U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-423/84-04

Docket No. 50-423

License No. CPPR-133 Priority ______ Category A

Licensee: Northeast Utilities Company
P. O. Box 270
Hartford, Connecticut

Facility Name: Millstone Nuclear Power Station, Unit No. 3

Inspection At: Waterford, Connecticut

Inspection Conducted: March 5-16, 1984

Inspectors:	A. Finkle, Lead Reactor Engineer	5-25-84 date
	J. Grant, Reactor Engineer	5-29-84 date
	H. Gray, Lead Reactor Engineer	5/29/84 date
	K. Manoly, Reactor Engineer	5/29/84 date
	J. Prell, Reactor Engineer	5-29-84 date
	H. vanKessel, Reactor Engineer	5-25-84 date
	J. P. Durr, Chief, Materials and Processes Section	5/30/84 date
Approved by:	S. D. Ebneter, Chief, Engineering Programs Branch	6/8/84 date

Inspection Summary: Inspection on March 5-16, 1984, (Report 50-423/84-04)

Areas Inspected: An announced Regional Construction Team Inspection of the Millstone Unit No. 3 facility by six reactor engineers and a section chief. The areas of management, design control, quality assurance, and construction control were inspected. The area of construction control was further divided

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into the electrical, mechanical and civil/structural disciplines. The inspection involved 479 inspection-hours on-site and 250 inspection-hours in the regional office.

Results: Six violations, three weaknesses, five strengths and four unresolved items were identified during this inspection. The following is a summary of the major findings:

VIOLATIONS

- Failure to maintain inplace storage cleanliness control of electrical and instrumentation equipment. (Section 8.3.1)

- Failure to perform electrical potting operations in accordance with the requirements. (Section 8.3.7)

- Failure to properly install a piping strut support. (Section 7.3.1)

- Failure to properly install structural steel beams. (Section 7.3.5)

- Failure to properly identify drawing design changes. (Section 5.3.4)

- Failure to provide pump flange alignment criteria. (Section 9.3.1)

UNRESOLVED ITEMS

- The licensees practice of combining loads from both sides of a piping anchor using the square root, sum of the squares method appears to be less conservative than standard industry practice. (Section 7.3.1)

- Pipe support 3CCP1-PSA 152 has inaccuracies in the design calculations. (Section 7.3.1)

- The decoupling of piping support and steel framing responses in the performance of the seismic analysis. (Section 7.3.2)

- Engineering procedures do not adequately address the evaluation of local stresses imposed on structural steel wide flange beams. (Section 7.3.5)

STRENGTHS

- The document control record card system. (Section 5.4.1)

- The extensive use of computers for management information systems. (Sections 3.3 and 5.4)

- The NUSCO trending program. (Section 4.3.1)

- The equipment qualification program. (Section 9.3.3)

- The Stone and Webster training qualification and certification of FQC inspectors. (Section 4.3.2)

WEAKNESSES

- The necessary practices for incorporation of E&DCR's is in conflict with the procedure. (Section 5.3.3)

- The reliance on the JUMA audit for satisfaction of the management QA Audit commitment. (Section 4.3.1)

- The failure of NUSCO to positively track design changes initiated by them. (Section 3.3)

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DETAILS

1.0 Persons Contacted

Stone and Webster Engineering

Ackley, R. - Project Engineer
Carmichael, H. M. - Assistant Project Manager
Carty, J. S. - Superintendent of Engineering
Chisholm, S. - Senior Inspector
Kuins, C. - QA Program Administrator Assistant
Curtis, W. R. - Acting Supervisor
Flodstrom, R. - Assistant Superintendent, FQC
Dasenbrock, A. A. - Resident Manager
Gardel, W. - Assistant Superintendent of Engineering
Hagerman, R. - Senior Engineer, FQC
Kappas, J. G. - General Superintendent of Construction
Kelly, R. B. - Director, QA
MacDonald, D. - Power Site Engineering Group
Matthews, M. R. - Assistant Superintendent, Field Quality Control
Nace, L. D. - Project Manager
Nelson, P. A. - Site Engineering Group, Engineering Assurance
Peterson, L. J. - Civil Inspection Supervisor
Plant, R. A. - Manager, Field Quality Control
Scannel, R. J. - Quality Assurance Program Administrator
Singh, R. - Senior Engineer, FQC
Sprouse, C. B. - Superintendent of Construction
Stamm, S. L. - Assistant Project Engineer
Turner, G. G. - Superintendent Field Quality Control
Vos, W. H. - Senior Engineer, Field Quality Control
Woods, J. E. - Power Site Engineering Group
Zawacki, R. - Engineer, FQC

Northeast Utilities Service Company

Blumenthal, D. A. - Quality Assurance Engineer
Boettcher, E. - Welding Engineer
Busch, R. E. - Project Manager
Counsil, W. G. - Senior Vice President, Nuclear Engineering & Operations
Ferland, E. J. - President
Fountain, J. M. - Project Staff Engineer
Hoisington, D. - Project Staff Engineer
Laware, J. - Engineering Technologist, QA
Lefebvre, R. E. - Project Staff Engineer
Miller, D. Jr. - Nuclear Operation Startup Consultant
Nordquist, D. - Manager, Quality Assurance
Orefice, S. - Project Engineer
Papadopoli, V. - Supervisor, QA
Sullivan, T. - Projects
Vivano, R. R. - Assistant Project Engineer

Vogel, R. W. - Assistant Project Engineer
Werner, R. P. - Vice President, Engineering and Construction

Northeast Nuclear Energy Company

Crockett, J. O. - Unit 3 Startup Superintendent
Mroczka, E. J. - Station Superintendent

The above listed personnel attended the entrance or exit interviews conducted on March 5, 9, and 16, 1984. Other personnel were contacted as the inspection interfaced with their work.

