such. The configuration shown on the TVA issued drawings at this point in time is different than that shown on the vendor drawings.

| R3

The labeling is also shown on vendor supplied drawings and does not require any DNC inspections to verify labeling or drawing/installation configuration control.

Of the 3675 discrepancies documented by NCR W-205-P, 3412 were identified to be associated with labeling of vendor wiring.

Though the labeling discrepancies were pervasive throughout the control panels, no quality or safety concerns were identified during the evaluation. All circuits were functionally tested and documented and would operate as designed.

If the vendor drawings had been updated to show the as-designed configuration as part of the design change process, the labeling discrepancies would not have existed.

| R3  
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#### 6.2 Junction Boxes

The concern related to the acceptability of galvanized steel junction boxes resulted from a misinterpretation of the procedural requirements. The CI interpreted that material not specifically mentioned was intended to be excluded for use. Although the intent of WBN was not to exclude this material, the misinterpretation was due, in part, to the site procedure. The procedure contained only a partial listing of approved materials, not intending to exclude galvanized steel, but to address some method of corrosion protection. This could possibly have caused the employee's concern. The potential for other sites to misinterpret the acceptability of galvanized steel caused this issue to be deemed potentially generic. Further investigation proved this not to be the case and the DNE upper-tier procedure was determined to be adequate.

#### 6.3 Hand Switches

The concerns addressing the Westinghouse W-2 hand switches displayed the CI's lack of knowledge concerning the NRC 80-20 bulletin and the switch modification work which had already taken place. The information was readily available to the employee which would have explained the perceived problem away.

### 7.0 CORRECTIVE ACTION

#### 7.1 Corrective Action Already Taken or Planned

In regards to configuration discrepancies for electrical panel labeling, site implementing inspection procedures now address labeling of electrical items as a result of NCR 7225 Revision 1. Vendor wiring in the unit 2 main control room panels at WBN is scheduled to be inspected. The Electrical Engineer in charge of the unit 2 main control room now reviews all ECNs, regardless of category, for any changes that may require physical work. Reference Construction Category Subcategory Report number 11200, "WorkPlan/Work Control" for CATDs which require DNE to update and issue vendor drawings as part of the design change process.

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| R3  
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Corrective action has already been taken to clarify the junction box material requirements in WBN QCP-3.03 by the Procedures and Training Section, WBN, DNC.

No corrective actions were required as a result of the hand switch concerns.

7.2 Corrective Action from CATD's

Non-applicable.

8.0 ATTACHMENTS

8.1 Attachment A, Subcategory Summary Table and List of Concerns

8.2 Attachment B, List of Evaluators

8.3 Attachment C, List of Concerns by Issue

ATTACHMENT A

REFERENCE - ECPS132J-ECPS132C  
 FREQUENCY - REQUEST  
 WP - ISSS - RHM

TENNESSEE VALLEY AUTHORITY  
 OFFICE OF NUCLEAR POWER

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 RUN DATE - 05/19/87

EMPLOYEE CONCERN PROGRAM SYSTEM (ECPS)  
 EMPLOYEE CONCERN INFORMATION BY CATEGORY/SUBCATEGORY  
 SUBCATEGORY: 191 ELEC. EQUIPMENT

CATEGORY: CO CONSTRUCTION-PROCESS

CONCERN NUMBER	CAT	SUB CAT	S H R D	PLT LOC	1 REPORT APPL				HISTORICAL REPORT	CONCERN ORIGIN	CONCERN DESCRIPTION	REF. SECTION # CAT - CO SUBCAT - 191
					2	BF	BL	SQ				
I -85-045-00101	CO	19100	S	WBN	1	N	N	N	Y	QTC	HAND SWITCHES IN THE MAIN CONTROL ROOM WERE DECLARED OBSOLETE APPROX. 1 YEAR AGO RATHER THAN CHANGE SWITCHES AS DIRECTED, ONLY THE LABELS AND NAME PLATES WERE CHANGED. WHEN CI QUESTIONED THIS PROCEDURE TO HIS SUPERVISOR (NAME KNOWN TO QTC) HE WAS TOLD "TO MIND YOUR OWN BUSINESS OR GET FIRED."	1.2.9, 3.2.3, 4.3.2, 5.1.3, 6.3
02	IH	60100	S	WBN	1	N	N	N	Y			
					2	NA	NA	NA	NO			
I -85-093-N0201	CO	19100	N	WBN	1	N	N	N	Y	NRC	NRC IDENTIFIED THE FOLLOWING CONCERN FROM REVIEW OF THE QTC FILE: "DID NOT REPLACE SWITCHES IN CONTROL ROOM." AFTER REVIEW OF FILE, CONCERN INDICATED THAT SWITCHES WERE ORDERED TO BE REPLACED BUT WERE NOT. ONLY NAME PLATES AND TAGS REPLACED.	1.2.3, 3.2.3, 4.3.2, 5.1.3, 6.3
					2	N	NA	NA	SR			
IN -85-913-00101 T50092	CO	19100	N	WBN	1	Y	Y	Y	Y	I-85-524-WBN	ELECTRICAL JUNCTION BOXES ARE NOT PER 6-40 AND ELECTRICAL STANDARD DRAWINGS, IN THAT THEY ARE MANUFACTURED OF GALVANIZED STEEL INSTEAD OF SHEET STEEL WITH PAINT ON BOTH SIDES. THESE JUNCTION BOXES MAY BE FOUND THROUGHOUT THE PLANT, ESPECIALLY IN THE A DGB (AUXILLIARY DIESEL GENERATOR BUILDING C/I HAD NO FURTHER INFORMATION NO FOLLOW UP REQUIRED.	1.2.2, 3.2.2, 4.2, 5.1.2, 6.2
					2	SR	SR	SR	SR			
BP-85-016-00301 T50233	CO	19100	N	WBN	1	N	N	N	Y	QTC	480 VOLT SHUTDOWN PANELS (UNITS 1, 2 & 0) HAVE A POTENTIAL NONCONFORMANCE WHICH HAS NOT BEEN DOCUMENTED FOR RESOLUTION. DETAILS KNOWN TO QTC, WITHHELD DUE TO CONFIDENTIALITY. NO FURTHER INFORMATION MAY BE RELEASED. NUCLEAR POWER DEPARTMENT CONCERN. CI HAS NO FURTHER INFORMATION. NO FOLLOW UP REQUIRED.	1.2.1, 3.2.1, 4.1, 5.1.1, 6.1
					2	NA	NA	NA	SR			

4 CONCERNS FOR CATEGORY CO SUBCATEGORY 191

CONCERNS ARE GROUPED BY FIRST 3 DIGITS OF SUBCATEGORY NUMBER.

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ATTACHMENT B

List of Evaluators

John Campbell - BLN  
Henry Loftis - SQN, BFN, and BLN  
Gary Lyles - BLN  
Rob Brown - WBN

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ATTACHMENT C

List of Concerns by Issue

<u>Issue</u>	<u>Concerns</u>
1.2.1 Panels	WBP-85-016-003
1.2.2 Junction Boxes	IN-85-913-001
1.2.3 Hand Switches	HI-85-045-001 HI-85-093-N02