

EMPLOYEE CONCERNS SPECIAL PROGRAM

**VOLUME 9 .
INDUSTRIAL SAFETY CATEGORY**

**SUBCATEGORY REPORT 90600
ELECTRICAL**

UPDATED

**TVA
NUCLEAR POWER**

8902210440 1.1
PDR ADDCK 890206
P 05000259
FDC

ECSP CORRECTIVE
Action Tracking Document
(CATD)

INITIATION

1. Immediate Corrective Action Required: Yes No
2. Stop Work Recommended: Yes No
3. CATD No. 90600-6
4. INITIATION DATE 08-12-86
5. RESPONSIBLE ORGANIZATION: WBN ONP
6. PROBLEM DESCRIPTION: QR NQR Site procedures governing drilling, cutting, and chipping operations conducted on permanent concrete structures do not address the site availability, or capabilities of existing employee protective devices and "wall survey" instrumentation. In addition, they do not provide any guidelines or requirements for their usage as a specific part of the job planning activities.
7. PREPARED BY: NAME DH [Signature] ATTACHMENTS
DATE: 08-12-86
8. CONCURRENCE: CEG-H [Signature] DATE: 8-12-86
9. APPROVAL: ECTG PROGRAM MGR. [Signature] DATE: 2/2/87

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN: _____

THIS ITEM COMPLETED
DATE 4-18-88

11. PROPOSED BY: DIRECTOR/MGR: _____ ATTACHMENTS
DATE: _____
12. CONCURRENCE: CEG-H: _____ DATE: _____
SRP: _____ DATE: _____
ECTG PROGRAM MGR: _____ DATE: _____

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

ECSP CORRECTIVE
Action Tracking Document
(CAID)

INITIATION

1. Immediate Corrective Action Required: Yes No
2. Stop Work Recommended: Yes No
3. CAID No. 90600-7
4. INITIATION DATE 08-12-86
5. RESPONSIBLE ORGANIZATION: WBN ONP
6. PROBLEM DESCRIPTION: QR NQR Permanent lighting provided within the Condensate Demineralizer Polisher Tank room in the Turbine Building is inadequate to permit employees to safely conduct certain required activities (sight glass readings) without the use of a flashlight.
7. PREPARED BY: NAME D.H.P. [Signature] ATTACHMENTS DATE: 08-12-86
8. CONCURRENCE: CEG-H [Signature] DATE: 8-12-86
9. APPROVAL: ECTG PROGRAM MGR. [Signature] DATE: 2/2/87

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN:
[Blank lines for plan description]
11. PROPOSED BY: DIRECTOR/MGR: _____ DATE: _____
12. CONCURRENCE: CEG-H: _____ DATE: _____
SRP: _____ DATE: _____
ECTG PROGRAM MGR: _____ DATE: _____

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

ECSP CORRECTIVE
Action Tracking Document
(CAID)

INITIATION

1. Immediate Corrective Action Required: Yes No
2. Stop Work Recommended: Yes No
3. CAID No. 90600-8 4. INITIATION DATE 08-12-86
5. RESPONSIBLE ORGANIZATION: SON ONP
6. PROBLEM DESCRIPTION: QR NQR Permanent lighting is not provided within the tank room areas of the Condensate Demineralizer Building. Operating experience has shown that routine access to this area is required. To allow the safe conduct of required activities within this area, the installation of permanent lighting should be considered.
7. PREPARED BY: NAME D.H. [Signature] ATTACHMENTS
DATE: 08-12-86
8. CONCURRENCE: CEG-H [Signature] DATE: 8-12-86
9. APPROVAL: ECTG PROGRAM MGR. [Signature] DATE: 2/2/87

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN: _____

11. PROPOSED BY: DIRECTOR/MGR: _____ ATTACHMENTS
DATE: _____
12. CONCURRENCE: CEG-H: _____ DATE: _____
SRP: _____ DATE: _____
ECTG PROGRAM MGR: _____ DATE: _____

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

REPORT TYPE: Watts Bar Nuclear Plant Subcategory

REVISION NUMBER: 2

TITLE: Electrical Related to Industrial Safety

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REASON FOR REVISION:

This revision contains general editorial changes and a revision to Section 5.0.

PREPARATION

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1/27/87

DATE

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2-10-87

SIGNATURE*

DATE

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ECSP MANAGER

2/23/87

DATE

N/A

MANAGER OF NUCLEAR POWER
CONCURRENCE (FINAL REPORT ONLY)

DATE

*SRP Secretary's signature denotes SRP concurrences are in files.

Preface, Glossary, and List of Acronyms
for ECTIG 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 ECTIG 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
CHTR	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
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
TVA	Tennessee Valley Authority
UT	Ultrasonic Testing
VT	Visual Testing
WBECS	Watts Bar Employee Concern Special Program
WBN	Watts Bar Nuclear Plant
WR	Work Request or Work Rules
WP	Workplans

1.0 CHARACTERIZATION OF ISSUES

1.1 Introduction

This subcategory report of the Industrial Safety Category of the Watts Bar Nuclear Plant (WBN) Employee Concerns Task Group (ECTG) addresses employee concerns and safety suggestions containing issues which involve perceived electrical hazards which exist, or which may exist, at WBN and/or at other Tennessee Valley Authority (TVA) nuclear plants. These perceived electrical hazards may be the result of, or may be caused by code violations, improper or inadequate design or construction practices, lack of maintenance, lack of management control and support, and/or inadequate or improper procedures, practices, standards, site requirements, or work practices.

None of the employee concerns and safety suggestions addressed by this subcategory report are related to or associated with nuclear safety issues.

As used within this subcategory report the abbreviation (ONP) refers to the Office of Nuclear Power, exclusive of the Division of Nuclear Construction (DNC). This distinction is necessary since the majority of the employee concerns addressed by this subcategory report relate to requirements and criteria issued by the Office of Construction (Nuclear) (now DNC), and/or to requirements and criteria issued by ONP.

The 31 employee concerns and safety suggestions addressed by this subcategory report were logically arranged into 10 discrete underlying groups each consisting of employee concerns which deal with identical or closely-related issues (these groups are referred to herein as "elements"). These elements are described in greater detail below in section 1.2.

1.2 Description of Elements

1.2.1 Temporary Lighting

Five concerns were about the temporary lighting utilized by WBN DNC and ONP within the plant. Concern EX-85-064-003 reported that there were unsafe lighting cords with broken bulbs, etc. Concern WI-85-044-003 also expressed a general concern over the condition of temporary lighting. Concern IN-86-141-002 stated that temporary lighting is in an unsafe condition throughout unit 2, and referred to missing/broken bulbs, the lack of guards, and missing insulation.

Concern IN-86-313-001 stated that a temporary lighting string in the unit 2 annulus area was improperly connected to a 200 amp breaker. Also, concern EX-85-072-005 stated that there were broken bulbs in the temporary lighting strings behind the steam generators.

The issue raised by this element is employee perception that the level of electrical maintenance conducted on temporary electrical systems at WBN is inadequate.

