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Licensee Contractor and Vendor Inspection Status Report

Quarterly Report
April – June 1998

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

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Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ABSTRACT

This periodical covers the results of inspections performed between April 1998 and June 1998 by the NRC's Quality Assurance, Vendor Inspection and Maintenance Branch that have been distributed to the inspected organizations.

CONTENTS

PAGE

Abstract iii

Introduction vii

Inspection Reports 1

Columbiana Boiler Company (999-1335/98-01) 2
Columbiana, OH

Duke Engineering and Services (99901330/98-01) 24
Bolton, MA

GNB Technologies (99901251/98-01) 34
Lombard, IL

Nuclear Logistics, Inc. (99901298/98-01) 46
Fort Worth, TX

Westinghouse Electric Company (99900404/98-01) 73
Nuclear Services Division
Cheswick, PA

INTRODUCTION

A fundamental premise of the U. S. Nuclear Regulatory Commission (NRC) licensing and inspection program is that licensees are responsible for the proper construction and safe and efficient operation of their nuclear power plants. The Federal government and nuclear industry have established a system for the inspection of commercial nuclear facilities to provide for multiple levels of inspection and verification. Each licensee, contractor, and vendor participates in a quality verification process in compliance with requirements prescribed by the NRC's rules and regulations (Title 10 of the *Code of Federal Regulations*). The NRC does inspections to oversee the commercial nuclear industry to determine whether its requirements are being met by licensees and their contractors, while the major inspection effort is performed by the industry within the framework of quality verification programs.

The licensee is responsible for developing and maintaining a detailed quality assurance (QA) plan with implementing procedures pursuant to 10 CFR Part 50. Through a system of planned and periodic audits and inspections, the licensee is responsible for ensuring that suppliers, contractors and vendors also have suitable and appropriate quality programs that meet NRC requirements, guides, codes, and standards.

The NRC reviews and inspects nuclear steam system suppliers (NSSSs), architect engineering (AE) firms, suppliers of products and services, independent testing laboratories performing equipment qualification tests, and holders of NRC construction permits and operating licenses in vendor-related areas. These inspections are done to ensure that the root causes of reported vendor-related problems are determined and appropriate corrective actions are developed. The inspections also review vendors to verify conformance with applicable NRC and industry quality requirements, to verify oversight of their vendors, and coordination between licensees and vendors.

The NRC does inspections to verify the quality and suitability of vendor products, licensee-vendor interface, environmental qualification of equipment, and review of equipment problems found during operation and their corrective action. When nonconformances with NRC requirements and regulations are found, the inspected organization is required to take appropriate corrective action and to institute preventive measures to preclude recurrence. When generic implications are found, NRC ensures that affected licensees are informed through vendor reporting or by NRC generic correspondence such as information notices and bulletins.

This quarterly report contains copies of all vendor inspection reports issued during the calendar quarter for which it is published. Each vendor inspection report lists the nuclear facilities inspected. This information will also alert affected regional offices to any significant problem areas that may require special attention. This report lists selected bulletins, generic letters, and information notices, and include copies of other pertinent correspondence involving vendor issues.

INSPECTION REPORTS

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 25, 1998

Columbiana Boiler Company
ATTN: Mr. T. Dougherty, President
200 West Railroad Street
Columbiana, Ohio 44408

SUBJECT: NRC INSPECTION REPORT 999-1335/98-01, NOTICE OF VIOLATION, AND NOTICE OF NONCONFORMANCE

Dear Mr. Dougherty:

On May 11-14, 1998, the U.S. Nuclear Regulatory Commission (NRC) performed an announced inspection of Columbiana Boiler Company (CBC) at its facility in Columbiana, Ohio. The enclosed inspection report presents the details of the inspection. Additional information on 10 CFR Part 21 training was transmitted to the NRC by telephone on June 12, 1998.

The inspection team reviewed CBC's activities associated with the fabrication of Uranium Hexafluoride (UF_6) cylinders, Models 30B and 48Y. The team evaluated CBC's compliance with the requirements of 10 CFR Parts 21 and 71, Certificates of Compliance, and the requirements of American National Standards Institute N14.1-1990, "Uranium Hexafluoride - Packaging for Transport." The inspectors focused on CBC's management and fabrication controls.

The team concluded that CBC's management controls and fabrication controls were generally acceptable and that the UF_6 cylinders fabricated by CBC will meet their intended safety function. However, the team identified one violation having high safety significance and five nonconformances having low safety significance.

The team was informed that CBC had hired a new Quality Assurance (QA) Manager in March 1998 who is completely updating CBC's QA program to comply with the requirements of 10 CFR Part 71. The team noted that CBC is currently in the process of developing new QA procedures which, when fully implemented, will address the issues identified during this inspection. The implementation of CBC's revised QA program was not addessed during this inspection. However, the implementation of the updated QA program will be inspected in a future inspection.

Please provide us, within 30 days of the date of this letter, a written statement in accordance with the instructions specified in the enclosed Notice of Violation and Notice of Nonconformance. We will consider extending the response time if you can show good cause for us to do so.

Mr. T. Dougherty

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response will be placed in the NRC Public Document Room.

Sincerely,

ORIGINAL SIGNED BY /s/

Susan F. Shankman, Deputy Director
Licensing and Inspection Directorate
Spent Fuel Project Office, NMSS

Enclosures:
1. NRC Inspection Report No. 999-1335/98-01
2. Notice of Violation
2. Notice of Nonconformance

Docket 999-1335

U.S. NUCLEAR REGULATORY COMMISSION
Office of Nuclear Material Safety and Safeguards
Spent Fuel Project Office

Inspection Report

Docket:	999-1335
Report:	999-1335/98-01
Vendor:	Columbiana Boiler Company Columbiana, Ohio
Date:	May 11-14, 1998
Inspection Team:	T. Matula, Team Leader, SFPO S. McDuffie, SFPO G. Roberts, INEEL
Approved by:	Susan F. Shankman, Deputy Director Licensing and Inspection Directorate Spent Fuel Project Office, NMSS

Enclosure 1

EXECUTIVE SUMMARY

NRC Inspection Report No. 999-1335/98-01

On May 11-14, 1998, the U.S. Nuclear Regulatory Commission (NRC) performed an announced inspection of Columbiana Boiler Company (CBC) at its facility in Columbiana, Ohio.

The team inspected CBC's activities associated with the fabrication of Uranium Hexafluoride (UF_6) cylinders, Models 30B and 48Y. The purpose of the inspection was to determine if CBC's fabrication activities were performed in accordance with the requirements of 10 CFR Parts 21 and 71; Certificates of Compliance (COCs) 6553, 9196, and 9234; and American National Standards Institute (ANSI) N14.1-1990, "Uranium Hexafluoride - Packaging for Transport." The team assessed CBC's management and fabrication controls. The results of the inspection are summarized in Table 1.

- Management Controls

  The team determined that CBC's management controls were generally acceptable. However, several areas of CBC's management control system were not in compliance with 10 CFR part 71, Subpart H. The team identified one violation and three nonconformances in this area. The lack of 10 CFR Part 21 postings and training documentation led to a violation regarding Part 21 which is considered to have high safety significance. Specific nonconformances, having low safety significance, include inadequate Quality Systems Manager (QSM) independence from cost and schedule considerations, failure to adequately control nonconforming material, failure to document noncompliances, and failure to conduct internal and external audits. The team made observations regarding the absence of a procedure for classification of components, an inadequate corrective action procedure, missing document approval signatures, and having a centralized location for fabrication drawings and procedures rather than having them at work stations.

- Fabrication Controls

  The team determined that CBC's fabrication controls were generally acceptable. The team identified two nonconformances having low safety significance regarding the control of torque used in the assembly of cylinders, as well as tool and equipment calibration. The team made an observation regarding material shelf life control.

- Overall Conclusions

  The team concluded that CBC's management controls and fabrication controls were generally acceptable and that the UF_6 cylinders fabricated by CBC will meet their intended safety function. However, the team identified one violation having high safety significance and five nonconformances having low safety significance. The team was informed that CBC had hired a new Quality Assurance (QA) Manager in March 1998

who completely updated CBC's QA program to comply with the requirements of 10 CFR Part 71. The team noted that CBC is currently in the process of implementing new QA procedures which, when fully implemented, will address the issues identified during this inspection. The implementation of the updated QA program will be inspected in a future inspection.

Table 1
Summary of Inspection Findings

Regulatory Requirement 10 CFR Section	Subject of Violation or Noncompliance	Number of Findings *	Type of Finding	Report Section
21.6	Posting requirements	1 (1)	Violation (999-1335/98-01-02)	2.3.2
71.103	Quality assurance organization	1 (1)	Nonconformance (999-1335/98-01-01)	2.2.2
71.105	Quality assurance program	1 (1)	Observation	2.2.2
71.113	Document control	1 (2)	Observation	2.4.2
71.117	Identification and control of materials, parts, and components	1 (1)	Observation	3.2.2
71.123	Test control	1 (1)	Nonconformance (999-1335/98-01-05)	3.3.2
71.125	Control of measuring and test equipment	1 (4)	Nonconformance (999-1335/98-01-06)	3.5.2
71.131	Nonconforming materials, parts, or components	1 (3)	Nonconformance (999-1335/98-01-03)	2.3.2
71.133	Corrective action	1 (1)	Observation	2.3.2
71.137	Audits	1 (1)	Nonconformance (999-1335/98-01-04)	2.5.2

* Numbers in parentheses indicate the number of supporting noncompliances as examples.

LIST OF ACRONYMS USED

ANSI	American National Standards Institute
CBC	Columbiana Boiler Company
CFR	Code of Federal Regulations
COC	Certificate of Compliance
INEEL	Idaho National Engineering and Environmental Laboratory
NMSS	Office of Nuclear Material Safety and Safeguards
NCR	Nonconformance Report
NDE	Nondestructive Evaluation
NRC	Nuclear Regulatory Commission
QA	Quality Assurance
QSM	Quality Systems Manager
SFPO	Spent Fuel Project Office
UF_6	Uranium Hexafluoride
WI	Work Instruction
WSIF	Work Station Inspection Form

INSPECTION PROCEDURE USED

86001, "Design, Fabrication, Testing, and Maintenance of Transportation Packaging"

4

PERSONS CONTACTED

The team held an entrance meeting with CBC on May 11, 1998, to present the scope and objectives of the NRC inspection. On May 14, 1998, the team held an exit meeting with CBC to present the preliminary findings of the inspection. The individuals present at the entrance and exit meetings are listed in Table 2.

Table 2
Persons Contacted

Name	Title	Entrance Meeting	During Inspection	Exit Meeting
J. Bossone	CBC, Quality Control Manager	X	X	X
T. Dougherty	CBC, President (via telephone)			X
A. Eckert	CBC, Executive Vice-President of Manufacturing (exit via telephone)	X		X
R. Fabrizio	CBC, General Manager of Manufacturing Operations	X	X	X
J. Jones	CBC, Quality Systems Manager	X	X	X
T. Matula	NRC, Inspection Team Leader	X	X	X
S. McDuffie	NRC, Inspector	X	X	X
J. Reed	CBC, Quality Control Assistant	X	X	
G. Roberts	NRC/INEEL, Inspector	X	X	X
T. Rummel	CBC, Vice-President	X	X	X

REPORT DETAILS

1. Inspection Scope

The team inspected CBC's management and fabrication controls regarding the fabrication of UF_6 cylinders, Models 30B and 48Y. The purpose of the inspection was to determine if CBC's fabrication activities were performed in accordance with the requirements of 10 CFR Parts 21 and 71; COCs 6553, 9196, and 9234; and ANSI N14.1. ANSI N14.1 requires that fabrication activities meet applicable requirements of 10 CFR Part 71, Subpart H, "Quality Assurance." The team inspected documentation, interviewed personnel, and observed activities.

2. Management Controls

2.1 General

To determine the effectiveness of the management controls, the team reviewed CBC's practices and procedures, as well as their implementation and related documentation. The team focused on program implementation, nonconformance controls, documentation controls, and audit programs.

2.2 Quality Assurance Policies

2.2.1 Scope

The team reviewed CBC's QA authorities, responsibilities, and independence; organizational charts; graded approach to QA based on importance to safety; and commercial parts dedication program.

2.2.2 Observations and Findings

The team identified a nonconformance (999-1335/98-01-01) regarding 10 CFR 71.103, "Quality assurance organization." This section states: "The persons and organizations performing quality assurance functions shall report to a management level that assures that the required authority and organizational freedom, including sufficient independence from cost and schedule, when opposed to safety considerations, are provided." This nonconformance has low safety significance, as the team observed no evidence that QA organizational freedom had previously been compromised, but the potential for future conflict of interest did exist. The team identified the following noncompliance in which CBC's QA organization was inadequate:

> The team found that the QSM does not have sufficient independence from cost and schedule. Specifically, CBC's organization chart showed that the QSM reports only to the Executive Vice-President of Commercial Operations; this

Vice-President is responsible for controlling costs and meeting fabrication schedules.

The team had an observation regarding 10 CFR 71.105, "Quality assurance program." This section states: "The licensee, through its quality assurance program, shall provide control over activities affecting the quality of the identified materials and components to an extent consistent with their importance to safety."

CBC did not have a program in place for classifying components important to safety. CBC had recently revised Procedure OP-3.9, "Procurement of materials, parts, services and welding material," Revision 1, March 26, 1998, which states that components may be classified at two levels of importance to safety, Categories A and B. In addition, CBC had recently revised Procedure OP-3.8, "Vendor Selection and Approval," Revision 1, March 26, 1998, to state that a commercial grade products dedication process will be in place. However, Procedures OP-3.8 and OP-3.9 do not describe the processes for classifying components or for implementing the commercial grade dedication process. CBC initiated Nonconformance Report (NCR) 12 to address the lack of component classification and commercial grade dedication procedures.

2.3 Nonconformance Controls

2.3.1 Scope

The team reviewed CBC's nonconformance control program to assess the effectiveness of measures established to control materials, parts, or components that do not conform to requirements. The inspection of nonconformance controls focused on how CBC identified, segregated, tracked, and controlled nonconforming items.

The inspectors also reviewed 10 CFR Part 21 training, implementing procedures, internal postings, supplier notifications, reporting processes, and program controls in accordance with the provisions of 10 CFR Part 21, "Reporting of Defects and Noncompliance."

2.3.2 Observations and Findings

The team identified a violation (999-1335/98-01-02) regarding 10 CFR 21.6, "Posting requirements." This section states: "Each . . . entity subject to the regulations in this part shall post current copies of – (i) The regulations of this part; (ii) Section 206 of the Energy Reorganization Act of 1974; and (iii) procedures adopted pursuant to the regulations in this part. These documents must be posted in a conspicuous position . . . where the activities subject to this part are conducted. If posting of the regulations in this part or the procedures adopted pursuant to the regulations in this part is not practicable, the licensee or firm subject to the regulations in this part may, in addition to posting Section 206, post a notice which describes the regulation/procedures, including

the name of the individual to whom reports may be made, and states where they may be examined." This violation has high safety significance since establishing an effective system for reporting defects and noncompliance is critical to assuring public health and safety. The team identified the following instances in which CBC's 10 CFR Part 21 postings and training were inadequate:

CBC did not post all the documents required by 10 CFR Part 21. Specifically, CBC had three locations where Part 21 postings were required; the main office building, and fabrication Plants 1 and 3. CBC did not post any of the required Part 21 documents in the main office building and the Part 21 postings in fabrication Plants 1 and 3 were incomplete. The Part 21 postings in fabrication Plants 1 and 3 consisted of Procedure OP-9.6, "10 CFR 21 Deviations," Revision 0, February 2, 1998, that contained only a portion of Section 206.

The team observed that CBC did not train its employees in the requirements of 10 CFR Part 21. Specifically, the Quality Control Manager stated that Part 21 training was provided to fabrication Plant 3 employees in February 1998; however, CBC could not provide any documentation of training performed regarding the requirements of Part 21. The team interviewed three CBC employees in fabrication Plant 3 regarding their knowledge of the requirements of Part 21. These individuals were not aware of the Part 21 requirements. CBC initiated NCR 14, stating that all employees will be trained on 10 CFR Part 21 requirements by June 1, 1998. On June 12, 1998, CBC provided written confirmation that all employees had received Part 21 training.

The team identified a nonconformance (999-1335/98-01-03) regarding 10 CFR 71.131, "Nonconforming materials, parts, or components." This section states: "The licensee shall establish measures to control materials, parts, or components that do not conform to the licensee's requirements to prevent their inadvertent use or installation. These measures must include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures." This nonconformance has low safety significance. The team identified the following noncompliances in which CBC's control of nonconforming materials, parts, and components was inadequate:

A. CBC did not control nonconforming material in its fabrication area. Specifically, Procedure OP-2.2, "Columbiana Inspection," Revision 1, March 26, 1998, states: "Material that is unacceptable . . . must be rejected and information submitted to the welding supervisor for disposition." The team found two pallets of nonconforming weld wire and weld rod in the fabrication area that were not identified in CBC's nonconformance reporting system. This material was not properly controlled, dispositioned, nor secured to prevent its inadvertent use. CBC took immediate corrective action by initiating NCR 10 to facilitate appropriate disposition of this material.

B. CBC's QA staff did not review and approve an NCR. Specifically, CBC QA staff initiated an NCR during receipt inspection of 50 valve end couplings for Model 48Y cylinders; one of the valve end couplings did not display a required heat number. The nonconforming valve end coupling was discarded, as directed by QA staff, but this disposition and final QA review/approval was not recorded on the NCR as required by OP-9.1, "Nonconforming Items and Corrective Action," Revision 0, February 2, 1998. CBC took immediate corrective action by completing the NCR and adding the appropriate close-out signatures to it.

C. CBC's nonconformance control program did not document or control deficiencies or deviations identified during fabrication. Specifically, Procedure OP-9.1, states: "Corrections made during the course of normal fabrication operations need not be reported provided such corrections are accomplished prior to QA acceptance." The team noted that a Model 48Y cylinder, X-ray 2116-2-2, was rejected by QA because of an unacceptable longitudinal seam weld. CBC did not document this deficiency in its nonconformance control program. CBC staff informed the team that the CBC nonconformance program does not document in-process deficiencies such as this, but rather they are tracked informally by QC until corrected. However, with no formal records of such deficiencies, CBC is unable to trend or identify any recurring fabrication problems and take corrective action. The CBC QSM stated that this information should be captured and that Procedure OP-9.1 will be revised to require documentation of deficiencies and deviations identified during in-process inspections.

The team had an observation regarding 10 CFR 71.133, "Corrective action." This section states, "The licensee shall establish measures to assure that conditions adverse to quality . . . are promptly identified and corrected. In the case of a significant condition adverse to quality, the measures must assure that the cause of the condition is determined and corrective action taken to preclude repetition."

The team observed that Procedure OP-9.1, "Nonconforming Items and Corrective Action," Revision 0, February 2, 1998, contains only one paragraph addressing corrective action. The procedure does not adequately discuss the process for documenting significant conditions adverse to quality, the root cause(s) for the conditions, and the corrective action taken. The QSM stated that a comprehensive corrective action process needs to be developed, and that a stand-alone procedure on corrective action was being developed and would be in place before the end of July 1998.

2.4 Documentation Controls

2.4.1 Scope

The team reviewed CBC's program for controlling quality-related documentation such as instructions, procedures, and drawings. The team examined the documents for

9

adequacy, approval signatures, and availability. The team also reviewed CBC's procedure development program.

2.4.2 Observations and Findings

The team had two observations regarding 10 CFR 71.113, "Document control." This section states: "The licensee shall establish measures to control the issuance of documents . . . . These measures must assure that documents, including changes, are reviewed for adequacy, approved for release by authorized personnel, and distributed and used at the location where the prescribed activity is performed."

A. CBC did not document any management approval on its fabrication instructions. Specifically, Procedure OP-3.2, Revision 0, February 2, 1998, states that CBC Work Instructions (WIs) shall be approved by the QSM and the relevant department manager. CBC issued 38 WIs for fabricating, testing, cleaning, and shipping Model 30B and 48Y cylinders. The team found no approval signatures on any of the 38 WIs. CBC documented fabrication steps on 22 individual Work Station Inspection Forms (WSIFs). The WSIFs contain acceptance criteria such as weld preparation angles, piece measurements, and weld acceptance criteria. The team found no approval signatures on any of the 22 WSIFs. CBC took immediate corrective action by initiating NCR 11, which addressed the requirement for approval signatures on procedures, WIs, and WSIFs.

B. CBC does not have fabrication drawings and procedures at work stations. Specifically, CBC staff informed the team that on May 11, 1998, all fabrication drawings and procedures for the Model 30B and 48Y cylinders were consolidated into a central location in the fabrication area. Prior to this date, the drawings and procedures were located at individual work stations. Fabrication and QC inspection personnel are required to go to the central location whenever they needed to refer to written instructions or procedures during fabrication or inspection activities. CBC management stated that they will closely monitor the new placement of drawings and procedures to ensure that it is effective, and revert to the old placement if it is not.

2.5 Audit Programs

2.5.1 Scope

The team reviewed CBC's audit program to determine whether audit plans, procedures, and records were available. The inspection of the audit program focused on determining whether: (1) CBC scheduled and performed internal QA audits and vendor audits in accordance with approved procedures or checklists, (2) qualified, independent, personnel performed the audits, (3) CBC managers reviewed audit results, and (4) CBC took appropriate follow up actions in those areas found deficient.

2.5.2 Observations and Findings

The team identified a nonconformance (999-1335/98-01-04) regarding 10 CFR 71.137, "Audits." This section states: "The licensee shall carry out a comprehensive system of planned and periodic audits, to verify compliance with all aspects of the quality assurance program, and to determine the effectiveness of the program." This nonconformance has low safety significance. The team identified the following noncompliance in which CBC's audits are inadequate:

> CBC had not performed any internal or external (vendor) audits. CBC had identified this program deficiency prior to the inspection, and recently created and revised Procedure CP-10.0, "Auditing," Revision 1, March 26, 1998, to address internal and external audits. CBC had not yet implemented this procedure at the time of the inspection, but discussions with CBC staff indicated a commitment to the new audit program. Furthermore, CBC took immediate corrective action by initiating NCR 12, which addresses external audits.

2.6 Conclusions on Management Controls

The team determined that CBC's management controls were generally acceptable. However, several areas of CBC's management control system were not in compliance with 10 CFR part 71, Subpart H. The team identified one violation and three nonconformances in this area. The lack of 10 CFR Part 21 postings and training documentation led to a violation regarding Part 21 which is considered to have high safety significance. Specific nonconformances, having low safety significance, include inadequate QSM independence from cost and schedule considerations, failure to adequately control nonconforming material, failure to document noncompliances, and failure to conduct internal and external audits. The team made observations regarding the absence of a procedure for classification of components, an inadequate corrective action procedure, missing document approval signatures, and having a centralized location for fabrication drawings and procedures rather than having them at work stations.

3. Fabrication Controls

3.1 General

The team reviewed CBC's fabrication controls to verify that all phases of the fabrication process were properly implemented, controlled, and verifiable. The team focused on material procurement, fabrication and assembly, test and inspection, and tools and equipment.

3.2 Material Procurement

3.2.1 Scope

The team verified that materials were controlled, verifiable, and traceable from the time of purchase through the life of the packaging by reviewing procurement documents, the receipt inspection program, material traceability and documentation, drawings and procedures, and the shelf life of safety-related components.

3.2.2 Observations and Findings

The team had an observation regarding 10 CFR 71.117, "Identification and control of materials, parts, and components." This section states, "The licensee shall establish measures for the identification and control of materials, parts, and components . . . These identification and control measures must be designed to prevent the use of incorrect or defective materials, parts, and components."

CBC does not have a procedure to monitor and control shelf life of specific parts or components. Specifically, CBC uses paint in the fabrication of UF_6 cylinders that is subject to shelf life control. The team observed that the paint was not identified regarding shelf life expiration and that CBC did not have a documented shelf life control procedure.

3.3 Fabrication and Assembly

3.3.1 Scope

The team determined whether fabrication procedures were documented, approved, and implemented for each step of the fabrication process. The team also looked at whether appropriate codes, standards, and drawings were identified and implemented. The scope of the inspection of fabrication and assembly included the review of activities concerning fabrication travelers, fabrication, assembly, special processes, cleaning, and storage.

3.3.2 Observations and Findings

The team noted that CBC had a document for each cylinder fabricated that listed all of the materials used, along with the associated traceability information, for the cylinder heads, shell, bonnet lugs, plugs, valves, and couplings. The team found that this document was an effective tool for identifying and documenting the material used in fabricating each cylinder.

The team found CBC's fabrication procedures to be adequate in that they contained the relevant Model 30B and 48Y cylinder fabrication requirements required in ANSI N14.1.

The team identified a nonconformance (999-1335/98-01-05) regarding 10 CFR 71.123, "Test control." This section states: "The licensee shall establish a test program. . . . The test procedures must include provisions for assuring that all prerequisites for the given test are met." This nonconformance has low safety significance. The team identified the following noncompliance in which CBC's test control is inadequate:

> ANSI N14.1, Paragraph 6.15.8, "Testing," states that not more than 55 foot-pounds torque shall be used to seat the valves. The application of excessive torque will damage the valves and is cause for rejection. However, In Procedures OP-4.1 and OP-4.2, the fabrication procedures for the Model 30B and 48Y cylinders, the team found no guidance to prevent excessive torquing when seating the valve.

3.4 Test and Inspection

3.4.1 Scope

The team ensured that tests and inspections were controlled, verifiable, and traceable. The team reviewed procedures and inspection records, observed work practices, interviewed personnel to determine compliance with the CBC test and inspection program, and verified that the procedures controlling testing and inspection were documented, approved, and implemented. The team also reviewed inspection requirements, acceptance criteria, test conditions, test documentation, nondestructive examination (NDE) controls, and QA hold points.

3.4.2 Observations and Findings

The team found that CBC's test procedures and inspection records were controlled and traceable. The team determined that the hydrostatic pressure and air leak test procedures were detailed and comprehensive. In addition, all NDE qualifications of the QA staff were documented and current.

3.5 Tools and Equipment

3.5.1 Scope

The team ensured that procedures for the control of tools and equipment were documented, approved, and implemented. The team evaluated the use of tools and equipment to determine whether the proper ranges and sensitivities were maintained, the necessary physical controls were in place, and the equipment calibrations were traceable to national standards for calibration. The team also examined selected calibration records and procedures for tools and gauges, as well as the traceability of specific tool use.

3.5.2 Observations and Findings

The team identified a nonconformance (999-1335/98-01-06) regarding 10 CFR 71.125, "Control of measuring and test equipment." This section states: "The licensee shall establish measures to assure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specific times to maintain accuracy within necessary limits." This nonconformance has low safety significance. The team identified the following noncompliances in which CBC's control of measuring and test equipment was inadequate:

A. CBC did not calibrate its micrometers used for inspection and acceptance over their entire range of measurement. Specifically, QA used 1-inch micrometers, over their entire measurement range, to inspect and accept components. Each day, QA staff used calibrated 0.5-inch and 1-inch measuring blocks to check these 1-inch micrometers for accuracy at these two points only. However, these two points of measurement do not verify the accuracy of the micrometers over their entire range.

B. CBC did not identify its calibrated measuring and test equipment. Specifically, CBC could not provide any logs listing all of its calibrated measuring and test equipment nor any records indicating the calibration due dates for each piece of equipment. In addition, CBC did not place calibration stickers on any of its measuring and test equipment except for pressure gauges and welding machines. Calibration stickers enable any worker to determine at a glance whether a specific tool has valid calibration.

C. ANSI N14.1, Paragraph 6.1.2, states: "The manufacturer shall measure the actual water capacity of each cylinder, and shall certify to the purchaser the water weight in pounds at a temperature of 60 °F." Therefore, an accurate water temperature reading is important regarding this certification. CBC did not calibrate the Weksler Instruments mercury thermometer used to measure water temperature during the cylinder water volume tests.

D. CBC has no method or procedure in place to identify and evaluate previously accepted components if the measuring and test equipment, used to accept the component, is found to be defective or out of calibration.

3.6 Conclusions on Fabrication Controls

The team determined that CBC's fabrication controls were generally acceptable. The team identified two nonconformances having low safety significance regarding the control of torque used in the assembly of cylinders, as well as tool and equipment calibration. The team made an observation regarding material shelf life control.

4. Overall Conclusions

4.1 Management Controls

The team determined that CBC's management controls were generally acceptable. However, several areas of CBC's management control system were not in compliance with 10 CFR part 71, Subpart H. The team identified one violation and three nonconformances in this area. The lack of 10 CFR Part 21 postings and training documentation led to a violation regarding Part 21 which is considered to have high safety significance. Specific nonconformances, having low safety significance, include inadequate QSM independence from cost and schedule considerations, failure to adequately control nonconforming material, failure to document noncompliances, and failure to conduct internal and external audits. The team made observations regarding the absence of a procedure for classification of components, an inadequate corrective action procedure, missing document approval signatures, and having a centralized location for fabrication drawings and procedures rather than having them at work stations.

4.2 Fabrication Controls

The team determined that CBC's fabrication controls were generally acceptable. The team identified two nonconformances having low safety significance regarding the control of torque used in the assembly of cylinders, as well as tool and equipment calibration. The team made an observation regarding material shelf life control.

4.3 Overall Conclusions

The team concluded that CBC's management controls and fabrication controls were generally acceptable and that the UF_6 cylinders fabricated by CBC will meet their intended safety function. However, the team identified one violation having high safety significance and five nonconformances having low safety significance. The team was informed that CBC had hired a new QA Manager in March 1998 who completely updated CBC's QA program to comply with the requirements of 10 CFR Part 71. The team noted that CBC is currently in the process of implementing new QA procedures which, when fully implemented, will address the issues identified during this inspection. The implementation of the updated QA program will be inspected in a future inspection.

5. Exit Meeting

On May 14, 1998, at the conclusion of the inspection, the team held an exit meeting with CBC staff and management to present the preliminary inspection findings. CBC's management acknowledged the inspection findings presented by the team. Additional information on 10 CFR Part 21 training was transmitted to the NRC by telephone on June 12, 1998.

NOTICE OF VIOLATION

Columbiana Boiler Company
Columbiana, Ohio

Docket 999-1335

During an NRC inspection conducted at Columbiana Boiler Company (CBC), Columbiana, Ohio, on May 11-14, 1998, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violation is listed below:

> 10 CFR 21.6, "Posting requirements," requires, in part, that each entity subject to the regulations in this part shall post current copies of: The regulations of this part; Section 206 of the Energy Reorganization Act of 1974; and procedures adopted pursuant to the regulations in this part. These documents must be posted in a conspicuous position where the activities subject to this part are conducted. If posting of the regulations in this part or the procedures adopted pursuant to the regulations in this part is not practicable, the firm subject to the regulations in this part may, in addition to posting Section 206, post a notice which describes the regulation and procedures, including the name of the individual to whom reports may be made, and states where they may be examined.
>
> Contrary to the above, CBC did not post all the documents required by 10 CFR Part 21. CBC had three locations where Part 21 postings were required; the main office building, and fabrication Plants 1 and 3. CBC did not post any of the required Part 21 documents in the main office building and the Part 21 postings in fabrication Plants 1 and 3 were incomplete. The Part 21 postings in fabrication Plants 1 and 3 consisted of Procedure OP-9.6, "10 CFR 21 Deviations," Revision 0, February 2, 1998, that contained only a portion of Section 206.

This is a Severity Level IV violation (Supplement V).

Pursuant to the provisions of 10 CFR 2.201, CBC is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to Susan F. Shankman, Chief, Transportation Safety and Inspection Branch, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. Where good cause is shown, consideration will be given to extending the response time.

Enclosure 2

Because your response will be placed in the NRC Public Document Room (PDR), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Dated at Rockville, Maryland

this 25th day of June, 1998

NOTICE OF NONCONFORMANCE

Columbiana Boiler Company
Columbiana, Ohio

Docket 999-1335

Based on the results of an NRC inspection conducted on May 11-14, 1998, certain Columbiana Boiler Company (CBC) activities were apparently not conducted in conformance with requirements.

A. 10 CFR 71.103, "Quality assurance organization," states: "The persons and organizations performing quality assurance functions shall report to a management level that assures that the required authority and organizational freedom, including sufficient independence from cost and schedule, when opposed to safety considerations, are provided."

Contrary to the above, the CBC Quality Systems Manager (QSM) does not have sufficient independence from cost and schedule. CBC's organization chart shows that the QSM reports only to the Executive Vice-President of Commercial Operations; this Vice-President is responsible for controlling costs and meeting fabrication schedules.

B. 10 CFR 71.123, "Test control," states: "The licensee shall establish a test program. . . The test procedures must include provisions for assuring that all prerequisites for the given test are met."

Contrary to the above, Procedures OP-4.1 and OP-4.2, the fabrication procedures for the Model 30B and 48Y cylinders, contained no instructions to prevent excessive torquing when seating the valves. Paragraph 6.15.8 in American National Standards Institute (ANSI) N14.1-1990, "Uranium Hexafluoride - Packaging for transport," states that not more than 55 foot-pounds torque shall be used to seat the valves.

C. 10 CFR 71.125, "Control of measuring and test equipment," states: "The licensee shall establish measures to assure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specific times to maintain accuracy within necessary limits."

Contrary to the above, the following instances were identified regarding inadequate control of measuring and test equipment:

1. CBC did not calibrate its micrometers used for inspection and acceptance over their entire range of measurement. CBC Quality Assurance (QA) personnel used 1-inch micrometers, over their entire measurement range, to inspect and accept components. However, QA measured the accuracy of the micrometers only at the 0.5-inch and 1-inch points.

Enclosure 3

2. CBC did not identify its calibrated measuring and test equipment. CBC could not provide any logs listing all of its calibrated measuring and test equipment nor any records indicating the calibration due dates for each piece of equipment. In addition, CBC did not place calibration stickers on any of its measuring and test equipment except for pressure gauges and welding machines.

3. CBC did not calibrate the Weksler Instruments mercury thermometer used to measure water temperature during the cylinder water volume tests.

4. CBC has no method or procedure in place to identify and evaluate previously accepted components if the measuring and test equipment, used to accept the component, is found to be defective or out of calibration.

D. 10 CFR 71.131, "Nonconforming materials, parts, or components," states: "The licensee shall establish measures to control materials, parts, or components that do not conform to the licensee's requirements to prevent their inadvertent use or installation. These measures must include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures."

Contrary to the above, the following instances were identified regarding inadequate control of nonconforming materials, parts, or components:

1. CBC did not control nonconforming material in its fabrication area. CBC had two pallets of nonconforming weld wire and weld rod in the fabrication area that were not identified in CBC's nonconformance reporting system. This material was not properly controlled, dispositioned, nor secured to prevent its inadvertent use.

2. CBC's QA staff did not review and approve a Nonconformance Report (NCR). CBC QA staff initiated an NCR during receipt inspection of 50 valve end couplings for Model 48Y cylinders; one of the valve end couplings did not display a required heat number. The nonconforming valve end coupling was discarded, as directed by QA staff, but this disposition and final QA review/approval was not recorded on the NCR.

3. CBC's nonconformance control program did not document or control deficiencies or deviations identified during fabrication. A Model 48Y cylinder, X-ray 2116-2-2, was rejected by QA because of an unacceptable longitudinal seam weld. CBC did not document this deficiency in its nonconformance control program.

E. 10 CFR 71.137, "Audits," states: "The licensee shall carry out a comprehensive system of planned and periodic audits, to verify compliance with all aspects of the quality assurance program, and to determine the effectiveness of the program."

Contrary to the above, CBC had not performed any internal or external (vendor) audits.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to Susan F. Shankman, Chief, Transportation Safety and Inspection Branch, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each nonconformance: (1) the reason for the nonconformance, or if contested, the basis for disputing the nonconformance, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further noncompliances, and (4) the date when your corrective action will be completed. Where good cause is shown, consideration will be given to extending the response time.

Because your response will be placed in the NRC Public Document Room (PDR), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection, described in 10 CFR 73.21.

Dated at Rockville, Maryland

this 25th day of June, 1998

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 26, 1998

Mr. William H. Rasin, Vice President
Nuclear, Fuels and Quality Assurance Services
Duke Engineering and Services
580 Main Street
Bolton, Massachusetts 01740

SUBJECT: NRC INSPECTION REPORT 99901330/98-01

Dear Mr. Rasin:

On June 9-10, 1998, the U.S. Nuclear Regulatory Commission (NRC) performed an inspection at the Duke Engineering & Services (DE&S) facility in Bolton, Massachusetts. The enclosed report presents the findings of that inspection. The inspection was conducted to review selected portions of your quality assurance program, and its implementation, as it relates to the supply of quality related services to the nuclear industry. The inspection specifically reviewed activities related to internal and external audits, conformance with licensee purchase order requirements, and your interface with the Duke Engineering and Services corporate office since your acquisition of the Yankee Atomic Electric Company's Yankee Nuclear Services Division. The inspectors also assessed DE&S's conformance to customer's procurement requirements and compliance with NRC regulations.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room.

Sincerely,

Suzanne C. Black

Suzanne C. Black, Chief
Quality Assurance, Vendor Inspection
and Maintenance Branch
Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation

Docket No. 99901330

Enclosure: Inspection Report 99901330/98-01

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No:	99901330/98-01
Organization:	Duke Engineering & Services
Contact:	William H. Rasin, Vice President Nuclear, Fuels and Quality Assurance Services (978) 779-6711
Nuclear Activity:	Supplier of quality assurance services to the nuclear industry.
Dates:	June 9-10, 1998
Inspectors:	Gregory C. Cwalina, Senior Operations Engineer Larry L. Campbell, Reactor Engineer Juan D. Peralta, Operations Engineer
Approved by:	Robert A. Gramm, Chief Quality Assurance and Safety Assessment Section Quality Assurance, Vendor Inspection and Maintenance Branch Division of Reactor Controls and Human Factors

Enclosure 1

1 INSPECTION SUMMARY

On June 9-10, 1998, the U.S. Nuclear Regulatory Commission (NRC) performed an inspection at the Duke Engineering & Services, Incorporated (DE&S) facility in Bolton, Massachusetts. The inspection was conducted to review selected portions of the DE&S quality assurance (QA) program, and its implementation, as it relates to the current supply of quality assurance services to the nuclear industry. The inspection specifically reviewed programs and procedures related to internal and external audits, conformance with licensee purchase order requirements, qualification of audit and inspection personnel, and the interface with the Duke Engineering and Services corporate office. The inspectors also assessed DE&S's conformance to customer's procurement requirements and compliance with NRC regulations.

The inspection bases were:

- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
- 10 CFR Part 21, "Reporting of Defects and Noncompliance."
- Yankee Atomic Electric Company Operational Quality Assurance Program (YOQAP-1-A), Revision 27

During this inspection, no violations or nonconformances were identified.

2 STATUS OF PREVIOUS INSPECTION FINDINGS

This was the first NRC inspection of DE&S.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Background

On December 1, 1997, the assets of Yankee Atomic Electric Company's (YAEC) Yankee Nuclear Services Division (YNSD) were acquired by DE&S. As a result of that transaction, DE&S has assumed responsibility for all safety related quality services previously provided by YNSD. These services include maintenance of an onsite QA staff at nuclear licensees; maintenance and upkeep of an approved vendors list (AVL) for several licensees; performance of surveillance, surveys or source inspections of vendors; audit and evaluation of new vendors for inclusion in the AVL; and other services (e.g., performance of fuel fabrication services, various engineering services and decommissioning activities). Previously, these services had been performed by YNSD in accordance with the NRC-approved YAEC quality assurance program, "Yankee Atomic Electric Company Operational Quality Assurance Program (YOQAP-1-A)," Revision 27.

Due to previously existing work obligations with YNSD customers, DE&S activities performed for those customers subsequent to the acquisition were performed in accordance with existing contractual obligations, i.e., YOQAP-1-A. Continued adherence of DE&S to the NRC-approved YOQAP-1-A allows the licensees to use DE&S as their quality assurance services provider without having to perform an additional audit to re-approve the QA program.

DE&S is in the process of upgrading and implementing a new QA program to cover all activities to be performed by DE&S at its Bolton facility. This conversion is scheduled to occur in or around July 1998. Following that conversion, licensees will need to audit and approve the DE&S QA program for new and current contracted services.

Because of the transfer of safety-related services from a licensee to a vendor, the NRC was concerned regarding the performance of these activities during the transitional period. Specifically, the NRC was concerned as to what QA program was applicable to DE&S activities, the control and qualification of auditors and inspectors (previously YNSD, now DE&S), relationships and interactions with DE&S/Corporate (Charlotte), maintenance of the approved vendors list, interface and interactions with licensees and the Nuclear Procurement Issues Committee (NUPIC), and assumption of Part 21 responsibilities.

3.2 Review of DE&S's 10 CFR Part 21 Program and its Implementation

a. Inspection Scope

The inspectors reviewed DE&S Procedure DPR-16.2, "NRC Reporting Requirements," Revision 3 and YAEC Technical Administrative Guideline (TAG) No. 6, "10 CFR, Part 21 Reporting," Revision 25 to determine compliance with NRC regulations as promulgated in 10 CFR Part 21.

b. Observations and Findings

Due to DE&S's adherence to the YOQAP-1-A QA manual, the inspectors determined that TAG 6 is currently applicable to DE&S safety-related quality activities. The inspectors noted several weaknesses within TAG 6, most notably the lack of adequate direction regarding deviations and their evaluation and a time limit constraint for evaluations that is inconsistent with NRC regulations.

DPR-16.2, which will become applicable for all DE&S activities following the conversion to the DE&S QA program, had similar deficiencies. Chief among those was the lack of specificity regarding evaluating deviations.

The inspectors also observed 10 CFR Part 21 postings and found them to be consistent with the current requirements.

c. Conclusions

The inspectors concluded that the Part 21 procedures contained weaknesses and were inconsistent with NRC regulations. However, the inspectors concluded that the weaknesses would not prevent DE&S from fulfilling their Part 21 evaluation and reporting reponsibilities. The weaknesses were identified to the DE&S management who stated that the identified weaknesses would be evaluated and appropriate revisions made to the procedures.

3.3 Review of Licensee Purchase Orders (POs)

a. Inspection Scope

The inspectors reviewed several NRC licensee purchase orders (POs) issued to YNSD and, subsequently revised and reissued, to DE&S to identify the applicable QA program requirements for DE&S performed safety-related work activities.

b Observations and Findings

The inspectors examined Vermont Yankee Nuclear Support Services Contract VY-1097-10, November 26, 1997. The contract was effective as of December 1, 1997 (the date of the DE&S purchase of YNSD) through December 31, 1998. Section XIII, "QUALITY ASSURANCE PROGRAM," states, " All services provided hereunder shall be performed in accordance with the Yankee Atomic Electric Company Operational Quality Assurance Program (YOQAP-1-A)..." The inspectors noted that this contract requires DE&S to utilize the YOQAP program when performing safety related services for Vermont Yankee, the same program previously authorized and approved when YNSD was performing the services.