1.2.2 Shock Hazards

Five concerns were about potential shock hazards. One of these concerns, IN-85-355-001, questioned the practice of running electrical cords and welding leads near the floor in areas subject to flooding. Two others, SQM-6-012-001 and WBM-6-008-001, express concern about potential shock hazards at an unspecified area at WBN and at Sequoyah (SQN). One concern, DLJ-85-005, is a safety suggestion submitted at SQN dealing with a missing ground plug on a projector cord. The remaining concern, WBN-0056, is a safety suggestion questioning the use of metal tags on instruments within electrical panels.

The issues raised by this element are employee perceptions that electrical shock hazards exist at WBN and SQN.

1.2.3 Clearance (Tag-Out) Procedure

Two concerns, SQP-6-010-001 and IN-85-714-001, question the "Tag-Out" practice utilized by TVA at WBN and at SQN. These concerns question the safety of the current system as opposed to one utilizing positive "Lockouts."

1.2.4 Drilling into Concrete

One concern, IN-85-402-001, relates to electrical hazards associated with drilling into concrete. This concern stated that drilling into permanent concrete structures at WBN without the prior use of some form of "wall survey" subjects the employee to the unnecessary risk of electrocution should the drill penetrate conduit containing energized wiring.

1.2.5 480V Disconnect Switches

Three concerns address safety problems associated with 480V receptacles and plugs in the plant. Concern EX-85-154-007 stated that the lack of disconnects unnecessarily subjected employees to the risk of being burned by arcing caused by inserting and removing the plug from such energized systems.

It also stated that such activities could cause the plug to explode. Concern EAC-85-005 is a safety suggestion submitted at SQN which stated that welding machine power cables have improperly modified 480V plugs or loose plug conductors. Concern EX-85-154-008 stated that employees are unaware that it is dangerous to unplug welding machines from 480V receptacles while the machine is energized.

The issues raised are the employee perception that activities associated with inserting or removing plugs in 480V receptacles is hazardous because of the lack of receptacle disconnect switches, because of the faulty modification of such plugs, or because of the lack of maintenance of such plugs.

1.2.6 Crane Disconnect Switch

Concern EX-85-154-006, questioned the lack of a safety disconnect mounted on a wall near pendant operated cranes in use at WBN. It also stated that the emergency stop switch on the pendant crane control box is not a "fail safe" device.

1.2.7 Welding Leads

Three concerns are about the welding leads utilized primarily by WBN DNC within the plant, IN-85-235-009, HI-85-042-N02, and IN-85-050-003. One concern stated that there is no quality control over welding leads and cords; the other concern stated that welding leads were damaged and frayed.

The issue raised by this element is employee perception that welding leads at the plant are not adequately maintained.

1.2.8 Electrical Supply Trailers and Transformers

Two concerns addressed electrical hazards associated with the temporary electrical supply trailers or transformers. Concern IN-85-957-001 questioned the safety of DNC temporary transformer trailers. Concern WBN-85-009 is a safety suggestion which questioned whether the transformers onsite could explode.

1.2.9 Permanent Lighting

Eight concerns expressed problems with the permanent lighting at WBN and at SQN. Concern IN-86-002-001 requested that permanent lighting with an easily accessible switch be installed in the steam generator enclosures within the Reactor Building. Concern SQM-6-006-001 stated that there was insufficient permanent lighting in the Condensate

Demineralizer Building polisher rooms at SQN to provide safe access for the assistant unit operators (AUO) to verify sight glass readings.

Concern WBN-0110 is a safety suggestion requesting that permanent lighting be installed in the elevation 692 pipe gallery because of the need for routine maintenance and equipment inspections within the area. Concern WBN-0216 is a safety suggestion stating that the location of the entry permission light over the interlock doors A56 and A57, on the elevation 713 entry portal to unit 2 lower containment are mounted too high, thereby causing neck strain. Concern WBN-85-003-PI is a safety suggestion requesting that permanent lighting be installed in the waste gas analyzer room on elevation 713 of the Auxiliary Building.

Concerns RWO-86-001 and EAC-85-010 are safety suggestions submitted at SQN stating that the lighting levels within the unit 1 lower containment are inadequate because the lighting circuits which were previously utilized for the interim hydrogen igniters have not been restored. The final concern within the element, DLJ-85-004, is also a safety suggestion submitted at SQN stating that the yard lighting in the condensate storage tank area is insufficient.

The issues raised by this element are the employee perceptions that existing permanent lighting is inadequate or improperly installed, or that permanent lighting should be installed in certain plant areas.

1.2.10 Dipstick/Arcing Problem

Concern BFN-85-002-002 questioned why nothing had been done to implement the suggestion in a "winning safety award" dealing with the installation of insulation on the battery terminal of a diesel fire pump engine at Browns Ferry Nuclear Plant (BFN) to prevent possible arcing with the dipstick when the diesel oil level is checked.

2.0 SUMMARY

2.1 Summary of Issues

The basic perceived problem expressed by the employee concerns and safety suggestions contained within this subcategory is that the Electrical Maintenance procedures and maintenance activities conducted at WBN and at SQN, both by DNC and ONP, are inadequate. Those concerns not questioning the adequacy of plant maintenance operations generally questioned the safety of, the installation of, or the design of an electrical system or component.

The issues raised by the various employee concerns and safety suggestions contained within this subcategory report are summarized as follows:

- a. Welding leads, temporary wiring, temporary lighting, and service and extension cords are unsafe because of inadequate or improper Electrical Maintenance procedures, practices, and/or policies.
- b. Shock hazards exist because of improper installation of electrical cables, improper design of fire protection systems in areas containing electrical equipment, inadequate maintenance of electrical equipment, or inadequate or unsafe procedures or practices.
- c. The current clearance procedure in use at WBN and SQN does not provide adequate employee protection.
- d. Existing site procedures and equipment are inadequate to protect employees from shock hazards associated with drilling, or cutting into permanent concrete structures, which contain or could contain embedded conduit encased energized conductors.
- e. Inserting or removing plugs from 480V receptacles is hazardous because of the lack of receptacle disconnect switches, because of the modification of such plugs, or because of the lack of maintenance of such plugs.
- f. The emergency disconnect switches on pendant operated cranes are improperly installed and are unsafe.
- g. Transformers and temporary electrical transformer trailers are unsafe.
- h. The lack of permanent lighting in certain plant areas, or the lack of adequate levels of light in certain plant areas is a hazard.
- i. The lack of action on a "winning safety award."

2.2 Summary of the Evaluation Process

The various employee concerns and safety suggestions associated with this subcategory report were investigated in accordance with the Industrial Safety Category Evaluation Plan. Since each element was investigated as an independent entity, the specific evaluation methodology utilized varied somewhat because of the nature of each such element. In general, the evaluation methodology consisted of the following steps:

- a. The compilation and review of all applicable DNC, ONP, WBN, SQN, and industry standards, codes, procedures, practices, and requirements.
- b. Plant walkdowns and inspections.
- c. Interviews with cognizant ONP and/or DNC employees, management, and craft personnel.
- d. The compilation and review of previous work, reports, and studies conducted on such concerns during the previous concerns evaluation program.

2.3 Summary of Findings

Of the nine issues raised by the various employee concerns and safety suggestions contained within this subcategory, as enumerated in section 2.1 above, three require corrective action.

The following is a summary of the findings and conclusion for each of the 10 elements contained within this subcategory.

2.3.1 Temporary Lighting

The issue raised by this element was inadequate or improper Electrical Maintenance procedures, practices, and policies. This issue was partially substantiated. Existing Electrical Maintenance programs are considered adequate. However, the element findings reveal that there is a lack of adequate management control.

2.3.2 Shock Hazards

The issue raised by this element is that situations or conditions exist where employees could be electrocuted or shocked as a result of the introduction of water through pipe flushing operations, or the activation of fire protection sprinklers, as a result of inadequate maintenance of electrical equipment, or as a result of inadequate procedures or practices. This issue was not substantiated. Existing Electrical Maintenance programs are considered adequate.

2.3.3 Clearance (Tag-Out) Procedure

The issue raised by this element is that when electrical or mechanical systems at WBN and SQN are deenergized to permit maintenance or repair activities, these systems are only protected from accidental restart by a protective card such as a Hold Order Tag on the equipment's main control point(s). Based on the wording of these concerns, the

concerned individuals felt that the current system did not provide as much employee protection as would be provided by a system employing positive locks on all main control points. This issue was not substantiated. The existing electrical clearance procedure in use at WBN and SQN provides adequate employee protection. This "tag-out" system is the standard clearance procedure in use throughout the industry.

2.3.4 Drilling into Concrete

The issue raised by this element was that existing site procedures and equipment are inadequate to protect employees from shock hazards associated with drilling or cutting into permanent concrete structures which contain or could contain embedded conduit encased energized conductors. This issue was partially substantiated. The applicable procedures, both now and at the time the concern was raised, are adequate. These procedures, together with the available "wall survey" and employee protection equipment, provide adequate employee protection. However, the existing procedures which address drilling, cutting, chipping, or other operations involving permanent concrete structures do not clearly provide guidelines and/or requirements for the use of available "wall survey" and employee protective equipment.

2.3.5 480V Disconnect Switches

The issue raised by this element was that inserting or removing plugs from 480V receptacles is hazardous because of the lack of receptacle disconnect switches, the improper modification of such plugs, or the lack of maintenance of such plugs. The issue was not substantiated. The 480V permanently mounted receptacles within the plant are in compliance with both TVA design criteria and the National Electrical Code (NEC) and provide an adequate degree of employee safety.

2.3.6 Crane Disconnect Switch

The issue raised by the employee concern contained within this element was the inadequate or improper design or location of the emergency disconnect switches on pendant operated cranes. This problem was not substantiated. Crane disconnect switches mounted on pendant type cranes at WBN are designed and constructed to meet all applicable codes and regulations.

2.3.7 Welding Leads

The issue raised by the employee concerns contained within this element was inadequate or improper Electrical Maintenance procedures, practices, and policies with respect to the maintenance of welding leads by DNC. This issue was not substantiated. Existing Electrical Maintenance procedures and policies were determined to be adequate.

2.3.8 Electrical Supply Trailers

The issues raised by the employee concern and the safety suggestion contained within this element are: (a) inadequate or improper procedures, practices, or policies with respect to electrical supply trailers utilized by WBN DNC, (b) inadequate or improper design or construction of such trailers, and (c) transformers onsite are hazardous and could explode. All three issues were not substantiated. Existing procedures were determined to be adequate. Such trailers are designed, constructed, and maintained in compliance with applicable codes and regulations, and site procedures and practices. While there are oil-filled transformers onsite, industry history has shown that such transformers do not represent a significant explosive hazard.

2.3.9 Permanent Lighting

The issue raised by the employee concerns and safety suggestion contained within this element was that the lack of permanent lighting, or the lack of adequate levels of lighting in certain plant areas of WBN and/or SQN is a hazard. This issue was substantiated. Certain plant areas, both at WBN and at SQN, do not have adequate levels of lighting to permit the safe completion of required activities and maintenance operations within such areas.

2.3.10 Dipstick/Arcing Problem

The issue raised by the employee concern contained within this element was the lack of action on a "winning safety award" at BFN. This issue was determined to be substantiated. Although the safety suggestion won a monthly safety suggestion award, subsequent evaluations apparently determined that the suggestion was without merit. Since no record of a formal evaluation could be found, the safety suggestion was reevaluated and is being implemented. The safety suggestion program at BFN has, subsequent to the date the subject suggestion was submitted, been revised to provide employees with status reports on all safety suggestions submitted. No further action is necessary.

2.4 Collective Significance of Findings

2.4.1 Management Effectiveness

The subcategory findings reveal that there is a general lack of management control over the administration of existing Electrical Maintenance procedures, policies and practices. Existing site procedures, policies, and practices reviewed are considered to be adequate in most cases.

2.4.2 Employee Effectiveness

The subcategory findings reveal that some problems identified in employee concerns and safety suggestions, notably those dealing with temporary lighting, are caused in part by the employees themselves. This conclusion, however, points to the fact that employees perceive a lack of positive management control over their work activities.

2.5 Perceived Causes

The following is a summary of the perceived causes of those findings which require corrective actions.

2.5.1 Temporary Lighting

The administration of the procedures, practices, and policies dealing with temporary lighting, service cord, and extension cords utilized primarily by DNC does not result in the adequate maintenance of such electrical equipment. Employees are not encouraged to properly maintain such temporary wiring, nor are they disciplined when such equipment is intentionally damaged or altered.

2.5.2 Drilling into Concrete

There was inadequate communication between DNC and ONP as to the availability of site "wall survey" equipment and special employee protective equipment. Because of this lack of communication, site procedures do not adequately address the use of such available equipment.

2.5.3 Permanent Lighting

No permanent lighting was designed to be installed in certain plant areas at WBN and SQN because of a lack of a recognized need for access into such areas. In certain cases operating experience or design differences between the two plants dictates more frequent access; therefore, permanent lighting is now required.

The lack of adequate levels of permanent lighting in certain plant areas at SQN resulted from plant modifications involving the hydrogen ignition system and are temporary in nature.

2.5.4 Dipstick/Arcing Problem

The safety suggestion award program at BFN at the time the subject safety suggestion received a monthly award did not provide any feedback to the concerned employee as to the status or ultimate disposition of his or her suggestion.

2.6 Corrective Actions Taken

No immediate corrective actions or stop work orders were initiated as a direct result of the subcategory evaluations. One corrective action was initiated by the WBN ONP safety staff on May 28, 1986, to correct an access problem encountered as a result of the investigation process. This corrective action involved the preparation of a MR to correct an access problem, and is discussed in section 2.6.3 below.

The following is a summary of the corrective action plans for those findings which required that corrective action be taken. Additional specific information concerning these plans can be found in section 7.0 of this report.