The inspectors reviewed a January 29, 1998, letter from the Northeast Utilities Service Company (NUSCO) to DE&S. The letter included execution copies terminating the Nuclear Support Services Agreement with YNSD and executing a Master Services Agreement with DE&S, effective January 31, 1998 through December 31, 1998. Section 33, "QUALITY ASSURANCE REQUIREMENTS," states, "Contractor shall perform all Work pursuant to a Quality Assurance Program to be submitted by the Contractor and approved by Utility prior to Contractor's undertaking any work." The inspectors noted that the specific QA program requirements were not included in the agreement. The inspectors reviewed the following three blanket release forms provided from NUSCO for DE&S quality services under PO 02055432: Work Release (WR) 009, January 30, 1998, WR 011, February 25, 1998, and WR 017, March 6, 1998. All three WRs imposed adherence to YOQAP-1-A, Revision 27 and noted that the January 29, 1998, Master Services Agreement applied. Again, this contract (as implemented via the WRs) requires DE&S to utilize the previously approved YOQAP program when performing safety related services for NUSCO.

The inspectors also reviewed the Master Services Agreement from the North Atlantic Services Corporation which became effective as of January 31, 1998 and the February

1998 Services Agreement from Boston Edison. Both of these agreements were similar to the NUSCO agreement in that specific QA program requirements were not included in the contract but were included in individual POs or work requests. As with NUSCO, the inspector identified that both licensees referenced the previously approved YOQAP-1-A as the applicable QA program in the POs and work requests.

c. Conclusions

The inspectors concluded that all DE&S activities for their current customers (licensees) are required to be performed under YOQAP-1-A. That program had been reviewed and approved as an acceptable QA program by the NRC. The inspectors noted that DE&S is planning to transition to their own QA program in or around July 1998. At that time, licensees will need to audit and approve the DE&S QA program prior to allowing DE&S to perform safety related work under the new DE&S program.

3.4 Quality Assurance Program

a. Inspection Scope

The NRC inspectors reviewed the Yankee Atomic Electric Company (YAEC)/Vermont Yankee Nuclear Power Corporation (VYNPC) Operational Quality Assurance Program, YOQAP-1-A, Revision 27, to assure that DE&S was adhering to the licensee-imposed requirements.

b. Observations and Findings

Quality Assurance Program Applicability YOQAP-1-A is an NRC approved quality assurance topical report for the YAEC Yankee Nuclear Power Station and the VYNPC Vermont Yankee Nuclear Power Station. YOQAP-1-A satisfies the NRC requirements contained in 50.34(b)(6)(ii) by describing how the requirements of Appendix B to 10 CFR Part 50 will be satisfied. The NRC inspectors reviewed several sections and the organizational charts contained in YOQAP-1-A which identified YAEC, Yankee Nuclear Service Division (YNSD), as the responsible organization for providing QA services.

The NRC inspectors and DE&S staff discussed the applicability of YOQAP-1-A for the QA services provided to licensees and the fact that the YOQAP-1-A organizational charts and text refer to YNSD and not DE&S. The NRC inspectors reviewed memoranda from the YAEC Chairman and Chief Executive Officer and the VYNPC Senior Vice President, Operations dated November 7, 1998, and November 24, 1997, respectively. Both memoranda stated, in part that "Effective December 1, 1997, those responsibilities defined in the Yankee Atomic Electric Company Operational Quality Assurance Program (YOQAP-1-A) and previously assigned to the Yankee Nuclear Services Division are hereby delegated to Duke Engineering & Services, Inc. (DE&S)." These memoranda indicated that DE&S had been retained to provide certain services, that all work shall be performed in accordance with YOQAP-1-A, and that the organizational responsibility for the continuing review and audit of the implementation of the YOQAP-1-A has been assigned to DE&S Quality Services.

DE&S informed the NRC inspectors that the YAEC President and VYNPC Senior Vice President retain the authority for assuring that the QA Program is implemented within their respective plants as stated in YOQAP-1-A.

The inspectors and DE&S discussed the provisions contained in YOQAP-1-A for providing QA services (auditing vendors, source inspection, certification of auditors and inspectors, and maintenance of the approved vendors list). Although there have been some title changes and DE&S has assumed the duties and responsibilities of YNSD, the functions and reporting relationships appeared to be consistent with the QA organizational structure contained in YOQAP-1-A.

DE&S informed the NRC inspectors that it is in the process of making a transition from performing certain work activities in accordance with YOQAP-1-A to performing those work activities in accordance with a DE&S QA Program. During this transition period, DE&S will continue to provide licensees QA services in accordance with the provisions of the licensee PO. DE&S plans to implement its own QA Program in or about July 1998 and plans to maintain both the YOQAP-1-A QA Program and implementing procedures and its own QA program and implementing procedures. DE&S indicated that the QA program and implementing procedures to be used after July 1998 will be the one specified in licensee POs or contracts.

Audits to Assess the DE&S QA Program Implementation The inspectors reviewed YAEC Procedure OQA-XVIII-2, "Audit Program," Revision 27, and determined that this procedure was being used by DE&S for performing internal audits.

DE&S informed the NRC inspectors that an audit was conducted in September 1997 to assess the effectiveness of the YAEC Corrective Action, Audit, and Vendor QA program activities and that this audit satisfied the YOQAP-1-A provision for confirming that DE&S was effectively implementing QA controls and commitments contained in the YOQAP-1-A and the implementing YAEC procedures for these activities. DE&S also informed the NRC inspectors that because it was performing those activities in accordance with the QA controls contained in the YOQAP-1-A and the implementing YAEC procedures, it believed that the September 1997 internal audit was applicable for activities currently being performed by DE&S.

The inspectors also reviewed a DE&S/Corporate (Charlotte) audit of the QA services provided by DE&S conducted in March 1998. DE&S informed the NRC inspectors that this audit was not performed to satisfy the YOQAP-1-A provision for conducting internal audits (i.e., to confirm that the QA controls for providing QA services were being effectively implemented), but was conducted as part of a DE&S/Corporate (Charlotte) audit program. The NRC inspectors agreed with DE&S that the DE&S/Corporate (Charlotte) audit could not serve as the required YOQAP-1-A internal audit because DE&S/Corporate (Charlotte) had not been audited and approved by DE&S for such auditing services.

Maintenance of the Approved Vendors List (AVL) The NRC inspectors reviewed YAEC Procedure OQA-XVIII-3, "Vendor Audits," Revision 22, with Interim Procedure Change

(IPC) Nos. 1 and 2, and determined that this procedure was being used by DE&S for performing vendor audits, review of vendor QA manuals, and for preparing and controlling the AVL. The inspectors also reviewed YAEC Procedure OQA-XVIII-6, "Evaluation of YAEC Approved Vendors," Revision 13, with IPC No. 1, and determined that this procedure was being used by DE&S for performing the annual evaluations of vendors.

DE&S informed the NRC inspectors that one AVL was maintained for all of its customers. The NRC inspectors reviewed the revision of the AVL that was in effect prior to the DE&S purchase of YNSD and the current AVL being maintained by DE&S. The NRC inspectors determined that DE&S, itself, was on the AVL for providing various services, including QA services, based on a licensee audit of YNSD conducted in March 1996. DE&S informed the NRC inspectors that the next licensee audit of DE&S is scheduled to be performed shortly after it implements its new QA Program in approximately July 1998.

The inspectors also noted that DE&S/Corporate (Charlotte) was on the AVL for providing engineering, computer, and calibration services. DE&S informed the NRC inspectors that DE&S/Corporate (Charlotte) was only being used by licensees and that only licensees had issued POs to DE&S/Corporate (Charlotte) for the approved safety-related services.

The NRC inspectors and DE&S discussed the possibility of using DE&S/Corporate (Charlotte) to supplement the QA services being provided to licensees. DE&S informed the NRC inspectors that no QA services were being subcontracted to DE&S/Corporate (Charlotte) and that there were no plans to subcontract any QA services provided to licensees to any vendor.

c. Conclusions

The inspectors determined that, for the scope of activities reviewed, DE&S met the applicable YOQAP-1-A QA commitments, YAEC implementing procedures, and the licensee's POs provisions for the QA services provided. A review of the September 1997 audit performed by YNSD found that the report contained an adequate scope to satisfy the internal audit provision of YOQAP-1-A for QA services. Finally, the inspectors concluded that the AVL appeared to be maintained in accordance with applicable YAEC procedures.

3.5 Vendor Audit/Surveillance and Personnel Qualification

a. Inspection Scope

The inspectors reviewed a sample of Vendor Audit Reports (VARs), Vendor Surveillance Reports (VSRs), and Commercial Survey Reports (CSRs) which documented the results of QA activities performed by DE&S (or YNSD) personnel before and after the acquisition by DE&S to assure that DE&S activities were being performed by properly qualified inspectors and auditors.

b. Observations and Findings

The inspectors reviewed the following reports to identify YNSD and DE&S personnel involved in audit, surveillance and survey activities:

Report No.	Vendor	Report Date
VAR 97-021	BICC-Brand-Rex	May 2, 1997
VAR 97-079	SPEC Consultants, Inc.	October 2, 1997
VAR 97-084	Research Engineers, Inc. ADLPIPE Division)	September 22, 1997
VAR 98-010	Torque Tension & Equipment, Inc.	March 9, 1998
VAR 98-033	U.S. Tech Services, Inc.	March 27, 1998
VAR 98-027	Southern Company Services, Inc.	April 21, 1998
VSR 98-043	Ederer	April 24, 1998
VSR 98-039	CVI, Inc.	March 16, 1998
VSR 98-041	Nuclear Logistics, Inc.	March 27, 1998
VSR 98-067	Molten Metals Technologies, Inc.	March 27, 1998
VSR 98-040	General Electric Nuclear Energy	April 3, 1998
CSR 97-020	GE Industrial Controls	August 14, 1997
CSR 97-021	Hytorc	October 21, 1997
CSR 98-005	New England Balance Service, Inc.	April 6, 1998
CSR 98-007	Syseca, Inc.	May 8, 1998

The inspectors also reviewed a sample of personnel files for DE&S-qualified inspectors and auditors identified in the reports listed above. In addition, the inspectors reviewed YAEC procedures (which DE&S continues to use in the transition period) OQA-X-2, "Inspection/Surveillance Training and Certification," Revision 8 (latest), and OQA-XVIII-1, "Auditor Training and Qualification," Revision 9 (latest). In accordance with Revision 27 to the YOQAP-1-A, these procedures satisfy the provisions of ANSI N45.2.6-1978, "Qualifications of Inspection, Examination, and Testing Personnel for Nuclear Power Plants," (as endorsed by Regulatory Guide (RG) 1.58, "Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel," Revision 1) and ANSI N45.2.23-1978, "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants," (as endorsed by RG 1.146, "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants," dated August 1980), respectively.

The inspectors noted that some personnel qualification records were signed by DE&S personnel. The inspectors reviewed the records and noted that the approving officials were DE&S (Bolton) employees and the certifications were approved in accordance with DE&S (Bolton) procedures consistent with YOQAP-1-A requirements.

c. Conclusions

The inspectors confirmed that QA activities described in the reviewed reports had been performed by personnel who had been properly qualified in accordance with applicable procedures.

3.6 Relationship With DE&S/Corporate (Charlotte)

The inspectors discussed the relationship of DE&S/Bolton with DE&S/Corporate (Charlotte) regarding the providing of quality assurance services to the nuclear industry (also discussed in Section 3.4, above). DE&S informed the inspectors that the two organizations were considered separate entities. All work performed by DE&S/Bolton is done using personnel qualified and certified using DE&S approved procedures. No Corporate personnel have been used by DE&S (or YNSD) in performing any quality assurance activities. DE&S recognized that using DE&S/Corporate as a subcontractor to to perform quality assurance services would require audit and approval of the Corporate QA program. The inspectors did not have any concerns in this area.

3.7 Participation in Nuclear Procurement Issues Committee (NUPIC) Activities

Prior to the sale of YAEC's YNSD to DE&S, YAEC was a member of NUPIC and its membership represented the YAEC, VYNPC, Maine Yankee, Boston Edison and Northeast Nuclear Energy plants. Following the sale, YAEC, which holds the NRC license for the Yankee Nuclear Power Station, informed NUPIC that it would retain its NUPIC membership and that its membership commitments for 1998 would be fulfilled with support from DE&S, which has been contracted to implement YAEC vendor oversight activities.

PARTIAL LIST OF PERSONS CONTACTED

DE&S

William H. Rasin, Vice President
C. Russell Clark, General Manager, Quality Assurance Services
Steven C. White, Manager, Operational Quality Assurance
Walter K. Peterson, Manager, Decommissioning Quality Assurance
Chris Lloyd, Group Manager, Vendor Quality Assurance

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 14, 1998

Mr. J. Jergl
Vice President, Technology and Quality Assurance
GNB Technologies
829 Parkview Boulevard
Lombard, Illinois 60148-3249

SUBJECT: NRC INSPECTION REPORT 99901251/98-01

Dear Mr. Jergl:

On October 20 through 22, 1997, and on March 4 through 6, 1998, the U.S. Nuclear Regulatory Commission (NRC) performed an inspection at the GNB Technologies (GNB) facilities at Lombard, Illinois, and Fort Smith, Arkansas, respectively. The purpose of the inspection was to perform an assessment of the adequacy of your commercial quality program associated with the manufacture of Class 1E qualified battery cells used in commercial nuclear power plant facilities. The enclosed report presents the results of the inspection.

As you well know, Nuclear Logistics Incorporated (NLI), Fort Worth, Texas, sells NCN series batteries manufactured by GNB to nuclear plants. GNB manufactures and controls the design of the Class 1E qualified battery cells by using its International Organization for Standardization (ISO) 9000 quality system at its two facilities that are associated with Class 1E battery cells. GNB has established an ISO 9001, "Model for Quality Assurance in Design, Development, Production, Installation and Servicing," for its Lombard, Illinois, corporate office and an ISO-9002, "Model for Quality Assurance in Production, Installation and Servicing," for its Fort Smith, Arkansas, flooded battery cell manufacturing facility. The contractual agreement is effected by having NLI verify, in accordance with its Part 50 of Title 10 of the Code of Federal Regulations, Appendix B, (10 CFR Part 50, Appendix B), quality assurance program, that GNB's design and manufacturing controls meet the applicable portions of Appendix B. NLI is responsible for ensuring GNB commercial controls meet the applicable requirements of 10 CFR 50, Appendix B.

The inspection team had originally planned to review activities such as the formation of cells, plate casting, paste mixing, and plate pasting at the Fort Smith facility. However, the team did not complete all of these activities because of a problem regarding process control and a procedural compliance issue. As a result, three of the five inspectors interrupted their inspection functions and commenced a review of the issue to determine the root cause of the noncompliance with GNB procedures. The team concluded, and your staff concurred, that a certain process, though suitable, was not appropriate for the application.

Although the team did not complete its review of each area included in the scope of its planned inspection, the team was able to draw some conclusions relating to GNB's process controls. The team determined that some areas of GNB's quality assurance system contained weaknesses as discussed in the enclosed NRC inspection Report. Some of the weaknesses were identified by the NRC inspectors and others were identified in two memorandums that were written in 1997 by NLI and provided to GNB. The inspectors noted that the two NLI memorandums stated, based on a limited scope assessment of GNB's Fort Smith and Lombard facilities, there "has been a Quality System breakdown." However, the inspectors were concerned that these problems were not documented in a nonconformance report in accordance with NLI's QA program control. The matter is further discussed in NRC's Inspection Report of NLI, Report 99901298/98-01.

The NRC is concerned with the identified weaknesses and quality system breakdown identified by NLI. Taken together, they suggest a lack of attention to detail in certain aspects of GNB's established and implemented quality assurance controls for the manufacture of Class 1E battery cells. The NRC will request NLI to respond to our conclusion and provide its proposed action to address the matter. You are not required to respond to this letter.

In accordance with 10 CFR 2.790 of the NRC "Rules of Practice," a copy of this letter and enclosures will be placed in the NRC's Public Document Room (PDR). Should you have any questions concerning the issues discussed in this letter, we will be pleased to discuss them with you.

Sincerely,

Original signed by: Suzanne C. Black

Suzanne C. Black, Chief
Quality Assurance, Vendor Inspection
and Maintenance Branch
Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation

Docket: 99901251

Enclosure: Inspection Report 99901251/98-01

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No.:	99901251/98-01
Organization:	GNB Technologies 829 Parkview Boulevard Lombard, Illinois 60148-3249
Contact:	Loranne M. May Quality Assurance Manager (630) 691-7949
Nuclear Industry:	Manufacture of Vented Lead-acid Battery Cells**
Dates:	October 20-21, 1997, Lombard, Illinois - Corporate Office March 4-6, 1998, Forth Smith, Arkansas - Manufacturing Facility
Team Members:	Kamalakar R. Naidu, Team Leader Stephen D. Alexander, HQMB, NRR David L. Skeen, PECB, NRR Joseph J. Petrosino, HQMB, NRR Saba N. Saba, EELB, NRR
Approved by:	Richard P. Correia, Chief Reliability and Maintenance Section Quality Assurance, Vendor Inspection and Maintenance Branch Division of Reactor Controls and Human Factors Office of Nuclear Reactor Regulation

** The manufacture and control of Class 1E battery cells at the GNB Fort Smith manufacturing facility is performed in conjunction with Nuclear Logistics Incorporated (NLI), Fort Worth, Texas.

1. INSPECTION SUMMARY

During this inspection, the NRC inspectors reviewed the implementation of selected portions of the commercial quality assurance program that GNB Technologies[1] (GNB) had established for its Lombard, Illinois corporate office, and Fort Smith, Arkansas flooded battery cell manufacturing facility. In August 1991, GNB entered into a contractual agreement with Nuclear Logistics, Incorporated, (NLI) to manufacture Class 1E qualified vented lead-acid battery cells. This affiliation between the two entities required NLI to accept NRC licensee purchase orders for Class 1E battery cells and to invoke applicable portions of its quality assurance (QA) program to control certain safety-related activities. The agreement between NLI and GNB had provisions for NLI to monitor GNB's manufacturing process controls to ensure that the applicable portions of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," were applied. Additionally, since NLI reconciled GNB's design changes and test reports of its commercial grade NCX flooded battery cells to establish a Nuclear Class 1E battery cell, NCN type, the NRC inspected both NLI and GNB activities. The findings related to NLI are documented separately in Inspection Report 99901298/98-01.

The inspection bases were

- Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR 50, Appendix B).

- 10CFR Part 21, "Reporting of defects and noncompliances," (Part 21).

2. STATUS OF PREVIOUS INSPECTION FINDINGS.

This was the first inspection of these GNB facilities.

3. INSPECTION FINDINGS AND OTHER COMMENTS.

3.1 GNB Quality Assurance Program

GNB Technologies has established a quality program to address the requirements of an International Organization for Standardization (ISO) 9000 quality system at both of its facilities that are associated with nuclear power plant Class 1E battery cells. GNB has established an ISO 9001, "Model for Quality Assurance in Design, Development, Production, Installation and Servicing," for its Lombard, Illinois, corporate office and an ISO-9002, "Model for Quality Assurance in Production, Installation and Servicing," for its Fort Smith, Arkansas, vented lead-acid battery cell manufacturing facility. The GNB Quality Manual (GNB-QM), Revision OB, effective date March 14, 1997, states that the GNB-QM sets forth the quality policies of GNB and forms the conceptual foundation for the quality system in place within GNB and is structured to meet the requirements of ISO-9001. The GNB-QM also states that it is the primary reference document for the purpose of auditing the effectiveness of the quality system and all remaining quality system documentation is subordinate to and supportive of the manual.

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[1] GNB is a wholly owned subsidiary of Pacific Dunlop Limited of Australia. In approximately 1899, Gould National Batteries was established and eventually became GNB.

The inspectors reviewed selected portions of GNB's quality system that were associated with the manufacture of Class 1E safety related batteries, and that were associated with the quality program which NLI used to assure itself that the applicable GNB quality requirements met the quality requirements of 10 CFR Part 50, Appendix B.

3.1.1 Engineering Design Change Control

a. Scope

The team assessed the efficiency and adequacy of the design of the battery cells that were qualified to withstand the environmental conditions of various nuclear power plants. The team reviewed GNB Procedures DC-99-00-ENG "Engineering Change Order Approval, Implementation and Distribution Process," Revision OE, of December 23, 1996, and 99-01-ENG, "Deviation Approval, Implementation and Distribution Process," Revision ED, that address the control of engineering change orders (ECOs).

b. Observations and Findings

The inspectors reviewed various documents and conducted inspections at both the Lombard and Fort Smith GNB facilities. Procedure DC-99-00-ENG, outlines procedures for processing, approval requirements and responsibilities with regard to the issuance of ECOs. Section 7.4.1 of this procedure requires GNB to identify design and manufacturing changes to all flooded stationary batteries to NLI so that NLI can evaluate them for impact upon the qualification of batteries and components provided for class IE applications. Procedure DC-99-01-ENG, outlines the steps for processing, approval requirement and responsibilities with regard to the issuance of deviations from existing specification and procedures. The procedure provides instructions on completing a Deviation Form, its approval routing, implementation procedure for a 'Deviation,' and distribution, closure and retention of a 'Deviation.' Any individual on the routing slip could reject the design change and provide reasons for rejection.

The team reviewed ECO 9700,653 issued on October 12, 1997, to revise Specification PR-15-09-ALL, "Cell Storage and Maintenance for Stationary Flooded and VLRA Cells," to reflect the change in the requirements to document the recharging and equalizing data. After reviewing this ECO, NLI determined that the ECO did not impact batteries intended for safety-related applications, and requested that the ECO be placed in the GNB ECO/Deviation binder maintained at NLI. However, there was a notation to review the acceptance criteria when NLI's Procedure, "Standard Verification Plan GNB Batteries and Hardware," (SVP-31) was being revised to verify if there was already a requirement already therein to document the recharging and equalizing data. It also requested the ECO be placed in the designated NLI binder for GNB Process Specification.