2.6.1 Temporary Lighting

WBN DNC will inspect all temporary wiring, lighting strings, and service cords to verify their adequacy and integrity. Additional emphasis will be placed on the maintenance of such temporary wiring by holding WBN DNC management responsible for the condition of such equipment, and by informing employees of their responsibility for such equipment. An interim electrical maintenance procedure for temporary wiring will be developed and implemented on or before November 14, 1986.

WBN DNC will also verify that all "Tuff-Skin" bulbs in use within their jurisdiction have bulb guards in compliance with NEC article 305. Procurement requirements will be initiated to ensure that all temporary wiring systems and materials meet applicable NEC requirements.

Although WBN ONP also utilizes temporary wiring, lighting strings, and service cords, they were judged to be in compliance with applicable standards and requirements.

The above actions will be incorporated into a WBN site policy on or before January 1, 1987.

2.6.2 Drilling into Concrete

WBN DNC and ONP will revise their current procedures governing drilling, cutting, and chipping operations on permanent concrete to incorporate information concerning existing site employee protection devices and "wall survey" equipment. This revision will also regulate their use as part of the job "preplanning" activities.

The above actions will be incorporated into a WBN site policy on or before January 1, 1987.

2.6.3 Permanent Lighting

SQN ONP will evaluate the need to install permanent lighting within the polisher tank rooms within the Condensate Demineralizer Building. This evaluation will be conducted within six months following the startup of unit 1.

Even though the issue at SQN involved a lack of permanent lighting, the issue, as it applied to WBN, involved a lack of adequate access.

The WBN ONP safety staff prepared a Maintenance Request (MR 578720) on May 28, 1986, to install stairways and work platforms in the condensate demineralizer polisher tank rooms within the Turbine Building. This work is underway and will be complete on or before January 1, 1987. While this action does not involve permanent lighting, it will eliminate the perceived cause of the issue.

2.6.4 Dipstick/Arcing Problem

Although the issue is valid, revisions to the safety award program at BFN have corrected the cause of the issue. The safety suggestion referred to by the subject employee concern was reviewed at the request of the site safety staff, and is being implemented. No corrective action plan was developed.

3.0 EVALUATION PROCESS

3.1 Evaluation Methodology

The various issues raised by the employee concerns and safety suggestions within this subcategory were investigated according to the Industrial Safety Category Evaluation Plan.

Reports and studies conducted on the employee concerns within this subcategory during the previous concerns evaluation program were compiled and reviewed, and are incorporated within this report.

The following is a summary of the specific evaluation methodology utilized in the evaluation of the issues contained within the 10 elements comprising this subcategory.

3.1.1 Temporary Lighting

The employee concerns contained within the element were evaluated utilizing the following methodology:

- a. Standards and requirements for temporary lighting and wiring were compiled and reviewed.
- b. WBN procedures, instructions, and practices relating to the purchase and maintenance of temporary wiring, service cords, and light stringers were compiled and reviewed.
- c. Plant walk-throughs were conducted to (1) investigate specific locations where identified by subject concerns, and (2) evaluate the current overall conditions of temporary lighting strings and cords.
- d. Informal interviews of six WBN DNC and ONP Electrical Maintenance and Engineering personnel were conducted concerning
 - (1) the level and frequency of maintenance,
 - (2) general degree of satisfaction with current maintenance procedures and practices, and
 - (3) possible causes of current and past maintenance problems.
- e. Informal interviews of four WBN DNC and ONP management were conducted to determine the frequency, scope, and administration of maintenance activities.

3.1.2 Snock Hazards

This element was investigated utilizing the following methodology:

- a. Standards and requirements for temporary lighting and wiring were compiled and reviewed.
- b. Applicable WBN procedures, instructions, and practices relating to the installation and maintenance of temporary wiring, service cords, light stringers, and permanent wiring were compiled and reviewed.

- c. Plant inspections were conducted at WBN to (1) investigate specific areas identified by the subject concerns, and (2) evaluate the current overall condition of the plant with respect to electrical equipment and cords installed or placed on or near the floor.
- d. Informal interviews of four cognizant WBN DNC and ONP electricians and Electrical Maintenance personnel were conducted concerning the potential shock hazards of electrical cords and equipment placed or installed near the floor in areas subject to flooding and the current maintenance practices.
- e. Both the WBN DNC and ONP safety staffs at WBN and SQN were contacted in an attempt to locate the unidentified area addressed in concerns SQM-6-012-001 and WBM-6-008-001, and to determine what actions had been taken on the safety suggestions included within the element.
- f. The WBN and SQN ONP Safety Staff and appropriate section supervisors were contacted to determine the status of safety suggestions submitted at these plants.

3.1.3 Clearance (Tag-Out) Procedure

This element was investigated utilizing the following methodology:

- a. Applicable corporate, WBN ONP, and SQN ONP procedures governing the clearance procedures in place at both sites were obtained and reviewed.
- b. Informal interviews were conducted of six WBN DNC and ONP electricians and Electrical Maintenance personnel and foremen to determine if the current clearance procedure is considered to be a safe and acceptable practice.
- c. Informal interviews were conducted with two WBN DNC superintendents to clearly define how their clearance system differed from and interfaced with the WBN ONP clearance procedure.
- d. Informal interviews were also conducted with two WBN and one SQN ONP Operations personnel concerning the day-to-day activities associated with the administration and maintenance of the clearance procedure, and also to determine the amount of training the responsible Operations personnel were required to have.

- e. Released WBN Clearance Sheets (form TVA 7295A) held by the Document Control Unit for the period April 1, 1984 through April 10, 1986, were reviewed for content and completeness, and to determine if any abnormal situations or "near-accidents" were documented during the period reviewed.
- f. A "walkdown" conducted by WBN ONP Operations of existing, active Hold Orders to verify the correct placement of all clearance tags was observed.
- g. Existing training policies and programs at WBN which are utilized to inform or to train employees in the observance and usage of the clearance program were reviewed for adequacy.

3.1.4 Drilling into Concrete

The element was investigated utilizing the following methodology:

- a. WBN DNC and ONP procedures were compiled and reviewed which address the subject of drilling into concrete structures.
- b. Informal interviews with four cognizant WBN ONP and DNC personnel were conducted to determine what type of "wall survey" equipment was onsite, who had control over such equipment, and what capabilities/protection the use of such equipment offered.
- c. Existing procedures were examined to determine if they adequately protected individuals from accidental electrocution while such individuals were drilling (or cutting, chipping, or excavating) permanent concrete structures.

3.1.5 480V Disconnect Switches

This element was investigated utilizing the following methodology:

- a. Applicable NEC provisions and TVA design standards and criteria were obtained and reviewed.
- b. Plant walk-throughs were conducted.
- c. Informal interviews were held with four cognizant WBN ONP and DNC personnel concerning the safety of the current system, and concerning its use by site personnel.

- d. Purchase specifications, and manufacturer literature concerning the installed receptacles and plugs was obtained and reviewed for compliance with applicable NEC requirements.