GNB's design change control appeared to be satisfactorily implemented and controlled in accordance with its quality system requirements. However, the inspectors noted an anomaly between the GNB and NLI quality system interface during its Lombard facility inspection. Although NLI stated that it concurred with GNB's changes for its Class 1E cells, the inspectors determined that GNB approved all Class 1E design changes without NLI concurrence. After GNB completed its design change, GNB routed the completed design changes to NLI. During the inspection at the Fort Smith facility, the inspectors learned that NLI and GNB had changed the ECO process in response to an earlier NRC inspector's comment. GNB changed its ECO process to include NLI in its design change request process concurrence. The team did not attempt to verify whether the previous practice of informing NLI of the design change (versus concurring with the change) affected any battery cells being manufactured.

c. Conclusions

The team did not identify any adverse findings in this area related to GNB activities.

3.1.2 Control of Vendors

a. Scope

The inspectors reviewed the procedure for controlling purchased material and services, Quality Control Procedure (QCP) 604, "Supplier Selection," Revision OE, dated July 22, 1997, and QCP 600, "Supplier Performance Measurement System," Revision OB, dated July 22, 1997.

b. Observations and Findings

QCP 604 requires GNB QA to conduct a survey to compile information on a new vendor and conduct an audit if necessary utilizing a check list of attributes to be verified. The procedure requires QA, Engineering, and Purchasing to jointly approve both the selection and rejection of any vendor. QCP 600 outlines the details of the supplier performance measurement system which requires compilation of feedback from other GNB plants. The feedback information is derived from other GNB plants during receipt inspections when personnel at those facilities observe various attributes, such as, quality performance, timely delivery of the goods, total cost of the goods, technical/engineering support from the vendors, and paper work/communication response time. This information is forwarded to the corporate QA which accumulates data for the supplier performance measurement system. The various GNB manufacturing plants are required to issue corrective action requests to the vendors when they observe conditions adverse to quality in the products they supplied.

At the Fort Smith facility, the team observed an NLI memorandum of October 6, 1997, which indicated that GNB's activities associated with "procurement document control and... control of purchased material (receipt inspection)" exhibited a "quality system breakdown." The NLI memorandum was written by the then NLI QA Manager which documented a limited scope assessment of the Fort Smith facility that was performed by the QA Manager and Vice President [former QA Manager] of NLI. Based on NLI's findings the memorandum identified an "action item list" for NLI and GNB personnel to correct and verify concerns that were found, instead of documenting the concerns on an audit report or nonconformance report.

Additionally, another NLI memo, dated September 29, 1997, stated in part "based upon the limited scope assessment performed at GNB-Lombard, Illinois, on September 25, 1997, that there has been a quality system breakdown in document control and vendor assessment."

c. Conclusions

The NRC inspectors observed that NLI did not document the adverse comments identified in its October 6, 1997, memorandum in a nonconformance report. This memorandum identifies that weaknesses may exist in the establishment or implementation of GNB's activities in other areas of the control of vendors. The team verified the adequacy of GNB's control of Amerace which supplies separators manufactured by its Micro Porus Products, Inc. division located in Piney Flats, Tennessee. GNB QA had completed a survey of Micro Porus Products in 1993.

3.1.3 Training of Personnel

a. Scope

The team reviewed the training imparted by GNB to its auditors by reviewing QCP-1700, "Qualification Trainees," Revision OB, dated February 19, 1998, and QCP-1800, "Training," Revision OB of August 8, 1997.

b. Observations and Findings

QCP-1700 prescribes the qualification of the auditors and describes the auditor training program. QCP-1800 outlines the training requirements for all employees performing activities affecting quality. The team reviewed the qualifications of three individuals and determined that they were adequately qualified.

c. Conclusions

The team identified no adverse findings in this area.

3.1.4 Corrective Action Program

a. Scope

The team assessed the adequacy of the GNB's corrective action program by reviewing QCP-1402, "Corrective Action (General)," Revision QA, of April 19, 1996, QCP-1601, "Customer Complaint Corrective Action Program," Revision OE, of November 12, 1996, and Lombard Work Instruction LWI-1500-14.

b. Observations and Findings

QCP 1402 outlines the corrective actions that are required from suppliers and customer complaints. QCP-1601 outlines the actions taken by GNB regarding customer complaints. This procedure applies to all customer complaints against product manufactured by GNB except for batteries intended for submarine applications. LWI-1500-14 describes the steps to be followed by GNB personnel for processing NLI claims and defines the interrelationship between NLI and GNB Warranty Department when processing claims. The GNB Team Leader - Flooded/Military and New Business Products is responsible to initiate a root cause analysis to determine the cause of failure. This procedure has been developed recently and is in the approval stage.

c. Conclusions

The team was unable to assess this area because the procedure has not been implemented.

3.2 Manufacturing Process Controls Strap Burning of Vented Lead-Acid Stationary Battery Cells

a. Scope

At the GNB's Fort Smith, Arkansas facility, the NRC inspectors observed Class 1E safety-related plate/separator assembly, and positive/negative plate lug-to-bus bar fusion process (strap burning) of four NCN-21 type battery cells to assess the effectiveness of the processes. These

four safety-related cells were part of two 60-cell batteries intended for the Baltimore Gas and Electric Company's (BG&E) Calvert Cliffs nuclear power plant. The applicable BG&E purchase order (PO), PO 18995, dated January 15, 1998, was for two 60-cell NCN-21, batteries, and these were the last four of the 120 cells to be built.

b. Observations and Findings

The inspectors observed GNB craftsmen, known as burners, assembling certain components of the four BG&E battery cells to assess the adequacy and appropriateness of the manufacturing process controls, and to observe the value added by the NLI QA inspection personnel who ensure that the process is within allowable manufacturing parameters. The process included the fusion of lead bus bars (called "straps") to the individual positive and negative plate lugs. The inspectors observed that the burners were not performing the task as described in the GNB Fort Smith Standard Operating Procedure (FSOP)-06-02, "Strap Burning of Flooded Stationary Cells." The FSOP called for the burner to first melt the strap "fingers" and plate lugs with his torch, then melt lead sticks to fill to the top of the mold, and stir the mixture with a stainless steel rod (stir stick), and finally repeat the last step. However, contrary to the FSOP, the burner was observed to first add some molten lead to the bus bar and plate lugs, then melt the mixture together and stir it with the stir stick. He then made another pass over the mixture to smooth the top surface and to blow off any residual slag.

Step 13 and 14, "Element Burning," of GNB's Flooded Assembly Operator Training and Certification Manual, Revision AA, no date indicated, described the strap-to-lug "double burn" process. The training manual calls for the burner to make two passes with the stir stick to ensure adequate depth of fusion between the bus bar and the plate lugs. When asked to describe the double burn process, neither of the burners interviewed nor their first line supervisor were aware that a double burn required two passes with the stir stick. They believed that one pass with the stir stick and another pass to blow off slag and mix the upper portion of the bus bar and plate lugs together was the double burn process. When asked why lead was first added to the bus bar and plate lugs before melting them together, the burners stated that because of the loose fit of the molds, it was necessary to first add lead to prevent burn-through during the melting process that would result in molten lead running out of the bottom of the mold. The first line supervisor independently confirmed that the burn process could involve adding a small amount of molten lead before melting the strap fingers and plate lugs on the smaller size cells such as, the NCN-21.

GNB management stated that the FSOP was originally developed by a corporate GNB engineer specifically for the larger H type cells and that it may not be appropriate for the smaller cells such as, NCN-21s, but they were not aware that the burners were not performing the burn as written in the FSOP. According to GNB, the double burn process was instituted a few years ago on H-series cells, which use thicker bus bars and plates than the N-series cells, after GNB experienced some problems with inadequate fusing during the burning process. The double burn was meant to achieve a deeper penetration of the bus bars and stirring the mixture twice was supposed to ensure adequate mixing and fusing. The process worked so well on the H-series cells that it was decided to post the FSOP at all of the assembly floor burn work stations, including the stations where the N-type cells were assembled. As a result of the questions raised by the NRC inspectors, GNB management stated that the double burn process would be reevaluated in regard to the NCN-series cells and that all burners would receive training on the double burning process.

The inspectors interviewed the NLI QA personnel at the GNB Fort Smith facility. NLI QA is responsible for witnessing the burning process for nuclear grade NCN-series batteries to assure that the GNB burners were implementing Procedure FSOP-06-02. Overall, the QA personnel

were knowledgeable of the manufacturing process and understood the NLI procedures governing oversight of the process. However, none of the NLI QA personnel understood the double burn process and believed that the double burn process consisted of a single pass to add melted lead and the second pass was to stir the mixture together with the stainless steel rod. When asked about training, the NLI personnel stated that most of their training for the different process controls was performed by on-the-job training from the senior or previous NLI personnel. The inspectors determined that the NLI QA Manual did not require the NLI QA inspectors to read and understand the GNB engineering requirements or specifications to familiarize themselves with the GNB procedures governing the burning process.

The NRC inspectors also observed two other types/sizes of battery cell bus bar/plate lugs being fused, the M, and H type of cells. The M cell was smaller than the NCN-21 and the H was larger than the NCN-21. Both the H and M cells are commercial GNB battery cells that are not used in safety-related applications. The inspectors observed that the burner who was assigned to an H type cell did use the double burn method which was delineated in the FSOP posted at the work station.

The controlling GNB specification for the FSOP is PR-14-05-FST, "Assembly Process for Flooded Stationary Cells-Fort Smith," Revision OD, October 22, 1997. GNB's Specification PD-14-00-FST, "General Engineering Requirements for Flooded Stationary Cells," Revision OC, October 22, 1997, and GNB Flooded Assembly Operator Training and Certification Manual, Revision AA, no date indicated, are also applicable. NLI had also established inspection requirements in NLI SVP-31, "Standard Verification Plan GNB Batteries and Hardware," Revision 11, December 1997. However, when all of the different documents and processes were compared with each other, inconsistencies were noted by the inspectors, specifically;

- Step 13, in the "Process Observation-Element Burning," of the GNB Flooded Assembly Operator Training and Certification Manual did not contain adequate verbatim information to ensure consistency in the strap burning process. It was unclear as to the particular point in time when external lead is supposed to be added to the lug-bus bar junction. The manual narrative is also different from the FSOP; therefore, the quality and adequacy of the burn may be indeterminate.

- The sequence for the strap burn specified in the FSOP was determined to be inappropriate for the smaller N type battery cells.

- When the NRC inspectors asked the shop supervisor to explain the correct method of performing double strap burn, he described almost exactly what the inspectors observed GNB's operator doing on the NCN-21 cells, which was not in accordance with the FSOP.

- PR-14-05-FST, Revision OD, requires: the maximum acceptable depth of burn of the plate lug to strap shall be 75% of the lug; conversely, PD-14-00-FST, Revision OC, requires: the minimum acceptable depth of burn of plate lug to strap shall be 75%.

- Although GNB engineering specified a 75% depth-of-burn value, neither GNB's Operator Training and Certification manual, FSOP, nor NLI's SVP-31 addresses the 75% acceptance value for process control or verification aspects. In fact after observing the process, the NRC inspectors concluded that it would be difficult for either the GNB burner or NLI QA inspector to determine whether the actual depth-of-burn is close to 75%.

- The narrative sequence and order of the burn events differ between the FSOP and Operator Training and Certification Manual

When the NLI and GNB management were initially informed of the observations by the NRC inspectors, the senior GNB officer, the Vice President of Technology and Quality Assurance, stated to the NLI Vice President and NRC inspectors that GNB had decided to immediately remove the burner's certifications and start the process of termination from GNB because the operator did not follow the FSOP. The NRC inspectors informed GNB and NLI management that punishing the burner might be in conflict with 10 CFR 50.7, "Employee Protection" regulations, because the activities being under 10 CFR 50, Appendix B could, in fact be, "Protected Activities". Therefore, the inspectors stated that they would have to contact the NRC Office of General Counsel for guidance. Consequently, three of the five NRC inspectors interrupted their respective inspection activities and started to obtain additional information regarding this matter. The NRC inspectors conducted interviews with other strap burning operators, the shop supervisor for the applicable area, the Plant Operations Manager, Manager of Process Engineering and NLI QA Inspectors to comprehensively evaluate the matter and determine if there was intimidation by GNB management.

As a result of this interruption for the additional effort, the NRC inspectors could not complete some of the other areas that they had planned to review.

c Conclusions

The NRC inspectors concluded that several weaknesses existed regarding the establishment and implementation of the strap burn process. For example, operator training instructions did not contain adequate verbatim requirements to assure that the process was consistent in the quality of the finished product, especially between different operators; first line supervision was not aware of procedural requirements and therefore did not notice failure to comply with the requirements; NLI QA inspectors were unaware of procedural requirements and, therefore, failed to notice noncompliance with the requirements; GNB did not appear to have an engineering justification to implement the double burn process to the Class 1E N-type cells; and the NLI QA personnel, while having an overall knowledge of the manufacturing process from the NLI procedures and via on the job training from previous NLI personnel, were not required to read and understand the basis for the process controls. This is considered a weakness in the GNB and NLI quality assurance programs. After interviewing the GNB and NLI personnel, the inspectors determined that it was not necessary to contact the NRC Office of General Counsel because they observed that the GNB and NLI personnel had not been intimidated by their management and the issue did not cause a chilling effect on the workers. The NRC team's actions for NLI to address this matter as related to safety-related items are identified in Inspection Report 99901298/98-01.

3.3 Observation of Manufacturing Activities at Fort Smith, Arkansas

a. Scope

Observe activities in progress to verify the implementation of NLI quality assurance program and GNB quality program during the manufacture of batteries at Fort Smith.

b. Observation and Findings

The team accompanied by GNB personnel toured the facilities and observed batteries intended for Arizona Public Service Company's Palo Verde plant being tested and batteries intended for Baltimore Gas and Electric Company's Calvert Cliff's plant being manufactured. The team observed that NLI quality Control (QC) inspectors affix a GNB yellow "hold" tag to items which

require their verification and release. The NLI inspectors establish hold points on a traveler to remind the GNB personnel that NLI personnel are required to sign-off before GNB can commence the next manufacturing step. Typical hold points have been established for the following operations when NLI inspections have to determine that the manufactured component has met the applicable GNB acceptance criteria.

- Verification that only Columbus Red Lead oxide is used.
- Cube weight, rod penetration and Active Material Apparent Density (AMAD) is documented for each paste mix lot.
- Verify that the finished plate weights and dimensions meet the applicable requirements.
- Verify that only approved busbars and plates are used for cell assembly and that the burn of the plates to the busbar are "double pass" and meet GNB specifications.
- Verify that the measured terminal to terminal resistances and the terminal to plate resistance are within the specifications limits.
- Perform 100-percent verification of post alignment and post seal nuts torque on the assembly line meet the applicable acceptance criteria.
- Witness and record the results of the cell leak test (cell will hold 1 psig for 30 seconds)
- Verify that cells are filled with electrolyte for a minimum of one hour. This includes monitoring the cell temperature, and at least two 24 hour let downs.
- After the formation, witness discharge tests to measure and document battery capacity.

The NRC team witnessed a performance test being performed on four NCN 31 type cells. The measuring instruments recorded the voltage at the battery, and each individual cell during the test showing the "Coup de Fouet" dips, the voltage recovery and the voltages at the end of the test. The inspectors observed that the capacities of these cells were over 100%.

The inspectors observed that the following are the major differences between the GNB commercial-grade and safety-related battery cells:

- The cells that are manufactured for NLI which are intended for nuclear utilities are certified that the battery meets Class IE requirements.
- A traveling tag (Hold Tag) is used along the production line as a hold for NLI inspectors.
- "Columbus Oxide" is used for the Class IE cells.
- Torquing of the post seals is done by NLI personnel.
- The AMAD values for positive plate are 3.45 - 3.60 g/e.c. a more restrictive low range to allow a possible higher value of capacity testing.
- The formation of the Class IE cells is different from commercial grade. The Class IE will be subjected to at least two 24 hour let down while the commercial grade is subjected to

one 8 hour let down.

c. Conclusion

The team did not observe any adverse findings in this area.

4. Personnel

GNB Technologies Lombard, Illinois

J. Jergl	Vice President, Technology & Quality Assurance
L. May	Quality Assurance Manager
L. Joubert	Purchasing Coordinator
M. Linne	After Sales Manager
K. Perzee	Director Procurement
B. Sheehan	Document Control
S. Vechy	Utility Sales & Marketing Manager
J. Boehm	Product Engineer
R. Schmitt	Team Leader Flooded/Field Engineering

NRC inspectors met the above persons during October 20-21, 1997.

GNB Technologies, Fort Smith, Arkansas

M. Schessler	Operations Manager
J. Reinhard	Manager of Process Engineering & Quality Assurance

The NRC inspectors met the above personnel during March 4-6, 1998.

Nuclear Logistics, Incorporated, Fort Worth, Texas

A. Bell	Vice President[2]
R Bonisolli	Quality Assurance Manager[3]
W. Malik	Project Manager

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[2] Mr. Bell was the NLI QA Manager during the Fort Smith facility inspection.

[3] Mr. Bonisolli was the QA manager during the Lombard facility inspection.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 10, 1998

Mr. Aron Seiken, President
Nuclear Logistics, Inc.
7461 Airport Freeway
Fort Worth, TX 76118

SUBJECT: NRC INSPECTION REPORT 99901298/98-01 (AND NOTICES OF VIOLATION AND NONCONFORMANCE)

Dear Mr. Seiken:

On January 14-16, and March 2-6, 1998, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Fort Worth office and at the GNB facility at Fort Smith, Arkansas, which manufactures batteries that Nuclear Logistics, Inc. (NLI) sells to the nuclear industry. The enclosed report presents the results of the inspection.

The NRC inspection team evaluated the programs that NLI established and executed to implement the provisions of Part 21 of Title 10 of the Code of Federal Regulations (10 CFR Part 21), and 10 CFR Part 50, Appendix B. Specifically, the inspectors reviewed NLI's quality assurance and quality control activities at the GNB battery factory, the refurbishment by NLI of Westinghouse Type DB-50 circuit breakers for Consolidated Edison's Indian Point Station, Unit 2, the dedication of new Westinghouse Type DS 416 breakers for New York Power Authority's Indian Point, Unit 3, and the NLI analysis to support the extension of the seismic qualified life of GNB Type NCX -1950 batteries from 10 to 20 years. Within these areas, the inspection consisted of an examination of procedures and representative records, interviews with personnel, and observations by the inspectors. The inspectors also verified the implementation of the actions taken by NLI to correct two nonconformances identified in NRC Inspection Report 99901298/96-01.

The NRC inspectors determined that NLI's procedures adopted pursuant to 10 CFR Part 21 did not meet the requirements in the regulation for such procedures. The NRC inspectors further determined that the implementation of NLI's quality assurance program did not meet certain NRC requirements imposed on you by your customers. Some NLI procedures to implement the provisions of 10 CFR Part 50, Appendix B, lacked appropriate acceptance criteria, were not qualified for the specific application, or were not followed. Furthermore, appropriate procedures were not established to perform complex battery seismic qualification evaluations.

The violation and nonconformances are cited in the enclosed Notice of Violation and Notice of Nonconformance and circumstances surrounding them are described in detail in the enclosed report. You are requested to respond to the violation and nonconformances and should follow the instructions specified in the enclosed NOV and NON when preparing your response.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room (PDR).

Sincerely,

Suzanne C Black

Suzanne C. Black, Chief
Quality Assurance, Vendor Inspection
and Maintenance Branch
Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation

Docket No. 99901298

Enclosures:
1. Notice of Violation
2. Notice of Nonconformance
3. Inspection Report 99901298/98-01

NOTICE OF VIOLATION

Nuclear Logistics Incorporated
Fort Worth, Texas

Docket No.: 99901298
Report No.: 98-01

During an NRC inspection conducted on January 14-16, and March 2-6, 1998, violations of NRC requirements were identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violations are listed below:

10 CFR Part 21.21, "Notification of failure to comply or existence of a defect and its evaluation," requires in part that, (a) Each individual, corporation, partnership, dedicating entity, or other entity subject to the regulations in this part shall adopt appropriate procedures to: (1) Evaluate deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards as soon as practicable, and, except as provided in paragraph (a)(2) of § 21.21, in all cases within 60 days of discovery.

Contrary to the above, NLI did not adopt a procedure to adequately ensure that identified deviations and failures to comply were evaluated. Procedure NLI-QUAL-08, which NLI adopted to implement the provisions of Part 21 did not discuss the aspects of evaluations of deviations and failures to comply that are delineated in Section 21.21(a) of 10 CFR Part 21. NLI also received a non-cited violation in NRC Report 99901298/96-01 for its failure to have adopted an appropriate procedure to implement the provisions of 10 CFR Part 21. (Violation 99901298/98-01-01)

This is a Severity Level IV violation (Supplement VII).

Pursuant to the provisions of 10 CFR 2.201, Nuclear Logistics Incorporated, is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington D.C. 20555, with a copy to the Chief, Quality Assurance, Vendor Inspection and Maintenance Branch, Division of Reactor Controls and Human Factors, Office of Nuclear Reactor Regulation, within 30 days of the date of the letter transmitting this Notice of Violation. This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. Where good cause is shown, consideration will be given to extending the response time.

Dated at Rockville, Maryland
this 10th day of June 1998

Enclosure 1

NOTICE OF NONCONFORMANCE

Nuclear Logistics Incorporated
Fort Worth, Texas

Docket No.: 99901298
Report No.: 98-01

Based on the results of an inspection conducted on January 14-16, and March 2-6, 1998, it appears that certain activities were not conducted in accordance with NRC requirements.

A. Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," states that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

Contrary to the above, in September 1997, NLI failed to promptly identify and correct significant quality problems with certain program controls and processes of its vendor, GNB Technologies (GNB), which manufactures Class 1E lead-acid storage batteries. The NLI quality assurance manager had documented the problems in two internal memoranda, dated October 6, 1997, and October 19, 1997, regarding a September 30, 1997, meeting/assessment performed at GNB, manufacturing facilities at Fort Smith, Arkansas and a September 26, 1997, meeting/assessment, performed at the GNB corporate office, Lombard, Illinois, respectively. (99901298/98-01-02)

B. Criterion III, "Design Control," of 10 CFR Part 50, Appendix B, states in part: "Measures shall be established to assure that applicable regulatory requirements and design basis .... are correctly translated into specifications, drawings, procedures, and instructions. The design control measures shall provide for verifying or checking the adequacy of design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.

Contrary to the above, NLI Calculation C-04010-W, "Pole Shaft Weld Evaluation," Revision 0, dated January 16, 1998, was not adequate to check the adequacy of design for the commercial pole shafts installed in Westinghouse Type DS-416 low-voltage metal-enclosed circuit breakers, supplied by NLI to the New York Power Authority for safety-related service in the Indian Point 3 nuclear plant. (99901298/98-01-03)

C. Also contrary to the requirements of Criterion III of 10 CFR Part 50, Appendix B, NLI Calculation C-017002-11, was not adequate to justify the extension of qualified life for the seismic qualification of certain GNB batteries in nuclear safety-related service. (99901298/98-01-05)

D. Criterion II, "Quality Assurance Program," of 10 CFR Part 50, Appendix B, requires, in part, that the quality assurance program provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained.

Contrary to the above, NLI QA inspectors had not received adequate training to assure proficiency in monitoring key GNB manufacturing processes (in particular, cell plate to busbar fusion or "burn" process), an activity affecting quality. Consequently, NLI QA inspectors failed to recognize that certain practices in common use at GNB were not in compliance with engineering specifications or with posted GNB process control instructions. Also, NLI did not develop adequate training requirements for technicians who perform electrical circuit breaker dedication and refurbishing (99901298/98-01-06)

E. Criterion V, "Instructions, Procedures and Drawings," of 10 CFR Part 50, Appendix B, states that activities affecting quality be prescribed by instructions, procedures, and drawings appropriate to the circumstances, that those instructions, procedures, and drawings be followed, and that the instructions, procedures, and drawings contain appropriate qualitative and quantitative acceptance criteria to determine if important activities have been satisfactorily accomplished.

Contrary to the above; (a) the fusing of plates to the cell busbar for GNB safety-related battery cell types being manufactured for NLI, an activity affecting quality, was being performed without a procedure that was appropriately qualified for the double burn process being used and (b) NLI quality assurance inspectors routinely witnessed this process, and were expected to be able to ensure that it was being done in accordance with specified requirements, but were not required to be familiar with, nor did they refer to the applicable specifications or procedures and instructions (9901298/98-01-07).

F. Also contrary to the requirements of Criterion V of 10 CFR Part 50, Appendix B, NLI Standard Verification Plan SVP-31, "GNB Batteries and Hardware," Revision 10, dated October 1997, which prescribed NLI activities affecting the quality of GNB batteries built for NLI for use in nuclear safety-related applications, did not contain appropriate acceptance criteria, or in some cases, any acceptance criteria, for certain essential attributes of the batteries or their manufacturing processes to be verified by the plan. (99901298/98-01-08)

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, with a copy to the Chief, Quality Assurance, Vendor Inspection and Maintenance Branch, Division of Reactor Controls and Human Factors, Office of Nuclear Reactor Regulation, within 30 days of the date of the letter transmitting this notice. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each nonconformance: (1) a description of steps that have been or will be taken to correct these items; (2) a description of steps that have been taken or will be taken to prevent recurrence; and (3) the dates your corrective actions and preventive measures were or will be completed.

Dated at Rockville, Maryland
This 10th day of June, 1998

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No.:	99901298/98-01
Organization:	Nuclear Logistics, Inc. 7461 Airport Freeway Fort Worth, Texas 76118
Contact:	Archie C. Bell Quality Assurance Manager (817) 284-0077
Nuclear Industry:	Servicing and refurbishing low- and medium-voltage switchgear, third party dedication of commercial-grade procured components.
Dates:	January 14,-16, 1998 March 2-6, 1998
Inspectors:	Kamalakar R. Naidu, HQMB, NRR Stephen D. Alexander, HQMB, NRR David Skeen, PECB, NRR Joseph Petrosino, HQMB, NRR Saba N. Saba, EELB, NRR Yeuh-Li C. Li, EMEB, NRR
Approved by:	Richard P. Correia, Chief Reliability and Maintenance Section Quality Assurance, Vendor Inspection and Maintenance Branch Division of Reactor Controls and Human Factors Office of Nuclear Reactor Regulation

Enclosure 3

1. INSPECTION SUMMARY

On January 14-16, 1998, and March 2-6, 1998, the NRC conducted an inspection at Nuclear Logistics, Incorporated (NLI), to review the implementation of the NLI quality assurance (QA) Program. Specifically, the inspectors (1) assessed the implementation of the NLI QA program for the manufacture of safety-related batteries at the Fort Smith, Arkansas, facility of GNB Technologies, Inc. (formerly Gould National Battery), (2) reviewed the criteria that NLI used to extend the life of certain GNB safety-related batteries from 10 to 20 years, (3) reviewed the recent refurbishment by NLI of Westinghouse Type DB-50 low-voltage power circuit breakers for Consolidated Edison's (ConEd's) Indian Point Station, Unit 2 (IP-2), and (4) reviewed the dedication by NLI of Westinghouse Type DS 416 breakers (procured as commercial-grade items from the current manufacturer, Eaton/Cutler-Hammer (ECH)) for use in safety-related applications at the New York Power Authority's (NYPA's) Indian Point Station, Unit 3 (IP3). The inspectors also verified the implementation of the actions taken by NLI to correct two nonconformances identified in NRC Inspection Report 99901298/96-01.

The inspection bases were:

- Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50, Appendix B).

- 10 CFR Part 21, "Reporting of defects and noncompliance" (Part 21)

The team identified one violation involving failure to develop an appropriate procedure to implement the reporting requirements of 10 CFR Part 21 (Section 3.1). In addition, the inspectors identified several nonconformances involving: use of a battery quality verification procedure which did not have adequate acceptance criteria (Section 3.2.b.1), failure to properly document and correct conditions adverse to quality (Section 3.2.b.2), permitting the use of an unqualified procedure for double burn process (Section 3.2, b.3), inadequate battery seismic qualification life extension analysis (Section 3.4), inadequate design verification of commercial-grade circuit breaker pole shafts (Section 3.5), and one inspector followup item (IFI) regarding the adequacy of training was also identified (Section 3.5).

2. STATUS OF PREVIOUS INSPECTION FINDINGS.

Nonconformance (99901298/96-01-01) Closed NLI verification plans for motor control components did not specify appropriate acceptance criteria to verify that certain critical characteristics had been met. In an attachment to a letter to the NRC, dated October 4, 1996, NLI stated that it had revised SVP-22, "Standard Verification Plan - Circuit Breaker," SVP-1, "Standard Verification Plan - 600V Starter," and SVP-43, "Standard Verification Plan -Functional Testing Assemblies." The revised SVPs specified appropriate acceptance criteria. According to records, NLI technicians were trained on the revised procedures in March 1997 and the affected equipment passed retests using the revised SVPs. The inspectors did not identify any further concerns with these procedures.

Nonconformance (99901298/96-01-02) Closed. NLI had not maintained traceability on a GE type circuit breaker sold to Entergy Operations, for use at its River Bend Station. NLI had since obtained the necessary traceability documentation, which was on file. The inspectors did not identify any further concerns.

3. INSPECTION FINDINGS AND OTHER COMMENTS.

3.1 10 CFR Part 21 Implementation

a. Inspection Scope

The NRC inspectors evaluated NLI Quality Procedure NLI-QUAL-08, "Nonconformance and 10CFR21 Reporting," Revision 4, dated June 1997, which NLI developed to implement the requirements of 10 CFR Part 21. The NRC inspectors reviewed the procedure, conducted discussions with NLI's QA Manager, evaluated associated procedures and memorandums, and reviewed 10 CFR Part 21 program concerns that were identified during the previous NRC inspection at NLI in 1996 and documented in Inspection Report 99901298/96-01.

b. Observations and Findings

The inspectors observed that NLI-QUAL-08 was posted in a conspicuous location at NLI's Fort Worth, Texas, facility in accordance with the NRC requirements. However, the stated purpose of the procedure was to provide the process and mechanism for the reporting and disposition of "nonconformances"; whereas 10 CFR 21.21(a) requires that procedures adopted pursuant to the regulation provide for the evaluation of deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards. NLI-QUAL-08 delineated the requirements both for performing a 10 CFR Part 21 reportability evaluation and issuing stop work orders. Section 2.0, "Definitions," of the procedure did not contain any definitions, but stated that the definitions in 10CFR21, Section 21.3 are applicable. Part 21 was included as an Attachment to the procedure. The procedure stated that it applies to items which have been supplied to the client and other significant conditions as specified in Section 4.0, "Nonconformance Reporting," of the procedure.

The inspectors determined NLI-QUAL-08 did not provide appropriate instructions to effectively implement Section 21.21(a) of Part 21. NLI-QUAL-08 focussed on dispositioning production nonconformances in NLI's QA program, but not specifically on implementing the provisions of 10 CFR Part 21. Fundamentally, the procedure commingled in-process nonconforming conditions with those that could be considered deviations and failures to comply in basic components already shipped to or offered for use at NRC licensed facilities. The inspectors determined that NLI Quality Assurance Manual Supplement NLI-08, Revision 0, dated May 1997, contained more specific 10 CFR Part 21 information and requirements than NLI-QUAL-08 which NLI had designated as its official procedures adopted pursuant to 10 CFR 21.21(a).

During a 1996 inspection, (NRC Inspection Report No. 99901298/96-01-01), the NRC found that NLI's Part 21 procedures were inconsistent with Part 21 and characterized the finding as a minor violation of Part 21 in accordance with NRC's Enforcement Policy as described in

NUREG-1600. In response to the identified violation during the 1996 inspection, NLI agreed to revise its procedures to comply with Part 21 requirements. During this inspection, the inspectors informed NLI that it had not taken adequate corrective action for the 1996 non-cited violation and did not develop an appropriate procedure to implement 10 CFR Part 21.

c. Conclusion

NLI still had not established adequate procedures to effectively implement the provisions of 10 CFR Part 21; although this deficiency was identified previously in 1996 as a non-cited violation in NRC Inspection Report. 99901298/96-01. Therefore, this deficiency constituted a repeated violation of 10 CFR 21.21(a) and accordingly, Violation 99901298/98-01-01 is cited.

3.2 QA Oversight of GNB Battery Design and Manufacturing Process

a. Inspection Scope

The NRC inspectors reviewed selected portions of the NLI QA program to determine if NLI adequately controlled quality activities at the GNB manufacturing facility and corporate engineering offices relating to the manufacture by GNB for NLI of nuclear grade, NCN-Series and NAN-Series lead-acid storage batteries designed for Class 1E service in nuclear power plants. Among the documents reviewed were those that described and prescribed NLI's QA oversight and direct verification (quality control or QC) activities at the GNB Fort Smith, Arkansas, factory. Principal program description and basic verification requirements were contained in NLI Report #R-017-001, Revision 5, dated October 17, 1997, "Integrated Verification of GNB Technologies Flooded Stationary Batteries for Use in Nuclear Power Plants; NLI Standard Verification Plan SVP-31, "GNB Batteries and Hardware," Revision 10, dated October 19, 1997, and Revision 11, dated December 2, 1997. The inspectors also reviewed selected individual NLI verification plans for components, parts and materials purchased by GNB such as VP-BATTERY-1-22, Revision 0, for Columbus Oxide 25% red lead. This phase of the review was for assessment of NLI QA oversight program adequacy. Program implementation, compliance and effectiveness were reviewed separately by examining manufacturing and testing records and direct observation of manufacturing activities and NLI QA inspectors witnessing and verifying those activities.

b. Observations and Findings

b.1 Oversight Program and Verification Plan

The inspectors did not identify any deficiencies in the description of NLI's QA oversight activities for GNB manufacturing processes in R-017-001, nor in the selected purchased hardware verification plans reviewed. However, the inspectors found that some of the verifications specified in SVP-31, Revision 10, did not include appropriate (or in some cases any) acceptance criteria, either in the body of the procedure or in the individual process verification data sheets. The inspectors identified the following deficiencies which still existed in Revision 11, except as indicated:

- Data Sheet 2 specified the acceptable range of Humbolt penetration for paste, but the instrument was found to be uncalibrated.

- The SVP-31 text in Section 3.0, "Sample Size," did not address the critical processes of grid casting, paste mixing, and grid pasting; although Paragraph 4.1.2, "Plate Pasting," under Section 4.0, "Cell Manufacturing," addressed this process generally.

- Paragraph 4.1.1, "Busbar Casting," required verifying that the lead alloy was "tested upon receipt and daily during use for NLI busbars. However, neither 4.1.1, nor its associated Data Sheet 1 specified what the lead should be tested for, test methods, or acceptance criteria.

- According to Paragraph 4.1.3, "Cured Plates," cured (dried/hardened paste) plates were supposed to be weighed and dimensionally checked on a 1/16 (32 minimum) sample basis with 100 % visual inspection for voids or missing pellets. Results were to be recorded on Data Sheet 3, "Cured Plates." The out-of-square and flatness tolerances were specified on Data Sheet 3 but not the range of actual allowable plate thicknesses, widths, and lengths. Here, SVP-31 only referred to GNB specifications for other requirements. It did not provide for writing in the applicable requirements for the size plates being inspected from the GNB specifications for use in the field while inspecting cured plates.

- Paragraph 4.1.4, "Busbar Inspection," specified recording results on Data Sheet 12, but Data Sheet 12 was for visual and dimensional inspection of flat washers. No data sheet had been provided for recording the results of the busbar inspection; therefore, there were no acceptance criteria, either in the body of SVP-31 or in the data sheets, except the instruction in 4.1.4 to "perform and record a destructive test to see if busbars bend under slight pressure." No guidance was provided on sample size for the destructive test, except in Section 3.0, "Sample Size," which prescribed a general 100% sample size except as noted in that section and a rate less than 100% for busbar inspection was not listed. Paragraph 4.1.4 in Revision 11 stated that Data Sheet 13 should be used, but it was a blank, general purpose data sheet, still without acceptance criteria.

- Data Sheet 4, "Cell Assembly," listed terminal post alignment as an attribute to verify, but did not define this alignment or state an acceptance criterion except that the GNB alignment fixture must not bind. The acceptance criterion for this attribute was listed in Paragraph 4.1.5.d "Cell Element Test," of the procedure, but not referred to on the data sheet. The inspectors observed the typical use of the data sheets only rather than the whole procedure in the field.

- Plate-to-terminal resistance was listed as an attribute to be verified on Data Sheet 4 and an acceptable range given, but the probe location, which could conceivably affect the reading, was not specified on the Data Sheet or in Paragraph 4.1.5.d where the test was also prescribed. NLI stated that the desired probe positioning was covered in operator training, but, as with the case of the so-called "double-burn" procedure, NLI's QA inspectors training consisted solely of observing GNB operators under instruction with a more experienced NLI inspector.

- The sealed-cell leak check parameters were given on Data Sheet 4, but without a tolerance on the test pressure or duration, and without acceptance or rejection criteria (e.g., an allowable amount of pressure drop during the test, if any).

- Data Sheet 4 stated that NLI QA personnel themselves were to torque the seal nut, but this is inconsistent with Criterion X of 10 CFR Part 50, Appendix B, "Inspection," which requires that QA overchecks be made by someone other than the one who performed the operation.

- The SVP-31 Section 3.0 sampling basis for Data Sheet 5, "Formation," stated that cell temperatures are "...constant during formation...." However, unless the cells can dissipate heat just as rapidly as the current produces it, the temperatures will rise. It was also not clear how temperatures were to be monitored constantly to verify this condition upon which the sample rate for verification was based. Data Sheet 5 specified that cell temperatures remain within a fairly wide range (given), but consistency among cells was not specified. This same sample basis appeared in Revision 11, but it did not refer to Data Sheet 5 which was eliminated in Revision 11.

- In Revision 10, neither Section 4.1.6, "Formation," nor Data Sheet 5 specified all the charging and discharging parameters (e.g., charge duration, charging rate, ampere-hours to be charged or discharged, or termination criteria such as end voltage, specific gravity, etc.) for the formation process. The only specific requirement was that two "24-hour letdowns" be performed during the process. In Revision 11, Paragraph 4.1.6 simply referred to the GNB formation procedure but did not provide a place to document that the requirements were met since Data Sheet 5 had been eliminated. The inspectors were concerned that the formation process, which is critical to subsequent battery performance and life, was not being adequately specified and monitored by NLI under the provisions of SVP-31.

- Paragraph 4.2.1.c, "Specific Gravity," [under Section 4.2, "Testing" (IEEE-450)], specified measuring and recording the electrolyte specific gravity of each cell before capacity testing, but an acceptable range was not provided here or on the associated Data Sheet 6.

- Paragraph 4.2.1.e, "Test Current," directed calculating the required test current based upon the battery "mean average temperature," but neither this instruction, nor the data sheet (Data Sheet 6) provided for specifying the "hour rate" desired for the test (e.g., the 2-hour rate, 4-hour rate, 8-hour rate, etc.) or the actual nominal or uncorrected discharge current corresponding to the hour rate to be used, of which, cell/battery capacity is a non-linear function.

- Paragraph 4.2.1.f, "Shunt Voltage," specified calculating the required shunt voltage based on the test current using the formula on Data Sheet 6. However, it was not possible to get a meaningful result using the formula as written on the Data Sheet because the shunt voltage formula on Data Sheet 6 did not make mathematical or electrical sense. The formula as expressed on the data sheet was:

"***(Shunt mv rating/shunt current rating) ÷ (x/test current) =_____***"[sic]

Where, presumably, "x" was supposed to be the shunt voltage to be measured. First, the equation was not expressed in terms of shunt voltage, i.e., the parameter being calculated, but rather as one ratio divided by another involving the desired parameter. Second, having the first ratio divided by the second (which contains the dependent variable) and the quotient equal to some undefined parameter was not mathematically or electrically correct. In effect, it was one equation with two unknowns, which, of course, is unsolvable. Even if expressed as a proportion, in order to follow Ohm's law and to be mathematically rigorous, the equation should have been written as follows:

(Shunt mv rating/shunt current rating) = (x/test current)

where "***x***" is the shunt voltage to be measured (and maintained in order to ensure constant test discharge current). However, because the shunt mv rating divided by its current rating is the shunt's rated resistance, solving for ***x*** or shunt voltage, the formula, more usefully expressed in the form of Ohm's Law would be:

Shunt Voltage = (Shunt mv rating) ÷ (shunt current rating) X (test current) =____.

The inspectors determined through a review of selected completed data packages that NLI QA inspectors and technicians had worked around the erroneous formula and figured out how to calculate shunt voltage correctly, but had not taken action to correct the pre-printed formula.

- As discussed in Section b.3 below, both revisions of SVP-31 reviewed lacked the "75% depth-of-burn" acceptance value for the busbar-to-plate fusion operation. SVP-31 only referenced GNB Specifications PD-14-00-FST and PR-14-05-FST.

The lack of acceptance criteria, or appropriate acceptance criteria (and adequate specificity in prescribing test parameters), instructions, procedures and drawings prescribing activities affecting quality (i.e., SVP-31) constituted a nonconformance with respect to Criterion V, "Instructions, Procedures, and Drawings," of 10 CFR Part 50, Appendix B. Accordingly, Nonconformance 99901298/98-01-08 was identified.

c.1 Conclusions

The inspectors concluded on the basis of this programmatic review that the overall NLI approach to QA oversight of GNB battery manufacturing processes supplemented with some direct and independent verification activities in selected areas was a generally sound approach, consistent with the intent of 10 CFR Part 50, Appendix B. However, many programmatic elements had significant weaknesses as cited in this report; and implementation was not always consistent or effective, suffering principally from inadequate detailed guidance for, or training of, NLI QA inspectors.

b.2 QA Audits and Corrective Action

Two NLI internal memoranda written by the NLI Quality Assurance (QA) Manager discussed "Informational Meetings/Limited Scope Assessments" of GNB's Lombard, Illinois, engineering office, responsible for battery design on September 26, 1997, and of GNB's Fort Smith, Arkansas, battery factory on September 30, 1997. The NLI President and Vice-President had received copies of the memoranda, dated October 19, 1997, and October 6, 1997, respectively. Both memoranda stated that "based on the Informational Meeting/Limited Scope Assessment, potential areas of concern were identified." As a result of the meetings, NLI generated an action item list. The inspectors noted that many of the issues delineated on the "NLI Action Item List" identified discrepancies in implementation or establishment of the GNB and/or NLI quality assurance program. For example, (a) GNB purchase orders (POs) referenced the incorrect revision level of the part number being ordered, (b) GNB receiving inspection records did not contain provisions for documentation review in all cases, (c) NLI advised GNB to revise its Fort Smith battery cell traveler by October 17, 1997, to ensure that acceptance criteria for hold points would be identified; and (d) NLI requested GNB to verify that pull tests are being performed on the jar-to-jar cover joint to demonstrate that the adhesive meets the requirements of the applicable material specification.

The October 6, 1997, memorandum further stated that "it appears based upon the limited scope assessment performed at GNB Technologies; Fort Smith, Arkansas, on September 30, 1997, that there has been a Quality System breakdown in Design Control (Configuration Control), Procurement Document Control and Control of Purchased material (Receipt Inspection)." The October 19, 1997, memorandum further stated that "it appears based upon the limited scope assessment performed at GNB Technologies; Lombard, Illinois, on September 26, 1997, that there has been a Quality System breakdown in document control and vendor assessment. In both cases, this breakdown is probably traceable to lack of sufficient trained resources to accomplish the required tasks."