3.1.6 Crane Disconnect Switch

This element was investigated utilizing the following methodology:

- a. All applicable standards and requirements concerning pendant operated cranes in use at WBN were compiled and reviewed.
- b. Informal interviews with both an experienced WBN ONP mechanical maintenance engineer, and with two WBN ONP employees who operate such cranes were conducted.
- c. Pendant operated cranes were inspected in several locations within the plant for:
 - 1. clarity of the control functions,
 - 2. the presence of a red "stop" button, and
 - 3. the location of the main 480V disconnect.

3.1.7 Welding Leads

This element was evaluated utilizing the following methodology:

- a. Standards and requirements for maintenance of welding leads were compiled and reviewed.
- b. WBN procedures, instructions, and practices relating to the maintenance of welding leads and related equipment were compiled and reviewed.
- c. Plant walk-throughs were conducted to (1) investigate specific locations identified by subject concerns, and (2) evaluate the current overall condition of welding leads and cords.
- d. Informal interviews were conducted of four WBN DNC and ONP Electrical Maintenance and engineering personnel concerning the level and frequency of maintenance activities on welding leads and on the procedures or practices involved.

- e. Cognizant WBN DNC and ONP management were contacted concerning the frequency, scope, and administration of maintenance activities.

3.1.8 Electrical Supply Trailers and Transformers

The element was investigated utilizing the following methodology:

- a. Applicable NEC provisions governing the use, construction, and protection of such temporary transformer enclosures were obtained and reviewed.
- b. Informal interviews were conducted with cognizant two WBN DNC personnel concerning the construction and maintenance of these trailers and concerning work practices and safety concerns involving these trailers.
- c. Informal interviews were also conducted with nine randomly selected WBN DNC personnel concerning their knowledge of and attitudes toward the safety of the trailers.
- d. Inspections were conducted on randomly selected trailers at the site to determine their overall condition and access security.
- e. Discussions were also held with the site Safety Staff concerning the potential for transformer explosions and/or fires.

3.1.9 Permanent Lighting

This element was evaluated utilizing the following methodology:

- a. Applicable lighting standards and design standards were obtained and reviewed.
- b. Walkdowns or inspections of the specific areas addressed by the concerns at WBN and at SQN were performed.
- c. Informal interviews were conducted of six cognizant WBN, and SQN ONP, and DNC personnel concerning the available light levels and current method of access to the sight glasses in the condensate demineralizer polisher tank rooms and the perceived lack of permanent lighting within the steam generator enclosures.

- d. WBN and SQN Safety Staffs and cognizant section supervisors were contacted concerning the disposition of the issues which arose from associated safety suggestions submitted at the plants.

3.1.10 Dipstick/Arcing Problem

This element was evaluated utilizing the following methodology.

- a. Discussions were held with the WBN safety (ONP) to determine if similar situations or conditions existed at WBN.
- b. A WBN plant "walk-through" was conducted.
- c. Discussions were held with the BFN safety staff (ONP) to determine (1) when the subject "winning safety award" was given, (2) what action had been taken, and if none, why? and (3) what procedures, policies, or programs were in effect at that time, and how have they changed subsequent to that time.

3.2 Requirements and Criteria

The following is a listing of the various requirements and criteria which were utilized in deriving the findings contained within this subcategory report.

3.2.1 General Requirements and Criteria

- 3.2.1.1 National Electrical Code (1984), National Fire Protection Association, Article 70. Establishes standard practices for the design of electrical systems for industrial, commercial, and residential use.
- 3.2.1.2 Title 29, Code of Federal Regulations (CFR), Part 1926, Occupational Safety and Health Administration (OSHA), Construction Industry Standards and Interpretations, Change 5, June 17, 1985.
- 3.2.1.3 Title 29, CFR, Part 1960, OSHA, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters.
- 3.2.1.4 American National Standards Institute (ANSI) B30 (1983), Cranes and Hoists. Establishes criteria for the design, installation, inspection, and use of cranes and hoists in general industry.

- 3.2.1.5 **ANSI Illuminating Engineering Society of North America, RP-7, (1983), American National Standard Practice for Industrial Lighting. Establishes general lighting level criteria for industrial activities.**
- 3.2.1.6 **TVA Occupational Health and Safety Manual (OHSM), Standard Number 008, Electrical/Mechanical Lockout and Tag-out (Revision dated January 4, 1982). Establishes TVA's corporate position on the use of lockout and/or tag-out procedures.**
- 3.2.1.7 **TVA ONP Occupational Health and Safety Procedures Manual, ONP Health and Safety Supplemental Procedure G16, Clearance Procedure (Revision dated July 19, 1982). The ONP implementation procedure for the requirements of item "6" above.**
- 3.2.1.8 **WBN ONP Employees' Safety Handbook (undated).**
- 3.2.1.9 **Office of Engineering Design and Construction, Manual of Safe Practices and Information, (undated handbook).**
- 3.2.2 **TVA Electrical Design Standards (DS)**
 - 3.2.2.1 **DS-E17.1.1, Lighting Design Standards and Practices, (Revision 2, June 15, 1983). Sets acceptable lighting levels for various plant areas and certain activities.**
 - 3.2.2.2 **DS-E12.5.2, 480V Power Receptacles, (Revision 1, October 23, 1982). Establishes the design criteria and acceptable electrical equipment for such power receptacles.**
- 3.2.3 **WBN ONP Administrative Instructions (AI)**
 - 3.2.3.1 **AI-1.8, Plant Housekeeping (Revision 9, January 16, 1986). Establishes and delineates the plant housekeeping requirements.**
 - 3.2.3.2 **AI-2.12, Clearance Procedure (Revision 13, April 2, 1986). The clearance procedure in use at WBN.**
 - 3.2.3.3 **AI-2.19, Independent Verification (Revision 4, July 11, 1986). Requires independent verification of certain clearance procedure activities where they relate to nuclear safety-related equipment and systems.**

- 3.2.3.4 AI-10.1, Plant Training Program (Revision 18, April 11, 1986). Establishes the training program and training procedures for ONP employees.
- 3.2.3.5 AI-9.8, Drilling, Cutting, Chipping, and Excavating (Revision 9, September 19, 1985). Establishes a means of approving and controlling work activities.
- 3.2.4 WBN Hazard Control Instructions (HCI)
 - 3.2.4.1 HCI-E2, Service Cords (Revision dated April 11, 1983). Establishes requirements for service cords.
 - 3.2.4.2 HCI-E7, Extension Cords (Revision dated May 15, 1979). Establishes requirements for extension cords.
- 3.2.5 SQN ONP AI
 - AI-3, Clearance Procedure (Revision 30, March 20, 1986). The clearance procedure in use at SQN.
- 3.2.6 WBN DNC Quality Control Instructions (QCI)
 - 3.2.6.1 QCI-1.10, Work Control (Revision 0, March 20, 1986). Establishes a means of controlling and approving DNC work activities.
 - 3.2.6.2 QCI-1.23, Division of Construction Use of the Division of Nuclear Power Clearance Procedure (Revision 1, April 9, 1982). Defines the use by DNC of ONP clearance procedure AI-2.12.
 - 3.2.6.3 QCI-1.36, Storage and Housekeeping (Revision 13, April 1, 1986). Establishes and delineates the housekeeping requirements for DNC.
- 3.2.7 WBN DNC Quality Control Procedures (QCP)
 - QCP-1.36, Storage and Housekeeping (Revision 10, April 1, 1986). Establishes a means of administratively controlling storage and housekeeping activities and inspections.
- 3.2.8 Various Other Requirements or Criteria
 - 3.2.8.1 WBN Standard Practice 9.5, Temporary Lighting and Service Cords (Revision 0, March 1985). Establishes standards for lighting and service cords.

- 3.2.8.2 ONP Operations Section Letter (OSLA) 32, Safety Review of Active Protective Tags and Clearance Sheets (Revision 4, October 3, 1985). Establishes a program to periodically review and verify all issued and outstanding clearance tags and clearance sheets.
- 3.2.8.3 OSLA-38, Clearance List (Revision 9, March 24, 1986, revised quarterly). An active list of ONP personnel who are qualified pursuant to AI-2.12 to hold clearances.
- 3.2.8.4 SQN HCI-G2, The Supervisor, dated May 26, 1983. Discusses pre-job planning.
- 3.2.8.5 SQN Standard Practice (SQS) 7, Hazard Control Plan (Revision 4, November 6, 1986).
- 3.2.8.6 SQN Supervisors Handbook, undated.

4.0 FINDINGS

Some of the issues addressed by this subcategory have implications at other ONP sites. For example, since temporary wiring and lighting is utilized to some extent at all ONP sites, this issue and its corresponding findings and conclusions may have universal implications. Issues involving electrical safety are being addressed through the development of ONP standards (which are generic documents for all ONP) and through the development of site procedures (which deal with one site's circumstances).

The findings and conclusions of this subcategory report are not in conflict with any findings and conclusions generated as a result of previous investigations of the employee concerns addressed by this report.

The findings and conclusions relative to the issues contained within each of the 10 elements which comprise this subcategory are presented below by element.

4.1 Temporary Lighting

Based on the findings below, the issue addressed by this element is substantiated.

4.1.1 Discussion

4.1.1.1 Site-Specific - WBN

Temporary lighting strings within the plant can be found with missing bulbs and missing guards.

However, of the 60 lighting strings and service cords inspected during the course of this investigation, no broken bulbs were observed, and no temporary wiring was found which had damaged or unrepaired insulation.

The concern which questioned the usage of a 200-amp breaker on a temporary lighting string was determined to be invalid. Temporary lighting within the specific area addressed by the concern was found to be fed by a 100-amp panel box through either 20-amp or 30-amp ground fault, circuit interruption devices. This was an acceptable practice and was in accordance with the provision and requirements of NEC article 305 (Temporary Wiring).

Based on informal interviews with WBN DNC personnel and management, the conditions addressed by this element have two basic causes: (a) work-related breakage and (b) intentional damage to or modification of temporary light stringers.

The standard for temporary electrical wiring is found in NEC article 305. This article requires that temporary wiring conform with the following generalized requirements:

- a. All branch circuits must originate in an approved power outlet or panelboard.
- b. All receptacles shall be of the grounding type.
- c. All lamps for general illumination shall be protected from accidental contact or breakage by either (a) elevation of at least 7 feet (2.13 m) above normal working surfaces, or (b) by a suitable fixture or lampholder with a guard.
- d. All 125V circuits which are utilized by employees shall have ground fault, circuit interruption protection.

Temporary light stringers and service cords are purchased under the provisions of WBN Standard Practice 9.5. This standard requires that these cords and lighting fixtures comply with applicable NEC standards. Although DNC does not have a corresponding established written practice, they follow the same general guidelines for the purchase of such cords and fixtures.

In WBN ONP, maintenance of temporary lighting stringers and service cords is governed by the provisions of WBN HCI-E2 (Service Cords), HCI-E7 (Extension Cords), and by WBN AI-1.8 (Plant Housekeeping). These provisions require that service extension and temporary light strings utilized by ONP be inspected at least annually.

Inspected light strings and electrical cords are marked with a label indicating the next required inspection date. These cords are issued by the ONP toolroom and are inspected and tested for polarity and grounding prior to issue. All lighting strings or other cords which are returned with missing or broken bulbs or guards are sent to ONP Electrical Maintenance for repair before reissue.

In WBN DNC the maintenance of temporary light stringers and wiring is governed by the provisions of QCI-1.36 and QCP-1.36 (both titled "Storage and Housekeeping"). These require that monthly quality control storage and housekeeping inspections be performed on all areas of the plant. The various WBN Assistant Construction Superintendents (ACS) are responsible for developing plans for, conducting, and documenting such monthly inspections for the areas and crafts under their authority. These inspections are conducted by the various craft superintendents or foremen as a team.

Following each such inspection, the ACS prepares a report of findings and issues a list of such findings back to the various craft for correction/repair and signoff. These records are maintained by the ACS, and problem areas are identified and targeted for increased surveillance. In addition to this formal inspection, the WBN Health and Safety Committee also conducts a formal inspection of one or more plant areas each month. The results of these inspections are also forwarded to the various craft for correction or repair. These two inspections are in addition to the formal semiannual management inspections conducted in accordance with TVA policy and OSHA requirements (Part 1960, Subpart D, "Inspections and Abatement").

DNC also has at least one man on each major level of the plant (outside security) who is responsible for inspecting and maintaining temporary lighting strings. They also have a "signup" sheet on each

level for use by employees as a means of requesting replacement bulbs and/or guards. Another practice employed by DNC is the "roll-back." This informal practice, which normally occurs during the last hour of the day on the last Friday of each month, involves pulling down, inspecting, and winding up all welding leads, lightings, strings, and service cords in use by DNC throughout the plant.

The WBN ONP maintenance program requires only annual formal inspections. However, since the WBN ONP toolroom routinely inspects each cord or lighting string before it is issued, it is felt that the current WBN ONP inspection and maintenance program activities are adequate. Based both on the frequency and scope of WBN DNC inspections and maintenance activities and upon the level of satisfaction expressed by WBN DNC employees informally interviewed during the course of this investigation, it is felt that the current WBN DNC inspection and maintenance program is adequate.

Although the involved concerns date back to August 1985, the current applicable WBN procedures have not changed substantially since that date. Changes after August 1985 included revising QCP-1.36 to incorporate deficiencies tracking and to assign inspection responsibility to the ACS.

During the course of this inspection, several areas of unit 2 were observed which had temporary lighting strings with missing or modified guards. When this was brought to the attention of the electrical superintendent and the maintenance foreman, they were corrected. Further discussions revealed that there was some uncertainty over whether the nylon-coated "Tuff-Skin" bulbs currently being used by WBN DNC required a guard. Discussions with DNC's safety staff revealed that, while these bulbs are harder to break, they do not have an exemption from the NEC requirement concerning the use of bulb guards. Even though the WBN DNC's safety staff has indicated that guards are not necessary on these bulbs, the electrical section is continuing to issue these bulbs with guards. In addition, they are in the process of replacing the "bird cage" guard with the more durable clear plastic guards.