Section 4.1, "Nonconformance Identification," of NLI Procedure NLI-QUAL-08, stated that a nonconformance can be identified by any NLI personnel during the course of a project or any other activity and that, upon identification of a nonconformance, the applicable sections of the NLI nonconformance report must be completed. Section 6.2, "Nonconforming Materials and Corrective actions," of the NLI Quality Assurance Manual (QAM), Revision 1, July 1991, required a nonconformance report (NCR) to be issued to document nonconforming conditions. Section 6.2 also stated that if the nonconformance is of significant nature and magnitude, the president or Quality Assurance Manager may issue a stop work order. Although the NLI QA Manager's memoranda concluded that NLI's limited scope assessment of GNB's Lombard and Fort Smith facilities indicated a "quality system breakdown" in five areas, NLI failed to promptly document these conditions adverse to quality in a nonconformance report and take adequate action to ensure that the identified deficiencies were corrected and to ensure that any affected, potentially nonconforming material was controlled. As a result, the inspectors were concerned about the impact of the identified deficiencies on the quality of GNB/NLI batteries. Of particular concern was the reliability of potentially affected battery cells to perform their safety functions under all design basis conditions.

c.2 Conclusion

On the basis of the review of the NLI limited scope assessment of GNB, the inspectors concluded that NLI, in this instance, had not followed NLI-QUAL-08 by failing to document the discrepancies identified at the two GNB facilities in a nonconformance report, and had not taken adequate corrective action. The inspectors concluded that this deficiency constituted, most basically, a nonconformance with respect to the requirements of Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B, and Nonconformance 99901298/98-01-03 was cited.

b.3 Observation of Strap Burning of Vented Lead-Acid Stationary Battery Cells

At the GNB Fort Smith, Arkansas facility, the NRC inspectors observed the process of plate and separator assembly and the process of positive and negative plate lug-to-bus bar fusion (strap burning). These processes were crucial steps in the manufacture of four NCN-21 type battery cells. The inspectors' objective was to assess the effectiveness of the GNB process controls and the effectiveness of the NLI QA inspection personnel who are supposed to ensure that the process remains within allowable manufacturing parameters. These four safety-related cells were part of two 60-cell batteries intended for the Baltimore Gas and Electric Company's (BG&E) Calvert Cliffs nuclear power plant. The applicable BG&E purchase order (PO), PO 18995, dated January 15, 1998, was for two 60-cell NCN-21 batteries, and these were the last four of the 120 cells to be built.

The inspectors observed that the burners were not performing the task exactly as described in the GNB Fort Smith Standard Operating Procedure (FSOP)-06-02, "Strap Burning of Flooded Stationary Cells," Revision AA, dated March 12, 1996. The FSOP specified first melting the strap "fingers" and plate lugs with the torch, then melting lead sticks to fill to the top of the mold, stirring the mixture with a stainless steel rod, and finally repeating the last step. However, contrary to the FSOP, the burner was observed first to add some molten lead to the bus bar and plate lugs, melt the mixture together and stir it with the stir stick, then make another torch pass over the mixture to smooth the top surface and to blow off any residual slag.

Steps 13 and 14, "Element Burning," of GNB's Flooded Assembly Operator Training and Certification Manual, Revision AA, (no date indicated) described the strap-to-lug "double burn" process. The training manual called for the burner to make two passes with the torch and stirring rod to ensure adequate depth of fusion between the bus bar and the plate lugs. However neither of the burners interviewed, nor their first line supervisor, were aware that a double burn required two passes with the stirring rod. It had been their understanding that one pass with the stirring rod and another pass to blow off slag and mix the upper portion of the bus bar and plate lugs together was what was meant by the term "double burn." When asked why lead was first added to the bus bar and plate lugs before melting them together, the burners stated that because of the loose fit of the molds, it was necessary on the smaller size cell straps to first add lead to prevent burn-through during the melting process that would result in molten lead running out of the bottom of the mold. The first line supervisor independently confirmed that it was an accepted practice (although, admittedly a deviation from verbatim compliance with the language of the procedure), and only when necessary, to add a small amount of molten lead obtained from a piece of pure lead called a lead burn stick before melting the strap fingers and plate lugs on the smaller size cells, such as the NCN-21.

The double burn described in the FSOP was originally developed by a corporate GNB engineer specifically for the larger H type cells in order to achieve a deeper penetration of the bus bars. Stirring the mixture twice was supposed to ensure adequate mixing and fusing. The process worked so well on the H-series cells that it was decided to post the FSOP at all of the assembly floor burn work stations, including the stations where the NCN type cells were assembled. However, the procedure was arbitrarily applied across the board without determining if it was really necessary or workable for all types and sizes of cells, such as by experimentation with test straps in the smaller sizes and consultation with burners and first line supervisors. NLI believed that the double burn was a superior practice and specified its use on all NLI cells.

The inspectors interviewed the NLI QA personnel at the GNB Fort Smith facility because they are responsible for witnessing the burning process for nuclear grade NCN-series batteries to assure that the GNB burners were implementing Procedure FSOP-06-02. Even though, the NLI QA personnel were generally knowledgeable of the manufacturing process and understood the NLI requirements for oversight of the strap burning process, none of them fully understood the double burn process and all of them stated that they believed that the double burn process consisted of a single pass to add melted lead and the second pass was to stir the mixture together with the stainless steel rod. The NLI QA personnel stated that their training for the different process controls consisted of on-the-job training from more senior or previous NLI personnel. The NLI QA inspectors did not, nor had they been instructed to, familiarize themselves with the GNB engineering requirements, specifications or individual procedures governing the burning process, nor did the NLI QA Manual or other procedures require them to have done so prior to witnessing strap burns. (Nonconformance 99901298/98-01-06)

The NRC inspectors also observed two other types/sizes of battery cell bus bar/plate lugs being fused, the M, and H type of cells. The M cell was smaller than the NCN-21 and the H was larger than the NCN-21. Both the H and M cells are commercial GNB battery cells that are not used in safety-related applications. The inspectors observed that the burner who was assigned to an H type cell used the proper double burn method which was delineated in the FSOP posted at the work station. However, the burners that fused the "M" cells also used the same single burn process that was used on the NCN cells.

The controlling GNB specification for the FSOP is PR-14-05-FST, "Assembly Process for Flooded Stationary Cells-Fort Smith," Revision OD, October 22, 1997. GNB's Specification PD-14-00-FST, "General Engineering Requirements for Flooded Stationary Cells," Revision OC, October 22, 1997, and GNB Flooded Assembly Operator Training and Certification manual, Revision AA, (no date indicated) are also applicable. NLI had also established inspection requirements in NLI SVP-31, "Standard Verification Plan GNB Batteries and Hardware," Revision 11, December 1997. However, when all of the different documents were compared with each other, the inspectors noted inconsistencies, specifically:

- Step 13, in the "Process Observation-Element Burning," of the GNB Flooded Assembly Operator Training and Certification Manual did not contain adequate information to ensure consistency in the strap burning process. It was unclear as to the particular point in time when external lead is supposed to be added to the lug-bus bar junction. The manual narrative is also different from the FSOP; therefore, the quality and adequacy of the burn may be indeterminate.

- PR-14-05-FST, Revision OD, requires: the maximum acceptable depth of burn of the plate lug to strap shall be 75% of the lug; conversely, PD-14-00-FST, Revision OC, requires: the minimum acceptable depth of burn of plate lug to strap shall be 75%.

- GNB engineering specified a "75% depth-of-burn" value, but neither GNB's Operator Training and Certification manual, FSOP, nor NLI's SVP-31 addressed the 75% acceptance value for process control or verification. After observing the process, the NRC inspectors concluded that it would be difficult for either the GNB burner or NLI QA inspector to determine whether the actual depth-of-burn is close to 75%.

The NRC inspectors informed NLI and GNB management of their observations, including the fact that the narrative sequence and order of the burn events differ between the FSOP and the Operator Training and Certification Manual.

Shortly after being informed of the inspectors' concerns, GNB's Vice President of Technology and Quality Assurance, informed the NRC inspectors that GNB had decided to immediately remove the certification of the burner whom the NRC inspectors had observed and interviewed. The Vice President also intimated that GNB was considering termination of this employee because he had apparently violated the FSOP. The NRC inspectors explained that this action was not necessary to satisfy the NRC, as the inspectors were primarily interested in GNB and NLI establishing the most appropriate practices, documenting them clearly and ensuring consistent compliance through adequate training and supervision, as opposed to a show of precipitous reaction to the problem. The inspectors further cautioned GNB and NLI management that terminating the burner after he had told NRC inspectors that he thought he could not follow the GNB procedure in all cases might be viewed, particularly by other employees, as retaliation against an employee for his candor with the NRC. The inspectors were concerned that this action could have a "chilling effect" on GNB employees and affect the NRC inspectors' ability to obtain information.

As an alternative, the inspectors proposed, and GNB and NLI management agreed, that the inspectors would conduct a series of private interviews with all personnel concerned (with union shop stewards and others requested by the interviewee present) and conclusively establish the facts and circumstances surrounding the procedural issues before proceeding further. In parallel, GNB and NLI agreed to dissect one of the NCN-21 straps burned using the practices in question and determine if the fusion was adequate. Accordingly, three of the five NRC inspectors interrupted their respective inspection activities and interviewed the burner of concern, other strap burning operators, the shop supervisor for the applicable area, the Plant Operations Manager, Manager of Process Engineering and NLI QA inspectors.

The NRC inspectors evaluated the information to determine (1) if there was intimidation by GNB management, (2) what the burning practices in use were, (3) what the operators' understanding of the requirements was, (4) what supervisors expectations were, (5) what NLI QA personnel routinely observed, and (6) what was the NLI QA inspectors' training on and understanding of the requirements for strap burning of batteries for NLI. After interviewing the GNB and NLI personnel, the inspectors determined that GNB and NLI personnel had not been intimidated by their management and the issue did not cause a chilling effect on the workers.

The inspectors informed NLI that a safety-related operation was not performed in accordance with an appropriate procedure because (a) the designated procedure was not consistently followed and (b) even had it been followed, there was no objective evidence that the double burn process was qualified for the manufacture of NAN or NCN type cells. Further, neither GNB nor NLI had an engineering justification to implement the double burn process to the Class 1E NCN or NAN-type cells. (Nonconformance 99901298/98-01-07)

c.3 Conclusions

NLI QA inspectors had not been trained on the strap burning procedural requirement. Being unaware of the requirements, NLI QA failed to recognize that the GNB burners were not strictly following the procedures when fusing lead bus bars (i.e.,"straps") to the individual positive and negative plate lugs of NCN type cells intended for safety-related applications. NLI concurred with the NRC inspectors that its QA personnel had been inspecting the strap fusion process without proper training, without detecting that the process was being performed contrary to procedures, and that the procedure was not appropriate in all cases.

3.3 Licensee Purchase Orders

a. Inspection Scope

The NRC inspectors reviewed purchase orders (POs) issued by several nuclear utilities (licensees) to NLI to determine if NLI adequately translated the technical and quality requirements into POs passed on to GNB for the manufacture of Class 1E battery cells.

b. Observations and Findings

The licensee POs contained (or referenced) sufficient detailed technical requirements, and imposed upon NLI applicable requirements of 10 CFR Part 50, Appendix B, and 10 CFR Part 21, for the supply of Class 1E battery purchase files. For example, Duke Power Company (DPC) PO MN 21954, for its McGuire Station, dated December 11, 1996, imposed 10 CFR Part 21 and stated the PO was for components used in nuclear safety-related applications. The PO ordered four NCN-27 batteries, Amperage: 1945AH, Duke MSDS: 10799, 60 cell flooded, wet charged, 100% capacity, 125 VDC. The PO stated that the batteries shall meet all requirements of DPC Specification MCS-1356.01-00-0001, Revision 001, shall be supplied under the supplier's Quality Assurance program that has been approved by DPC, and stated that if lower tier procurement is required, then applicable QA requirements must be invoked on lower tier subcontractors/ suppliers. The PO also invoked the requirements of DPC Specification MCS 1356.01-00-001, Revision 001, dated September 27, 1989, "Vital Instrumentation and Control Batteries and Racks Procurement Specifications" on NLI. The inspectors observed that the DPC specification addressed seismic and environmental qualification as well as test, inspection, schedules and report requirements.

NLI job order package 017-074 to GNB for the design and manufacture of the batteries for DPC, McGuire Nuclear Station Units 1 & 2, indicated that the DPC PO ordered four strings of 60 NCN-27 battery cells. The NLI project synopsis for the DPC order stated that it was "to

supply dedicated and qualified GNB NCN-27 battery racks and cells - 4-strings (60/string) to McGuire Nuclear Station Units 1 & 2, per DPC MN21954. The cells are to be formed to 100% capacity and discharge tested in accordance with IEEE 450-1987 requirements - one minute and one hour discharge tests.... Seismic and environmental qualification on the batteries and racks will be performed by analysis."

c. Conclusion

The inspectors concluded that NLI translation of licensee requirements into its purchase orders to GNB was generally adequate.

3.4 Extension of NCX-1950 Battery Life

a. Inspection Scope

NRC Region II Inspection Report 50-269/95-14 identified that the qualified life of GNB Type NCX-1950 batteries that had been originally qualified for 10 years at the Keowee Hydro Station (Class 1E standby power source for the Oconee Nuclear Station), was being extended by NLI for Duke Power Company to 20 years, ostensibly under the provisions Institute of Electrical and Electronic Engineers (IEEE) Standard 535-1986. Note that NCX series batteries are commercial GNB batteries that have been in Class 1E service for some time. The inspectors reviewed the report that NLI produced for Duke in support of the battery seismic qualification life extension, NLI Report No. C-017002-11, "Battery Seismic Qualification and Design Life," dated February 28, 1998. The inspectors also reviewed supporting documents including NLI's Calculation C-017050-1, based on its Report C-017002, Revision 1, dated August 12, 1996, and Wyle Laboratories' Seismic Simulation Test Report Nos. 44681-2, and 42261-1 dated October 27, 1981, and November 12, 1991 respectively. In addition, the inspectors reviewed the NLI technical procedures NLI-TECH-04, "Equipment Qualification," and NLI-TECH-05, "Materials Engineering," related to equipment qualification.

b. Observations and findings

The purpose of NLI Report No. C-017002-11 was to demonstrate that the GNB NCX Series (NCX-7 through NCX-35) and GNB nuclear safety-grade NCN Series batteries (NCN-7 through NCN-35) were seismically qualified for the 20-year design life. Note that the NCX-1950 cells in use at Keowee belongs in the NCX-7 through -35 series, but bears the earlier style of type designation based on rated capacity rather than the number of plates. The report stated that qualification of the GNB NCN and NCX Series batteries was performed in accordance with NLI-TECH-04 and NLI-TECH-05, but NLI-TECH-04, and NLI-TECH-05 did not provide sufficient guidance to assure consistency and quality of the seismic qualification report and did not include appropriate quantitative and/or qualitative acceptance criteria for determining that important technical requirements concerning similarity had been satisfied. The report also referenced the two Wyle Reports cited above that documented numerous seismic qualification tests previously performed for various NCX battery cells at Wyle Laboratories. In NLI report C-017002-11, the basis for seismic qualification was by combination of test and evaluation and was supposed to show the applicability of the Wyle test results to the batteries being qualified.

However, the NLI report was not a stand-alone document and required extensive supplemental explanations to support conclusions concerning battery similarity, and the applicability of the test data referenced. Specifically, Report C-017002-11 did not

- provide adequate technical justification to demonstrate the applicability of the previous Wyle test results to the batteries being qualified,
- include a detailed comparison of the batteries to demonstrate the similarity between the specimen batteries and the batteries that successfully withstood qualification tests,
- describe what test data included in the Wyle test report were applicable and specifically which data in the seismic qualification reports is used in C-017002-11,
- adequately explain why it was acceptable to ignore some failures that were noted as anomalies in the Wyle report.

In view of these deficiencies, the inspectors determined that NLI had performed an inadequate design verification calculation, in part because of the lack of an adequate procedure to help ensure that such a complicated analysis is done correctly. In response to the inspectors' concerns, NLI prepared Supplement 1 to C-017002-11, dated March 6, 1998. In this supplement, NLI included a summary of the applicable test data and an evaluation of all the anomalies including justification for ignoring some test failures identified in the Wyle reports. There was also a detailed description of the similarity evaluation which included a comparison of battery design features to demonstrate that the identified design differences would not impact the qualification of the batteries. (Nonconformance 99901298/98-01-05).

c. Conclusions

The inspectors concluded that Supplement 1 to NLI Report No. C-017002-11 adequately addressed concerns raised by the inspectors and provided a reasonable technical basis for the seismic qualification for the batteries and the extension of the qualified life from 10 to 20 years.

3.5 Dedication and Refurbishment of Circuit Breakers

a. Inspection Scope

The team reviewed NLI's purchase order documentation files for the refurbishment of Westinghouse Type DB-50 circuit breakers for Consolidated Edison's (ConEd) Indian Point Station, Unit 2 (IP2), the purchase (from the current manufacturer, Eaton/Cutler-Hammer) and dedication of Westinghouse Type DS-416 circuit breakers for New York Power Authority's Indian Point Station, Unit 3 (IP3), and the refurbishment of three Westinghouse Type DHP circuit breakers for Illinois Power Company's (IPC's) Clinton Power Station (Clinton). The inspectors also reviewed the training requirements for NLI personnel performing safety-related activities.

b. Observations and Findings

b.1 NLI Breaker Technician Training

The NLI training manual contained no specific category for a circuit breaker technician. Personnel files of the individuals identified as breaker technicians and interviews with them revealed that most of the individuals did not have much experience at maintaining or refurbishing circuit breakers and what experience they did have was not with nuclear safety-related equipment. The technicians learned about specific circuit breaker types mainly by reviewing original equipment manufacturer (OEM) instruction booklets, the applicable NLI breaker refurbishment procedures and any plant-specific information that may have been supplied to them by a particular customer.

NLI had recently instituted a new training program specifically for circuit breaker technicians, engineering personnel, test technicians, and QA/QC personnel. Circuit breaker technician training includes reading all applicable generic nuclear industry communications (including vendor service advisory letters, technical bulletins, etc.) concerning each model circuit breaker and identifying any discrepancies between the NLI procedure and the industry communications to NLI management. However, because this is a new program, the inspectors will review the effectiveness of this program during a future inspection to observe if it has been effectively implemented. (Inspector Followup Item 99901298/98-01-04).

During the review of the implementation of the QA program for the manufacture of batteries at GNB, Fort Smith, Arkansas, the inspectors determined that NLI QA inspectors assigned to oversee the quality assurance program at GNB had not been trained to the procedural requirements of the strap burning process. This issue is discussed in detail in Section 3.2.b.3 of this report.

b.2 Breaker Dedication and Refurbishment Procedures

The inspectors found that NLI develops its breaker refurbishment procedures and practices primarily through trial-and-error experience gained during refurbishments or dedicating new commercial grade breakers for licensees as evidenced by the history of three breaker issues involving Salem, IP2, IP3, and Clinton. The inspectors observed that the licensees found several discrepancies in the work that the NLI technicians performed on their breakers. NLI used the licensees findings as a basis for reworking the breakers and revising its procedures.

Refurbishment of GE Magne-Blast Breakers In 1996, NLI used this approach when it refurbished a large number of General Electric (GE) Magne-Blast circuit breakers for Public Service and Gas Company's Salem power station (Salem). Salem raised several issues during the refurbishment work and the licensee sent representatives to observe the work being performed to ensure the breakers met their requirements. The NLI Magne-Blast breaker refurbishment procedure is now on revision 15 and is quite detailed. By contrast, the NLI procedure for the Westinghouse breakers is not as detailed and has less than 5 revisions.

Westinghouse Type DB-50 Breakers for IP2 On July 9, 1997, IP 2 contracted NLI to perform refurbishment of 6 Westinghouse Type DB-50 safety-related circuit breakers. NLI refurbished the breakers in accordance with its procedure NLI-TECH-P103, "Remanufacturing of Westinghouse 480 V DB-50 Circuit Breakers," which ConEd approved before NLI began the work. The licensee performed their maintenance procedure on the first three refurbished breakers delivered to IP2, and found several discrepancies. As a result, ConEd issued a "stop work order" to NLI on October 16,1997, until the discrepancies were addressed by NLI. NLI wrote Nonconformance Report (NCR) #53 to address the issues.

ConEd issued a 10 CFR Part 21 notification on January 14, 1998 (Event Notification 33535), followed by a detailed letter on February 17, 1998, describing three defects found in the NLI-refurbished breakers: (1) a disconnected jumper wire that prevented the breaker alarm switch from being reset from the control room, (2) intermittent binding of the manual closing mechanism roller bearing caused by wear, and (3) "G"-gaps, which affect contact pressure, were out of adjustment. The resolution to the findings in the NCR stated that the alarm switch jumper was disconnected during testing and there had previously been no explicit step in the procedure to reconnect it, but that this would be corrected. NLI reportedly learned from the OEM that there had been previous failures of bearings involving collapse of the inner race. The NLI procedure covered checking and adjusting the "G" gaps, but when tests are performed after the adjustment, there is a possibility for the "G" gap to change. NLI resolved these issues by revising the refurbishment procedure to add steps to reconnect the alarm switch jumper and check the G gaps after all the other adjustments are made. NLI stated that the procedure will also be revised to include replacing the roller bearing with a bushing per the OEM recommendation.

The licensee had determined that the defects identified would not prevent normal breaker operation. The disconnected jumper would not allow remote reset of the alarm from the control room, but it could be reset at the breaker. The roller bearing problem does not affect the electrical closing operation and is only used during manual operation. The G-gaps, while out of tolerance, would not alone have prevented the breaker from closing. The breaker reportedly operated 20 times at NLI and met all of the timing requirements. NLI personnel informed the inspectors that they have not performed any other DB-50 breaker refurbishments and that there is no current contract to refurbish any other DB-50 breakers. Thus, the specific defects identified by ConEd do not appear to be a generic concern.

Westinghouse Type DS-416 Breakers for IP3 Documentation of the purchase, testing, dedication, and delivery of 11 new Westinghouse Type DS-416 circuit breakers by NLI for the New York Power Authority's (NYPA's) IP3 plant indicated that NLI procured the breakers from the local Westinghouse Electric Supply Company (WESCO) as commercial grade components and then dedicated them for nuclear safety applications. WESCO bought the breakers directly from Eaton/Cutler-Hammer (ECH) which has been manufacturing the Type DS breakers since 1994. When the first two NLI-dedicated breakers were delivered to IP3, NYPA performed its preventive maintenance procedure as part of the receipt inspection. The NLI breakers did not meet the acceptance criteria in the NYPA procedure in several areas. As a result, the breakers were sent back to NLI and a NYPA representative visited the NLI facility to observe the performance of the NYPA maintenance procedure on the breakers. Only two of the discrepancies were determined to be nonconforming conditions by NLI: (1) the levering-in

mechanism screw was inadvertently tightened during the final check , and (2) the levering-in hinge was wedged behind the face plate because the face plate was not properly installed. NLI agreed to add specific steps to its dedication procedure to address these two issues.

Westinghouse Type DHP Circuit Breakers for Clinton Power Station Illinois Power Company (IPC), issued a purchase order to NLI for the refurbishment of three Westinghouse Type DHP 4-kV circuit breakers for its Clinton Power Station (Clinton). When the licensee received the refurbished breakers, plant personnel performed procedure B 68-97-6, Revision 5, "Clinton Power Station Westinghouse DHP Circuit Breaker Receipt Inspection Checklist," and found several discrepancies. The licensee also issued an interim 10 CFR 21 report on February, 13, 1998, to inform the NRC that IPC and NLI were investigating the discrepancies for reportability, and would complete the evaluation by April 15,1998. The inspectors discussed this report with NLI and were informed that NLI Nonconformance Report # 60 addressed the concerns raised by the licensee. NLI evaluated the discrepancies and determined that most of them were due to a difference in methodology for measuring tolerances and gaps. NLI determined its method of measuring gaps was correct.

NLI determined that there were 6 nonconforming conditions on the three refurbished breakers. Three items (2 loose nuts and 1 loose terminal lug) are not explicitly contained in the NLI procedure and may have been inadvertently overlooked. Two cases of measurements being out of specification (anti-close interlock and the puffer dimension) were identified. The last nonconformance was the use of a micro-ohm meter instead of a Ductor® to measure contact resistance, which gave an unacceptable reading. The contact resistances were subsequently measured with a Ductor and found to be within specifications. NLI agreed with the inspectors that there was a lack of detail in its refurbishment procedure in some specific areas and agreed to revise the procedure to provide detailed instructions in those affected areas.

b.3 Use of Inadequately Dedicated Commercial-Grade Components

On January 15, 1998, NRC inspectors identified two issues with the NLI DS-416 breaker dedication process that appeared to differ from the dedication process performed by Westinghouse Nuclear Services Division's (WNSD's) Repair and Replacement Services in Cheswick, Pennsylvania: (1) The pole shaft in the breakers being dedicated by NLI were of the commercial design in which the pole levers are welded to the shaft using two separate welds of approximately 120° each rather than a continuous weld of 180° as is used on the special nuclear-grade pole shafts used and supplied by WNSD; and (2) the direct trip actuator (DTA) used with Amptector programmable overcurrent trip systems installed on the NLI breakers was recognized to be of the commercial-grade type that only has glued joints (internally) to hold its permanent magnet and its pole pieces together instead of bolting the pieces together.

DS-416 Commercial Pole Shafts After finding the commercial grade pole shaft in a DS-416 breaker that had been supplied to (and returned from) IP3, the inspectors informed NLI that NRC Bulletin 88-01, "Defects in Westinghouse Circuit Breakers," and W NSID (now WNSD) Technical Bulletin 87-11, "Westinghouse Circuit Breakers, Type DS/DSL, Welds on Breaker Pole Shafts," (which was also attached to the NRC bulletin) directed licensees to inspect the pole shaft welds to determine if they were acceptable for operating plants to justify continued operation until such time that the pole shafts with questionable welds could be replaced.

The NRC bulletin and NSID-TB-87-11 were issued in response to a failure of a DS type reactor trip breaker to open in July 1987, during a manual trip demand from the control room. The RTB had bound mechanically in the closed position because the main drive link cam follower roller had become wedged between a raised segment of the close cam and the adjacent side frame plate. Excessive lateral movement of the main drive link and a broken center pole-lever-to-pole-shaft weld permitted the binding to occur. After the TB was issued, WNSD revised the weld procedure specification and weld inspection criteria for the pole shaft welds. W procures replacement pole shafts from a local supplier using the revised criteria and uses them to replace the commercial-grade pole shaft when it dedicates the breakers supplied by ECH.

In response to the inspectors' observation, NLI stated that its technicians had inspected the welds in accordance with NSID-TB-87-11. NSID-TB-87-11 stated that the pole lever weld fillets should be at least 3/16-inch, free of visible cracks or other defects and the weld beads should extend around the shaft continuously for at least 180-degrees of its circumference. The pole shaft welds examined by the inspectors had fillets that appeared to be of acceptable size and quality, but, as stated previously, had two 90- to-120-degree beads instead of a single 180-degree bead. NLI was not aware of the unique features of DS-416 breakers supplied by WNSD for Class 1E service because it had purchased the breakers from ECH as commercial-grade items and had not yet had any experience with WNSD-supplied DS breakers, such as through refurbishment. The NLI QA manager acknowledged the inspectors' concerns and immediately informed IP-3 personnel that they had received DS-416 breakers with commercial-grade DTAs, and with commercial-grade pole shafts.

To address the concerns with the potentially inferior pole shafts, NLI performed a series of tests (including a static load test and a 5000-cycle operational test) designed to confirm the adequacy of the welds on a pole shaft of the type installed in breakers built by ECH that they supplied to IP3. In addition, NLI analyzed the expected static loading and theoretical weld capacity of the pole lever welds and documented their analysis in Calculation C-048010-W, "Pole Shaft Weld Evaluation." Revision 0 of this evaluation, dated January 16, 1998, was attached to NLI NCR #62, dated February 4, 1998, in which NLI documented the concerns with the pole shafts and DTAs identified by the NRC inspectors.

However, the inspectors found that the pole shaft weld evaluation contained several errors. First, the calculation was based on erroneous static values for certain key breaker operating parameters. The force on each moving contact arm was estimated in the calculation based on the value of 95 pounds, reported in a test report, TIR-048010-4, attached to the calculation. The inspectors noted that the reported value 95 pounds was only about one-fourth of the correct single-pole value for the combined force of all four pole base springs under proper compression of 332 pounds.

NLI's lead breaker technician demonstrated on the DS-416 test breaker the method he used to obtain the 95-pound value. The inspectors observed that the technician measured the contact force with a force gage by pressing the contacts together enough just to engage the arcing contacts and having the mains just touching, but not compressing the pole base springs behind the stationary main contact fingers. When, at the inspectors request, the technician measured

the force on one pole base spring, by compressing the proper amount as shown in the Westinghouse technical manuals for the breaker, with its associated main contacts, the force developed by one of four pole base springs was about 90 pounds, nearly as much as NLI had thought was the amount for one pole.

Second, the inspectors pointed out to NLI that its calculation failed to take into account the force-amplifying effect of the location of the insulating link relative to the location of the main contacts. NLI's calculation had used its 95-pound value directly in the computation of the operating torque on the center pole lever. However, the main contact force for one pole (which should have been about 360 pounds for the test breaker to begin with) is amplified at the insulating link because the main contacts are about 5 inches from the moving contact arm hinge, or 2 inches farther out on the arm than the point at which the insulating link is connected to the arm at only about 3 inches from the hinge.

Third, the inspectors noted that the calculation failed to take into account the force and hence torque-multiplying effects of the dynamic impact loading during the breaker closing operation. The inspectors recognized that the 5000-operation cycle testing NLI had conducted addressed this factor, but it was not considered in the calculation.

Finally, on the basis of the erroneous test data and flawed static analysis, NLI's pole lever weld evaluation asserted that its calculated theoretical weld capacity and the comparable torque exerted on the center pole lever weld in the static load test would be over four times its calculated pole lever operational torque; whereas, when the expected operational torque was more accurately determined, the weld capacity or test load might exceed the operational torque only by a factor of 1 to 2, if any.

Subsequent to the inspection, after the deficiencies had been explained to NLI, the vendor developed an improved calculation, Revision 1 to C-048010-W, dated March 9, 1998. In this revised calculation, NLI computed the expected pole lever weld torque using a value of main contact force that was more consistent with the design. The revised calculation also employed an appropriate contact force correction factor based on measurements of the main contact and insulating link joint distances from the moving contact arm hinge. Finally, the revised calculation used a value for the center pole lever torque lever arm that was measured with the breaker closed. While rigorous dynamic analysis of the forces and torques during the closing operation suggests that this may not be the worst case position, it should be nearly so. Therefore, the inspectors determined that the revised calculation more accurately estimated at least the static torque on the center pole lever weld. The resultant design and test margin was closer to a factor of 2 rather than 4 as originally asserted.

In subsequent discussions of the pole shaft issue between the inspectors and WNSD, WNSD explained that they had no reason to dispute NLI's conclusions about the suitability (for nuclear safety-related applications) of the current vintage of commercial pole shaft produced by ECH. Having previously examined the older commercial grade pole shafts that actually failed in service, the inspectors noted the welds on the new ECH pole shaft pole levers appeared to be of substantially better quality. WNSD further explained that it could only use, or supply, and stand behind its special nuclear-grade pole shaft that WNSD has made to its specifications, and

reportedly under strict controls, solely for this application because it is the only currently-produced DS pole shaft for which WNSD has verified the design and fabrication process by design testing and for which WNSD does production unit inspection and testing.

DS-416 Commercial Direct Trip Actuator Westinghouse Amptector® and Digitrip® solid-state electronic overcurrent trip systems effect breaker tripping through an electromechanical device called a direct trip actuator (DTA). These trip systems are made to be installed in Westinghouse low-voltage metal-enclosed power circuit breakers (e.g., Type DS) as well as those of other manufacturers (e.g., General Electric Type "AK"). A DTA contains a permanent magnet, that holds a plunger in place (in the reset condition) against the force of an internal actuating spring. The plunger is linked externally to a trip lever such that a trip signal from the Amptector counteracts the permanent magnet and allows the spring to move the plunger and actuate the trip lever. The original W DTA design used a single piece of metal bent in a U-shape for the magnet pole piece, with the permanent magnet placed at the bottom of the "U". In 1994, Eaton/Cutler Hammer (ECH), who bought the DS breaker product line from Westinghouse and is the current manufacturer of commercial W Type DS and DHP switchgear, redesigned the DTA so that two separate pieces of metal replaced the single U-shaped piece and the magnet was placed along the side of one of the pieces. A high temperature glue was used to hold the magnet, the core, and the two metal pieces together.

After several commercial customers reported that DTAs failed in service, ECH modified the DTA design to include bolting the assembly together in addition to being glued. The modified DTAs can be identified by either a blue or yellow round sticker on the black plastic casing. The inspectors observed that the DTAs that had been mounted on the breakers being dedicated at NLI for IP3 were of the commercial grade quality glue-joint type. They had no stickers, and also had electrical leads protruding from their cases instead of terminals on the cases for leads from the Amptector or Digitrip units, which is another sign of a commercial-grade DTA. The commercial grade DTAs supplied by ECH with their DS breakers with the blue or yellow stickers (indicating both screws and glue holding the magnet and pole pieces together) have reportedly only been supplied by ECH to WNSD. Those supplied in breakers or separately through strictly commercial channels would not be expected to have the stickers and would be expected to be of the glue-joint only design.

If the DTA cannot be reset after tripping because some of its internal parts have come loose, it can hold the trip shaft in the trip position and prevent the breaker from closing. NLI addressed these issues and presented their evaluation to the inspectors. One of the pole shafts in question was installed in a Type DS-416 breaker and cycled over 5,000 times without failure. Inspection showed that there were no cracks in the welds. A DTA of the type in question was artificially aged in an oven and cycled several times, then installed on the test breaker and operated over 5,000 times (during the pole shaft tests) with no separation of the glue joints. NLI contacted Eaton/Cutler Hammer via E-mail and received a response that indicated only large-frame GE breakers fitted with Amptector or Digitrip overcurrent trip systems that use the DTA had reportedly experienced problems with the glued joints in the DTAs. No DTAs used in DS-416 breakers had experienced failures due to separated glue joints. Based on their own evaluation and testing and discussions with ECH, NLI concluded that the ECH-supplied pole shafts and DTAs were acceptable for use in DS-416 breakers in Class 1E applications. Nevertheless the deficiencies identified constituted inadequate review for suitability of

application and design verification and hence, a nonconformance with respect to 10 CFR Part 50, Appendix B, Criterion III, "Design Control." (Nonconformance 999012298/98-01-03)

c. Conclusions

Training and experience of NLI breaker technicians was weak; although, NLI's new training program, if effectively implemented, should improve technicians level of knowledge. However, NLI's lack of breaker maintenance and rebuilding experience, in conjunction with procedures requiring extensive revision before being satisfactory, has resulted in breakers having to be returned for rework when the discrepancies are identified by the licensees. Although NLI has taken corrective action and revised their procedures when problems have been identified by licensees, the inspectors concluded, and emphatically pointed out to NLI, that this trial-and-error method was unacceptable for a supplier of basic components and related services under what is supposed to be a QA program in accordance with 10 CFR Part 50, Appendix B. The inspectors also pointed out that such heavy reliance on the licensee to detect errors substantially reduces the margin of safety maintained by all parties performing work as correctly as possible and verifying the work. It has created deviations or failures to comply that were evaluated under Part 21 requirements to determine if they could create substantial safety hazards, and in some case deemed reportable to the NRC.

The inspectors further concluded that NLI's failure to communicate effectively with the licensee when planning and specifying the work to be done was a weakness, as exemplified by NLI's not informing themselves of receipt inspection requirements that the breakers are expected to meet upon delivery to the plant. Had NLI obtained that information before performing the work, there would likely have been fewer breakers needing to be returned for rework.

Finally, the inspectors concluded that in its dedication of the DS-416 breakers for IP3, NLI had performed an inadequate review for suitability of application for the pole shafts. Even though NLI eventually inspected the pole lever welds using NSID-TB-87-11, not all the acceptance criteria were met and, absent the subsequent evaluation prompted by the NRC, IP3 would have had to continue the inspections mandated by WNSD and NRC Bulletin 88-01 until the pole shafts could be replaced with nuclear-grade pole shafts. On the basis of the original calculation with the deficiencies identified by the inspectors, the inspectors concluded that the subsequent evaluation that NLI had performed was an inadequate design verification of the DS-416 pole shaft welds. However, the inspectors ultimately concluded that on the basis of the substantially improved appearance of the ECH pole shaft welds, the satisfactory static and dynamic test results, and the margin determined in the revised pole lever torque load calculation (which should bound its remaining flaws), NLI ultimately provided reasonable assurance that the welds were acceptable. On the basis of the reported satisfactory cycle test results and the fact that in-service failures in the commercial DTAs had only been reported for large-frame GE AK Type breakers, NLI provided reasonable assurance that the commercial grade DTAs as currently manufactured by ECH would be suitable for Class 1E service, but as thus far demonstrated, only in Type DS-416 breakers.

4. PERSONS CONTACTED

A. Seiken President
A C. Bell Quality Assurance Manager
W. Malik Project Manager

ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Type	Description
Opened		
99901298/98-01-01	VIO	Failure to develop a procedure
99901298/98-01-02	NON (A)	Failure to take corrective action for conditions adverse to quality
99901298/98-01-03	NON (B)	Inadequate design verification of pole shaft
99901298/98-01-04	IFI	Effectiveness of training
99901298/98-01-05	NON (C)	Inadequate design procedure to calculate seismic qualification life extension
99901298/98-01-06	NON (D)	Inadequate training of QA inspectors
99901298/98-01-07	NON (E)	Unqualified procedure for double burn process
99901298/98-01-08	NON (F)	Lack of acceptance criteria in procedure
Closed		
99901298/96-01-01	NON	Inadequate dedication
99901298/96-01-02	NON	Loss of equipment traceability

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 9, 1998

Mr. George W. Dillon, Manager
Repair & Replacement Services
Nuclear Services Division
Westinghouse Electric Company
2000 Cheswick Avenue
Cheswick, Pennsylvania 15024

SUBJECT: NRC INSPECTION REPORT 99900404/98-01

Dear Mr. Dillion:

On January 6-7, and 12-13, 1998, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your Cheswick, Pennsylvania, facility. The enclosed report presents the results of that inspection.

The inspection was performed to: (1) observe tests that Westinghouse Nuclear Services Division (WNSD) was conducting to determine the root cause of the failure of a DS-416 type circuit breaker to open on December 18, 1997, at New York Power Authority's Indian Point Unit 3 nuclear power plant (IP-3); (2) review the implementation of your quality assurance program relative to the reporting requirements of Part 21 of Title 10, of the Code of Federal Regulations (10 CFR Part 21) relative to circuit breaker problems reported in the past; and (3) review records related to the refurbishment of DB-50 circuit breakers for Consolidated Edison of New York's Indian Point Unit 2 (IP-2).

During the inspection, the NRC inspectors observed that Westinghouse personnel at the Cheswick plant were knowledgeable and competent in the performance of their jobs related to the inspection items above. However, even though the refurbishment records for IP-2 adequately documented the activities performed, the inspectors found instances where the responsible individuals did not complete requisite documentation for the work they performed. Additionally, the inspectors identified five unresolved items for which the inspectors require additional information from WNSD to determine whether the issues in question are acceptable items, nonconformances or violations.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be placed in the NRC's Public Document Room (PDR).

Sincerely,

Suzanne C. Black

Suzanne C. Black, Chief
Quality Assurance, Vendor Inspection and
Maintenance Branch
Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation

Docket No.: 99900404

Enclosure: Inspection Report 99900404/98-01

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No.:	99900404/98-01
Organization:	Westinghouse Electric Company Nuclear Services Division Repair and Replacement Services 2000 Cheswick Avenue Cheswick, Pennsylvania 15024
Contact:	Tom Moser, Manager, Assembly, Qualification & Test (412) 275-3980
Nuclear Industry Activity:	Safety-related equipment repair and replacement services for nuclear power plants
Dates:	January 6-7; 12-13, 1998
Inspectors:	Kamalakar R. Naidu, Senior Reactor Engineer Joseph J. Petrosino, Quality Assurance Specialist David Skeen, Reactor Systems Engineer
Approved by:	Richard P. Correia, Chief Reliability and Maintenance Section Quality Assurance, Vendor Inspection, and Maintenance Branch Division of Reactor Controls and Human Factors Office of Nuclear Reactor Regulation

Enclosure

1 INSPECTION SUMMARY

On January 6-7, 1998, NRC inspectors observed tests being conducted at the Westinghouse Nuclear Services Division (WNSD), Repair & Replacement Services (RRS) facility in Cheswick, Pennsylvania, on a Westinghouse (W) Type DS-416 circuit breaker that failed to open during operation at New York Power Authority's (NYPA) Indian Point Unit 3 nuclear power plant (IP3) on December 18, 1997. The breaker failed to open following a surveillance test run of a residual heat removal (RHR) pump. NYPA requested WNSD to perform a root cause analysis for the breaker failure.

On January 12-13, 1998, NRC inspectors performed an inspection of the WNSD Cheswick facility to continue the review of the activities to determine the root cause of the IP3 breaker failure. The inspectors reviewed WNSD's implementation of its quality assurance program relative to the reporting requirements of Part 21 of Title 10, of the Code of Federal Regulations (10 CFR Part 21) relative to W medium- and low-voltage licensee-identified circuit breaker problems. Issues reviewed included problems with Type DHP (4-kV), and Type DB and DS type (600-volt, and below) breakers. The inspectors also reviewed records associated with your refurbishment of DB-50 circuit breakers for Consolidated Edison of New York's Indian Point Unit 2 (IP-2).

The inspection Bases were

- Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50, Appendix B)

- 10 CFR Part 21, "Reporting of Defects and Noncompliance"

During this inspection, the inspectors identified five unresolved items relative to review of reportability of commercial-grade direct trip attachments (paragraph 3.1.b.2), confirmation of the minimum trip bar force in DB-50 type circuit breakers (paragraph 3.1.b.3), tests to determine the clearance between the rear arc horn and the molded arc chute case in a DHP type breaker (paragraph 3.1.b.5), review of 10 CFR Part 21 program (paragraph 3.2.b) and applicability of W NSD-TB-91-06-RO to DS 416 type breakers (paragraph 3.3.b).

2 STATUS OF PREVIOUS INSPECTION FINDINGS

There were no previous inspection findings reviewed during this inspection.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Westinghouse Circuit Breaker Issues

a. Inspection Scope

The NRC inspectors reviewed several recently-identified circuit breaker issues to assess the manner in which WNSD resolved them. The NRC inspectors reviewed the records to determine if WNSD evaluated the following circuit breaker issues for reportability to Part 21.21 (a)(1). WNSD call deviations and failures to comply "potential issues."