4.1.2 Findings/Conclusions

4.1.2.1 Site-Specific - WBN

Existing procedures for the routine maintenance of light stringers, service cords, and extension cords are adequate to ensure that such temporary wiring is constructed to meet applicable standards, requirements, and criteria. However, there is a lack of management control over the line administration of Electrical Maintenance procedures and the enforcement of existing site standards and requirements for such temporary wiring and lighting.

In addition, the policy of requiring bulb guards on "tuff-skin" bulbs in use at the site is unclear.

4.2 Shock Hazards

Based on the findings below, the issues raised by the employee concerns and safety suggestions are unsubstantiated.

4.2.1 Discussion

4.2.1.1 Site-Specific - WBN

Based on the information contained within SQM-6-012-001 and WBM-6-008-001, it was assumed that the concerns addressed the Radiochemical Laboratory at WBN and SQN. This area of both plants has some limited chemical storage, a known access/egress problem, electrical equipment, and fire protection sprinkler system, thereby fitting the area referred to by these concerns.

While it is true that there is electrical equipment within this area, its presence poses no significant shock hazard. The majority of the sample analysis equipment in the titration room is nonelectrical, and all electrical supply circuits supplying this area are equipped with both disconnects and circuit breakers. There is no history within the industry which indicates that areas containing electrical equipment such as that contained within these labs pose a significant electrocution or shock hazard should the fire sprinkler system activate.

Temporary electrical cords and wiring are frequently run near the floor in congested areas of the plant such as the unit 2 lower containment area. The NEC,

Article 305-2 (c) requires that temporary circuits be located where the conductors will not be subject to physical damage, and that such branch circuit conductors not be laid on the floor. This requirement is reflected in ONP by HCI-G2, HCI-E2, HCI-E7, and in similar practices within WBN DNC.

Informal discussions with DNC electricians and subsequent plant inspections revealed that temporary power feeders and branch circuits are placed overhead whenever possible. However, because of space considerations in certain congested plant areas, temporary wiring and welding leads are often placed around the edge of the room near the floor. Whenever this practice is necessary these conductors are hung at least one foot above the floor level. Welding machines utilized by DNC are also elevated on racks off the floor. By elevating both these electrical cords and the welding machines above the floor, the potential for shock hazards because of flooding are greatly reduced.

In WBN ONP, maintenance of temporary wiring is governed by the provisions of WBN AI-1.8. These provisions require that temporary wiring utilized by WBN ONP be inspected at least annually. In WBN DNC the maintenance of temporary wiring is governed by the provisions of QCI-1.36 and QCP-1.36. These require that monthly quality control storage and housekeeping inspections be performed on all areas of the plant.

The various WBN DNC ACSs are responsible for developing plans for conducting, and documenting such monthly inspections for the areas and crafts under their authority. These inspections are conducted by the various craft superintendents or foremen as a team. Following each such inspection, the ACS prepares a report of findings and issues a list of such findings back to the various craft for corrections or repair, and signoff. These records are maintained, by the ACS, and problem areas are identified and targeted for increased surveillance.

In addition to this formal inspection, the WBN Health and Safety Committee also conducts a formal inspection of one or more plant areas each month. The results of these inspections are also forwarded to the various craft for correction or repair. These two inspections are in addition to the formal

semiannual management inspections conducted in accordance with TVA policy and OSHA requirements (Part 1960, Subpart D, Inspections and Abatement).

The safety suggestion questioning the use of metal identification tags within electrical panels and cabinets raised a valid issue. Discussions with the ONP safety staff revealed that an MR has been written (MR 503865) requiring that all such metal tags be replaced with nonconductive plastic tags. Based on this, no further action is warranted.

4.2.1.3 Site-Specific - Sequoyah

The safety suggestion concerning a missing ground plug on a projector cord was valid. This problem had been reported to the ONP safety staff. Discussions with them revealed that a new 3-prong plug has been installed on the projector cord.

4.2.2 Findings/Conclusions

4.2.2.1 Site-Specific - WBN

Based on the above findings, the existing procedures and practices for installing temporary wiring in congested areas, and on the maintenance inspection procedures for such temporary wiring, are considered to be adequate.

4.3 Clearance (Tag-Out) Procedure

Based on the findings below, the issues raised by this element are not substantiated.

4.3.1 Discussion

4.3.1.1 Generic Discussion

The OSHM standard requires that electrical, hydraulic, or mechanical systems must be deenergized and that all residual energy must be dissipated before maintenance or repair can commence on such systems. It further requires that all energy sources be isolated or blocked at a point that cannot be overridden, and that the points of energy control be secured against the unauthorized reenergization of the system. The standard permits the securing of the points of energy control by any of three methods:

- a. Using a physical means of preventing the accidental or unauthorized reenergization of the system through the use of locks or "lockout" devices and a warning tag identifying the responsible person or persons.
- b. Posting a warning at the point(s) of energy control giving the reasons for, the date of, and the name(s) of persons responsible for the isolation. This method requires that all personnel with access to the control point(s) be trained in the method of control.
- c. Placing a person at the point(s) of energy control during the maintenance or repair activity with the specific responsibility of protecting against unauthorized actuation.

The clearance procedure method utilized by ONP is based on method "b" above, and is found in OHSM Supplementary Procedure G16 (herein referred to as "SP-G16"). This implementing document is a "tag-out" procedure requiring that all energy control points be secured by a warning tag. Both WBN AI-2.12 and SQN AI-3 (clearance procedures) are site implementations of the clearance procedures established by SP-G16.

In order for a "tag-out" clearance procedure to be acceptable as a primary means of employee protection as required by OHSM Standard Number 008, the following conditions must all exist:

- a. The procedure must adequately address all aspects of obtaining, holding, working under, and removing hold order clearances.
- b. The procedure must be strictly followed.
- c. The responsible parties issuing and holding clearances must have a thorough knowledge of the clearance procedures, and the issuing party must be qualified to accurately define all clearance boundaries associated with such clearance, and
- d. All employees must understand the purpose of the clearance procedure, and be able to recognize all tags and signs utilized for clearance purposes.

In addition to these conditions, the clearance procedure must be perceived by the employees as being a safe, reliable, positive means of protection while working on "tagged-out" systems and components.

4.3.1.2 Site-Specific - WBN

Under SP-G16 clearance can be issued only by the area dispatcher, Shift Engineer (SE), or designated Assistant Shift Engineer (ASE) and only to persons who have been authorized to hold clearances by the plant manager.

In order to obtain this authorization WBN AI-2.12, Section 4, requires that each person requesting such authorization complete a formal training session which includes a comprehensive examination. It further states that a clearance can be issued only by personal contact between the SE and the requesting party. Voice contact is acceptable only in those cases where the SE is absolutely certain of the identity of the requesting party.

The SE, ASE, or other qualified personnel authorized by the SE are required to personally place all tags on all primary and secondary control points. Second person verification is also formally required on all safety-related systems. This second person verification requirement is found in WBN AI-2.19.

When the maintenance activity for which the clearance was obtained is completed and all maintenance personnel are clear, the person holding the clearance is required to notify the SE that the clearance may be released. The SE must then verify that all persons holding the clearance have released it, and that all grounds have been removed before removing all protective tags and making the equipment ready for service.

In addition to the provisions of SP-G16, the WBN ONP Operations Section has a clearance verification and maintenance procedure found in SLA-32. OSLA-32, which was put in place on March 26, 1982, requires that all active clearances at WBN be physically verified to ensure that (a) the clearance is still needed, (b) all required tags are listed on the clearance sheet, and (c) that all required information and names are on all tags. This review must be done by the SE or ASE on either of the following schedules:

- a. Every six months for all clearances over six months old, plus a quarterly review of a random sample of all other active clearances, or
- b. A quarterly verification of about one-fourth of all active clearances, beginning with the oldest. No clearance will exceed one year without verification.

This verification and maintenance procedure ensures that outstanding clearances remain complete, that all cleared components have proper, readable tags affixed, and that all unnecessary clearances are closed.

The WBN clearance procedure contains a section addressing the interface between ONP and DNC. Since many original hold orders originate with DNC, special precautions must be taken to ensure that changes or modifications to such components are tracked and included in the clearance. This interface is addressed by QCI-1.23. This procedure adopts the procedures contained within ONP AI-2.12, and contains a list of site DNC personnel who have been qualified and authorized pursuant to AI-2.12 to hold clearances.

4.3.1.3 Site-Specific - SQN

Under SP-G16 clearances can be issued only by the area dispatcher, SE, or designated ASE and only to persons who have been authorized to hold clearances by the Plant Manager. In order to obtain this authorization SQN AI-3, section 5.1.3, requires that each person requesting such authorization complete a formal training session which includes a comprehensive examination. It further states that a clearance can be issued only by personal contact between the SE and the requesting party. Voice contact is acceptable only in those cases where the SE is absolutely certain of the identity of the requesting party. The SE, ASE, or other qualified personnel authorized by the SE are required to personally place all tags on all primary and secondary control points. Second person verification is also formally required on all safety-related systems. This second person verification requirement is found in SQN AI-3, Section 3.2.2. When the maintenance activity for which the clearance was obtained is completed and

all maintenance personnel are clear, the person holding the clearance is required to notify the SE that the clearance may be released. The SE then must verify that all persons holding the clearance have released it, and that all ground identification tags have been returned properly before removing all protective tags and making the equipment ready for service.

In addition to the provisions of SP-G16, the SQN ONP Operations Section has a clearance verification and maintenance procedure found in Section 8.3 (Clearance Records) of AI-3. This procedure differs from that utilized by WBN as follows:

- a. All outstanding clearances are reissued and renumbered by the SE starting at zero on January 1 of each year.
- b. On April 1, the SE must administratively review all outstanding clearances and conduct a random physical verification of at least 10 percent of all outstanding clearances to confirm that all tags are in place and attached to the correct components.
- c. On July 1, the SE must again review all outstanding tags, and must physically verify all clearances over six months old.
- d. On October 1, the SE must repeat the April 1 requirements.

These verification and maintenance procedures ensure that outstanding clearances remain complete, that all cleared components have proper, readable tags affixed, and that all unnecessary clearances are closed.

4.3.1.4 WBN DNC Procedures

WBN DNC has a similar clearance procedure for equipment, components, and systems before its release to ONP. This procedure is also based on OHSM Standard Number 008, and requires the use of either a "Danger" tag at all energy control points, or the posting of an employee to guard such points. The procedure requires that such tags be signed and dated by the issuing craft or engineering supervisor and delivered to the responsible craft or engineering

supervisor for placement on the control points. All such tags are to be signed and dated by the issuing person, and must be removed by that person or his designee. When electrical and mechanical clearances are both required, the electrical clearance is placed first, and removed last to ensure that cleared mechanical equipment is not accidentally energized.

4.3.2 Findings

4.3.2.1 Site-Specific - WBN and SQN

The following findings apply both to WBN and to SQN.

Based on a review of the various clearance procedure-related documents listed in section 5.1 of this report, the procedures at both WBN and SQN appear adequate.

Informal interviews with WBN and SQN Operations personnel, and with various ONP and DNC personnel who are qualified to hold clearance revealed that the implementation of existing clearance procedures is taken quite seriously. Active and closed clearance sheets, ONP and DNC craft supervisor clearance logs which were reviewed during the course of the investigation, appeared to be complete. Observed clearance verification activities pursuant to WBN OSLA-32 and reviewed clearance verification sheets revealed no significant problem with the completeness of outstanding clearances at WBN.

Training requirements for SEs and ASEs as well as general employee training requirements are documented in WBN ONP AI-10.1. SEs and ASEs are required to undergo a rigorous training program administered by ONP and by the Nuclear Regulatory Commission as part of their position qualifications. This training includes instruction in the accurate completion of clearances. ONP and DNC personnel must successfully pass a course on the site clearance procedure before they can hold clearances. All WBN employees receive general employee training which includes the clearance procedure and documents clearance tag recognition.

In ONP this training is part of the General Employee Training (GET) 1.1, and is included in the ONP Employee Safety Handbook and the DNC Manual of Safe Practices and Information issued to new employees.

Informal interviews with ONP and DNC personnel during the course of this investigation revealed that the clearance procedure and the processes required to obtain and hold clearances were understood. Most of the people informally interviewed felt that the existing system was a safe practical means of employee protection. Those questioning the system generally trusted the existing procedure, but would feel better protected with a positive "lockout" system. It should be noted that under the existing procedure nothing prevents or prohibits an individual from requesting that the energy control points be additionally secured through the removal of fuses and breakers, where possible, and that all systems should be considered to be "energized" until such systems are verified to be safe through the use of test equipment. One foreman, stated that he had worked in an industry where all control points were required to be locked. He indicated that when he came to TVA he distrusted the "tag-out" system at first, but that experience has proven that the system works well.

The primary reasons for utilizing a "tag-out" system over a "lockout" system are:

- a. The current "tag-out" process utilized by TVA is the standard practice in the power generation industry, and is accepted by the Nuclear Regulatory Commission.
- b. Because of the large number of outstanding hold orders at these plants, their duration, and their frequent complexity, the procedures for, and maintenance and administration of a lock type system would be far more complex than those required by the present system.
- c. The use of a "lockout" system would result in an undesirable degree of inflexibility. Systems which were "locked out," especially where numerous components were involved, could not be reenergized during emergency situations as easily, and
- d. A large percentage of the energy control devices, both electrical and otherwise, are not designed to permit the use of a positive locking device. However, most of these devices could be modified to either accept a lock or be physically secured.