WNSD utilizes Procedure Westinghouse Electric Corporation Energy Systems Business Unit Policy/Procedure (PP) 21.0 "Identification and Reporting of Conditions Adverse to Safety" Revision 2 dated May 29, 1997 to evaluate potential issues.

b Observation and Findings

b.1 High-Burden & Standard-Burden Type Closing Coil in Type DB Circuit Breakers. Duke Power Company's (Duke's) Keowee Dam (a two-unit hydro-electric power station) is the safety-related standby power supply for Duke's Oconee Nuclear Station. NRC Augmented Inspection Report 50-269/97-011 documented the events associated with the failure of Keowee Unit 1 to achieve rated voltage following a loss of the Lee Steam Station dedicated electrical power path on June 20, 1997. Lee Steam Station acts as an alternate standby power source for Oconee. This report identified that "high-burden" closing coils were being used in the W DB-25 type breakers at Keowee. These coils were drawing more current than the "standard-burden" coils and consequently were blowing fuses. The inspectors wanted to determine (1) if WNSD supplied DB-type breakers with high-burden coils for use in safety-related applications, and 2) if there was a problem with fuses blowing in these breakers with high- or standard-burden closing coils. To accomplish this, the inspectors examined different editions of W instruction booklets (I.B.s) for DB-type breakers that contained tables which provided information on the currents drawn by closing coils for various control voltages.

In response to the inspector's inquiries, WNSD stated that it had not supplied high-burden closing coils to any nuclear power plant for safety-related applications and that it was not aware that there was a problem with frequent blowing of control fuses in circuit breakers with standard-burden closing coils. WNSD stated that when control fuses blow, it is usually an indication that the breaker mechanism needs lubrication because the closing coil draws more current when it has to overcome excessive friction. The inspectors determined that high-burden closing coils are used only in breakers at Keowee which were not originally designed for nuclear safety-related service. Further, WNSD had not supplied the breakers to Keowee.

b.2 Direct Trip Actuator (480-V Breakers). WNSD informed the inspectors that, in 1994, Eaton/Cutler-Hammer (ECH), the current manufacturer of W switchgear, made a design change to the direct trip actuator (DTA). The DTA is typically used on W Type DB and DS breakers with either an Amptector or the newer Digitrip solid state overcurrent trip devices. WNSD sold Amptectors and Digitrip devices with DTAs installed in them or as spare items, to licensees who have other manufacturer's breakers including General Electric, and ABB/ITE, as safety-related components. ECH manufactures the DTAs as commercial grade components under its ISO 9000 quality system and supplies them to WNSD who dedicates them for use in safety-related applications.

The DTA is made up of a permanent magnet, that holds a plunger in place against a spring force. The plunger is linked to a trip lever such that a trip signal from the Amptector counteracts the permanent magnet and allows the spring to move the plunger and actuate the trip lever. In the original W-designed DTA, the magnet pole piece consisted of a single metal bracket bent in a U-shape held inside the permanent

magnet with a screw at the bottom of the "U". For economic reasons, ECH redesigned the actuator so that two separate pieces of metal replaced the single U-shaped piece and the magnet was placed along the side of one of the pieces. A high temperature glue was used to hold the magnet, the core, and the two metal pieces together in the U shape.

In late 1995, the Tennessee Valley Authority (TVA), licensee for the Browns Ferry Nuclear Plant, informed WNSD that an Amptector DTA failed after several cycles because a glue joint failed. Vermont Yankee also reported a similar failure of a Digitrip DTA in a GE breaker. Commercial customers also experienced DTA failures and returned them to ECH. However, reportedly, there were no failures of DTA glue joints except on GE breaker installations. Nevertheless, due to these complaints, ECH modified the DTA design to include bolting the assembly together in addition to glueing. ECH identified the modified DTAs by either a blue or yellow round sticker on the black plastic casing. For a short period of time, after experiencing problems with the ECH commercial DTAs, WNSD procured limited quantities of DTAs from a Canadian supplier which are identified by either a grey or red plastic casing instead of black. WNSD did not experience any problems in the Canadian supplied DTAs. The inspectors determined that WNSD has taken adequate action to control its use of commercial-grade DTAs in safety-related breakers. According to the WNSD-issued Maintenance Program Manual for Safety Related Type DS Metal-Enclosed Switchgear, commercial (glue joint) DTAs with black cases can also be distinguished from the original design black-case DTA by their pink-colored electrical leads, whereas the old design black-case DTA has screw terminals on the case for connection of leads from the Amptector or Digitrip unit. This manual states that the black DTAs with pink leads are not seismically qualified. The inspectors will determine if the issue was reportable under 10 CFR Part 21 at a future inspection. Pending the review, this item is considered unresolved item (URI) 99900404/98-01-01.

b.3 Indian Point Unit 2 -DB-50 Breaker Problems. On October 14, 1997, after experiencing recurring problems with DB-50 breakers failing to close, Consolidated Edison of New York (ConEd), the licensee for IP2, shut the plant down to investigate the cause of the breaker failures. ConEd provided details on this event to the NRC in Licensee Event Report (LER) 97-024. ConEd issued a preliminary Part 21 notification to the NRC on January 14, 1998, with plans to submit a full 10 CFR Part 21 later. The licensee also believes that the extra winding on the trip pan spring contributed to the breaker mis-operation. The licensee reported that removal of the three trip pads (one for each phase) from the trip bar as part of a modification to replace the old-style electro-mechanical trip device with the Amptector solid-state trip device may have contributed to failures. The licensee contends that the loss of mass resulting from removal of the trip pads can allow the breaker to trip prematurely. However, the licensee's comprehensive testing program, involving high-speed videography, closing solenoid current traces, and time and motion data, revealed that light trip bar force in conjunction with the kind of vibration or shock produced when the breaker hesitates near the end of the closing stroke is the situation that causes the breaker to occasionally trip open upon closing.

The NRC inspectors asked whether WNSD reconciled its original seismic qualification report to determine whether the reduction in mass and or the extra winding on the trip pan spring could adversely affect the operation of the breaker. WNSD stated that there was conservatism in the design, but they had not yet reconciled the change to the qualification test report. WNSD also stated that an upper limit of 31 ounces of force to raise the trip bar a quarter-inch is used as a limiting criterion at the factory, and is published in vendor literature. However, W did not publish a lower limit operational design criterion of 14-ounces which it uses internally for manufacturing and refurbishment guidance at the factory to determine full operability. WNSD staff stressed that the 14 ounce value is not a designed or analyzed number because WNSD did not perform seismic testing to validate the value. WNSD stated that it plans to perform seismic testing in the near future to substantiate its lower limit guidance. WNSD does not believe that either the removal of the trip pads from the trip bar or the extra winding on the trip pan spring is a major contributor to the failures of the IP2 DB-50 breakers. WNSD personnel informed the inspectors that it intends to perform seismic and evaluation tests to confirm that the trip pad removal and the extra winding on the trip pan spring do not contribute to unreliable operation of DB type breakers.

The licensee also reported finding that in one of the breakers that had failed in service and that had their trip pads removed as part of the Amptector installation, the torsion type trip pan return spring had one additional turn wound into it. Because this is not a standard condition, the licensee originally suspected that the overwound spring might have contributed to misoperation of the affected breaker. However, the licensee subsequently learned from Westinghouse that the additional turn in this spring actually raises the force required to trip the breaker. The licensee suspected that the spring may have been overwound by a technician as an unauthorized measure to compensate for the trip bar force reduction caused by removal of the trip pads. The licensee was concerned that this practice, if wide spread, could potentially cause excessive trip force, possibly leading to breakers failing to trip on demand, although this was not the case with the failures in question.

However, the licensee observed a presumably unintended side effect of the increased torque, and hence, additional downward force on the trip bar end of the trip pan produced by the overwound spring. The other arm of the torsion spring rests against the trip latch and acts as a reset for the latch as well. During a trip free operation, the roller on the roller lever must get around the point of the trip latch. The force to move the latch out of the way and separate the latch faces against the force of the reset spring comes from the opening force (including weight) of the moving contact arms. If the torsion spring is overwound it exerts more force on both the trip pan and the trip latch. Therefore, the moving contact arms must rise up enough to generate sufficient feedback force to separate the latch faces and go trip free. In fact, the licensee and the WNSD engineer observed that in this condition, if the breaker goes trip free for another reason (e.g., trip bar not reset or being held up by an unreset trip device) upon attempting to close, the moving contact arms will jump up and move through a significant portion of their travel in the closed direction before falling back open.

In response to the licensee's document stating apparent contributory causes, reportedly given to the WNSD breaker engineer on site on October 30, 1997, the WNSD prepared written comments on the licensee's analysis which explained the effect, as described above of the overwound spring. The WNSD engineer also explained that the failure in service of the breaker with the overwound spring was more likely one of the cases of bad timing, i.e., premature cutoff of the X-relay as opposed to a low trip force with breaker hesitation case.

The NRC inspectors plan to review the results of the tests to see if the removal of the pads from the trip bar made it susceptible to excessive vibrations, and consequently prevented the breaker from closing or staying closed, and if the 14-ounce value is a reliable design number that licensees could use to verify the minimum trip bar force. Pending WNSD 's completion of the analysis, this matter is considered an unresolved item (URI 99900404/98-01-02).

b.4 Shunt Trip Plunger Stuck in a DB-75 Circuit Breaker at Ginna Power Plant. Rochester Gas and Electric, the licensee for the Robert E. Ginna nuclear power plant (Ginna), issued a 10 CFR 21 report concerning a problem with a shunt trip device on a DB-75 type circuit breaker. The problem was that the plunger in the shunt trip did not return to the full out position following operation. When the licensee tested the assemblies in stock in the warehouse, the plunger would not return to the full out position on 2 of the 10 assemblies. WNSD stated that it was unaware of this issue, because Ginna had not contacted them. The inspectors determined that WNSD did not have any information to evaluate this item to determine if it was reportable.

b.5 Improper Clearance for Westinghouse 50DHP350 Breaker Arc Chutes. On May 7, 1997, in a letter to the NRC, Illinois Power Company's (IPC), stated that five arc chutes, part number 56F417G02, for W 50DHP350, 1200-ampere, 4160-Vac circuit breakers, at its Clinton Power Station had inadequate clearance between the rear arc horn of the arcing contact and the lower edge of the molded case of the arc chute. In a letter dated July 2, 1997, IPC reported the issue regarding arc chutes to the NRC under 10 CFR Part 21.

WNSD informed the inspectors that it did not receive the arc chutes and arc horn assemblies from IPC and therefore was unable to determine if a problem did, in fact, exist. After discussing this issue for several months with WNSD, IPC issued a nuclear safety-related purchase order (PO), dated November 10, 1997, to Westinghouse Electric Corporation, St. Louis, Missouri, so that IPC could ship the arc chute/assembly for inspection. The PO specified that Westinghouse/Cutler Hammer was to perform inspections and/or testing of a newly manufactured arc chute, an arc chute originally supplied, and one rear arc horn removed from Clinton breaker serial number 01YN00-5B4.

In response to this issue, WNSD opened a Regulatory & Licensing Engineer (RLE) potential Part 21 deficiency (PD), document NSD-EDRE-RLE 97-350, and closed the PD on September 19, 1997. The closure was

> Based on the inability of Cutler Hammer to repeat the issue and the implied impact if the situation actually exists, this issue will not be considered for reportability pursuant to 10 CFR Part 21 and PD-0272 is closed. If Clinton ever returns the arc chutes and the subsequent evaluation yields different conclusions regarding the impact on breaker operability, the issue will be reopened.

It was not clear how WNSD concluded that the issue was not reportable without all applicable information.

The NRC inspector determined that WNSD was unable to establish the exact date/lot numbers of the suspect arc chutes even though the issue was potentially generic. As of February 2, 1998, the arc chutes and arc horn were at the ECH facility waiting for IPC and ECH staff to determine test dates. The results of the test will be reviewed during a subsequent NRC inspection. This matter is considered an unresolved item (URI 99900404/98-01-03).

c. Conclusions

The inspectors determined that WNSD had not supplied high-burden closing coils to any nuclear power plant for safety-related applications, and has not supplied commercial-grade DTAs (with the suspect glue joint) to its customers for safety-related applications. Three unresolved items have been identified in this area: WNSD has not yet determined that either the removal of trip pads from the trip bar or the extra turn on the trip pan spring, or both affects the operation of the DB-50 type breakers under all conditions (URI 99900404/98-01-01), has not yet reconciled the minimum trip bar force of 14 oz for the DB- 50 type breaker (URI 99900404/98-01-02), and has not yet completed the tests on the IPC arc chutes (URI 9990404/98-01-03).

3.2 Implementation of 10 CFR Part 21

a. Inspection Scope

The NRC inspectors reviewed records associated with the circuit breaker issues identified in Section 3.1 above that relate to compliance to 10 CFR 21.21.(a)(1). The NRC inspectors also reviewed Westinghouse Electric Corporation Energy Systems Business Unit Policy/Procedure (PP) 21.0, "Identification and Reporting of Conditions Adverse to Safety," Revision 2, dated May 29, 1997, to verify the adequacy and effectiveness of its implementation by reviewing several 10 CFR Part 21-related component issues identified by various licensees that were considered potentially reportable.

b Observation and Findings

WNSD stated that ESBU-21 0 covered both the evaluation and disposition of PIs and potential deviations (PDs) described earlier However the inspector found no reference to PDs in the procedure WNSD conceded that there was no section in the procedure that delineated the process WNSD used to handle PDs Further a review of the disposition of selected PIs and PDs revealed that WNSD may have prematurely closed the documents before it specifically determined if customers needed to be informed

For example, WNSD closed out PI 97-023, "DB Breaker-Failure to Close," on January 6 1998, because RLE recommended that the Safety Review Committee (SRC) close PI 97-023 on the basis that the issue is not reportable pursuant to 10 CFR Part 21 and customer notification was planned at a later date pending completion of testing As discussed in Section 3.1, IP2 identified two concerns with its DB-50 breaker performance 1) low trip bar forces which may result in a trip free condition when attempting to close the breaker and 2) overwound trip pan spring which would increase the force necessary to trip the breaker both are potential generic issues

Even though testing was required to "verify breaker closing performance" and "all plants using DB circuit breakers where the safety function is performed by closing the breaker are potentially affected" the PI was closed The NRC inspectors were following up on several recent W circuit breaker problems and therefore could not fully review the WNSD Part 21 program area Pending review in this area during a future inspection this item is considered unresolved (URI 99900404/98-01-04)

c Conclusion

The inspectors did not have adequate information to determine if WNSD properly dispositioned potential deviations URI 9990404 was identified in this area

3.3 Observation of Tests on Type DS-416 (480-V) Circuit Breaker

a Inspection Scope and Background

On January 6 and 7, 1998, the inspectors observed testing being conducted by WNSD as part of the root cause of the failure of a DS-416 type breaker to open at IP3 on December 18, 1997. Following a routine residual heat removal pump surveillance, the breaker could be opened neither remotely from the control room nor locally at the front of the breaker. While the licensee was preparing to isolate the 480-V bus after the failure, the breaker opened without operator intervention. During its troubleshooting of the failure, the licensee had determined, in consultation with a WNSD technical representative, that the main contact operating linkage could hang up due to pole shaft over rotation and also possibly excessive friction in various joints due apparently to an inadequate overhaul by a now-defunct independent switchgear repair outfit called Power Distribution Technology (PDT), Inc.. The onsite troubleshooting efforts were the focus of an NRC inspection at IP3 on December 18-23, 1997, Inspection Report No 50-286/97-81.

b Observation and Findings

The WNSD technicians could not duplicate the failure exactly as it occurred in the breaker cubicle. As the licensee had found on site, by removing the reset spring and prying on the insulating link of the main moving contacts, the breaker could be made to hang up and then could not be opened by tripping. Testing the trip function without the reset spring is known as the DS-206 Margin Test as described in WNSD Technical Bulletin NSD-TB-91-06-RO. However, slight pressure applied to the upper side of the insulating link would allow the linkage to fall back into its normal position and the breaker would then open and could be operated normally. The inspectors observed a high speed video of another DS-416 breaker from IP3 taken by the NYPA. This breaker had failed the DS-206 margin test at least once, but had never failed to trip open with its reset spring installed. The video revealed that during the closing cycle, the pole shaft recoiled slightly after the moving main contacts engaged the stationary contacts. The WNSD technicians observed that the pole shaft on the failed breaker was not lubricated in the center where it rotates in recesses in the rear edges of the mechanism side sheets. In addition, the WNSD engineer had found that the W factory-applied proprietary formula dry lubricant "Poxylube" had been removed in all required locations (including certain key main contact linkage joints) except on the closing spring pin, apparently during the last overhauls at PDT. The licensee and WNSD postulated that the resultant excessive friction could retard the recoil of the inadequately lubricated pole shaft and its linkages after the moving contacts engage the stationary contacts and result in the linkage getting stuck in a unique position that prevents the breaker from opening either electrically or manually. The act of exercising the breaker during the ongoing testing may have loosened up the mechanism so that it now worked properly with its reset spring installed. WNSD plans to disassemble the breaker in order to take detailed measurements of subcomponents and their locations.

Technical Bulletin NSD-TB-91-06-RO was issued after three DS-206 breakers failed to completely open on demand at a nuclear plant. The bulletin stated that severe binding of the moving parts of the main contact assembly may prevent the contacts from fully opening and clearing the normal or fault currents through the Type DS-206 breaker. DS-206 breakers are similar in design to the DS-416 breaker except that the latter has a higher current rating. The DS-206 breaker is designed for 600 amp loads, whereas the DS-416 breaker is designed for 1600 amp loads. The TB stated that the larger size breakers, such as the DS-416, have additional opening (also known as "kick out") springs in each pole base assembly to disengage the larger heavier contacts and help interrupt the higher currents for which the larger breakers, like the DS-416, were designed. Having more and stronger pole-base springs, the larger DS breakers were not considered at the time to be susceptible to the type of failure described in the technical bulletin. WNSD now believes that the issue may have to be revisited after the failure of the DS-416 breaker at IP-3. The inspectors will conduct a follow up on this item during a future inspection. Pending this follow up, this item is considered unresolved (URI 99900404/98-01-05).

c. Conclusion

WNSD procedures for conducting the tests appeared to be adequate. However additional information on the final results of the tests that WNSD is performing is required to determine the root cause of the failure of the breaker to open. URI 99900404/ 98-01-05 was identified in this area.

3.4 Refurbishment of DB-50 Breakers for IP 2

a. Inspection Scope

In 1997, ConEd experienced unsatisfactory operation of W 480-Volt DB-50 type circuit breakers at IP2. Several of the breakers that failed to close on demand had been refurbished by WNSD under Con Edison purchase order 6-98814 in 1986. The inspectors reviewed the records in which WNSD documented the refurbishing activities of IP2 breakers.

b. Observation and Findings

WNSD maintains traceability of records by issuing an engineering work order (EWO) to refurbish a breaker and by referencing the breaker manufacturer original shop order number (and serial number if there is one) stamped on the breaker nameplate. If WNSD performs work on several breakers, then the EWO number is given the suffix designation of "-1," "-2," etc. WNSD issued EWO 861.072-1 and 861.072-2 to identify the work performed on breakers with numbers 24Y4800M1 and 24Y4800BA-1 respectively. For these breakers, the applicable procedure was DAR-071585-1, Revision 2, "Test Specification for DB-50 Breaker."

When the breakers were received, records indicated that WNSD personnel performed a receipt inspection which included visual examination of the breakers after removing the arc chutes. WNSD documented adverse findings in material deviation reports (MDRs). Representatives from manufacturing, and quality assurance were required to concur with the final disposition stated in the MDRs. MDRs 9033 and 9051 identified several findings, including the following:

- Handles were welded to the front of the breaker cabinet.
- The plating on the back of the frame was stained.
- The rivets on the Amptectors were loose.
- The corner of the upper stud was bent.
- Fine porosity was observed on the Bronze metal of the arcing contacts.

The inspectors determined that the dispositions of the adverse findings were acceptable. Records indicated that technicians then refurbished the breakers, replacing worn or broken parts as required, and generated lists of all new parts used. After completely assembling the breaker, technicians performed specified electrical tests (including contact verification, contact millivolt drop test, AC di-electric hi-pot test on the main poles and insulation resistance of the control wiring), and mechanical tests (including manual breaker closing and tripping). The clearances between the trip bar and the shunt trip attachment and the DTA were measured to verify that they were within specifications. The current settings of the Amptector were verified. The pertinent records were legible and retrievable. However, the signatures of the persons who performed the inspection and the dates when they performed the inspection were missing on some of the documents.

c. Conclusion

The inspectors did not observe any indications that WNSD refurbishing contributed to the failures of the DB-50 breakers at IP2. However, some inspection records were incomplete.

3.5 Entrance and Exit Meetings

At the entrance meetings on January 6 and 12, 1998, the NRC inspector discussed the scope of the inspection, outlined the areas to be inspected, and established interactions with WNSD management and staff. In the exit meeting on January 13, 1998, the inspectors discussed their findings and observations including five unresolved items. An unresolved item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.

4. PERSONS CONTACTED

G.W. Dillion	Manager, Repair and Replacement Services
M.A. Ahmed	Fellow Engineer, Equipment Qualification
T. Critchlow	Medium Voltage Lead Engineer
P. Folmar	DB Breaker Engineer
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R. Miller	Regulatory & Licensing Engineer
T.D. Moser	Manager, Assembly, Qualification & Test
D.E. Rygg	Manager, Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

Item Number	Type	Description
99900404/98-01-01	URI	Review to determine the reportability of problems in DTAs.
99900404/98-01-02	URI	WNSD to complete tests to confirm that minimum trip bar force is 14 oz and to confirm if the removal of the pads on the trip bar and the overwound trip pan spring affects the operation of the breaker or its qualification.
99900404/98-01-03	URI	WNSD to complete tests to establish the minimum clearance between the rear arc horn and the arc chute molded case of a DHP breaker.
99900404/98-01-04	URI	NRC to review selected WNSD 's PIs and PDs to determine if they have been closed before informing affected customers.
99900404/98-01-05	URI	WNSD to determine if NSD-B-91-06-RO is also applicable to DS-416 type breakers.

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