2. Purpose and Scope of the Inspection

The purpose of this inspection was to determine the effectiveness of the licensee's management in directing the construction of Millstone 3 in accordance with NRC requirements and the licensee's commitments. This was accomplished by performing in-depth examinations in the areas of management controls, design controls, quality assurance, and construction. The construction area is further divided into the electrical, mechanical, piping, welding and civil/structural disciplines.

The inspection spanned a six week period and was divided into two weeks of preparation, two weeks on-site, and two weeks of report writing. The inspection began with the two week preparation period in the regional office reviewing the licensee's construction program documents and familiarizing the inspectors with the organization. The document review consisted of the licensee's quality assurance program, construction procedures, and the Final Safety Analysis Report.

The first week of the on-site inspection was organized such that a coordinated examination was made of the component cooling water system by all engineering discipline team members. Portions of the system were selected and detailed examinations were made of the piping, supports, valves, heat exchangers, pumps, and electrical components. The examinations consisted of physical measurements and visual observations to verify that the equipment met the drawings and specifications. The quality documentation was reviewed to confirm that appropriate inspections had been performed. The second week of the inspection was devoted to other systems and components utilizing similar inspection methods.

Concurrent with the foregoing examinations, the remainder of the team explored the broader aspects of management, quality assurance and design control. There was continuous communication between team members to identify common deficiencies or strengths. These in-depth insights were supplemented by interviews of management staff, engineers, quality control inspectors, quality assurance auditors and craftsmen.

3. Management

3.1 Areas Inspected

The purpose of this inspection was to determine the degree of management involvement at the site and ascertain if the appropriate levels are being kept apprised of activities and problems. This was accomplished by reviewing communications systems and through interviews of the responsible managers.

3.2 Organization

The licensee is Northeast Utilities (NU) which is a consortium of utilities committed to building this project. NU has established two subsidiary companies to support this and other nuclear facilities. Northeast Utilities Service Company (NUSCO) provides technical support to the project while Northeast Nuclear Energy Company (NNECO) will operate the facility when systems are turned over for operation. NUSCO administers the contract with the architect-engineer, Stone and Webster Engineering Corporation (S&W), and provides technical direction along with cost and scheduling control.

3.3 Findings

The management review was conducted by interviewing members of the NUSCO and S&W management team at the site and examining some of the communications systems used for transmitting instructions.

The interviews were directed toward the interfaces between organizations and between managers to detect any weaknesses that could adversely affect the management of the project. The following personnel were interviewed:

R. Ackley, Project Engineer, S&W
R. Busch, Project Manager, NUSCO
A. Dasenbrock, Resident Manager, S&W
L. Nace, Project Manager, S&W
G. Turner, Superintendent, FQC, S&W
R. Werner, Vice President Generation Engineering and Construction, NUSCO

These and other topics were discussed:

- The managers method for disseminating information to their subordinates and across organizational interfaces.
- The involvement of quality assurance organizational interfaces.
- The major problems facing the manager.
- The adequacy of the support received from other functions (such as engineering keeping pace with construction).
- The adequacy of the staffing relative to the work load.
- The availability of qualified engineers, craftsmen and inspectors.
- The length of time the manager has occupied their present position.
- The previous positions held that prepared them for their current position.

- Reporting mechanisms to higher management.
- The managers understanding of quality assurance and his employment of QA in the project.

The interview results were generally in agreement. The managers appear to have a good working relationship with one another and a spirit of cooperation is apparent. The flow of information between individual managers and across organizational interfaces does not appear to have any unnecessary restraints. There are formal and informal communication networks which provide free cross talk between groups; these networks assure good coordination of activities. This multitude of interfaces does present the potential for too many interface points for proper control of important decisions. This is not viewed as a weakness but should be examined by the NUSCO management periodically to insure there is adequate control.

There is, however, one weakness in the communication system. The licensee has over the years directed S&W to make safety related changes to the plant design. In the early years and until 1982, this was accomplished through letters to S&W. Since 1982, these safety related changes have been effected through "Project Change Requests".

The Project Change Request is primarily a cost control document and is used to assure that no unnecessary design changes are initiated without due consideration by the project level managers. Each design change is reviewed by the NUSCO and S&W project and engineering managers before it is jointly approved. Once a change is approved, the Project Change Request is closed and the change is tracked solely on cost control documents. Some of these changes directly affect the safe operation of the plant and should be tracked in document control systems that assure the change is implemented. NUSCO has not tracked these design change requests nor the letters and they have not followed up to assure all directives have been implemented. The cost control documents give some assurance that these tasks are carried to completion; however, they should be tracked in a document control system designed to assure positive tracking and completion. The failure to assure that NUSCO initiated design changes are satisfactorily implemented is viewed as a weakness. (423/84-04-01)

The managers interviewed were knowledgeable of the function of quality assurance and in several cases had served as quality assurance managers. They have established meetings and reports designed to keep all levels of management informed of the status of quality assurance on the project. A review of the attendance lists for recent meetings disclosed that corporate officers participate in these meetings.

The licensee has assigned personnel to the S&W offices in the past to provide direct communications and improve the response time to problems which required NUSCO's input. Recently, the licensee has directed the NUSCO and S&W managers and their staffs to establish their offics on the site. In addition, the licensee has assigned a corporate vice president to devote all of his attention to the project. This has served to further shorten the communication lines and expedite the decision making processes.

The licensee has instituted several computerized management information systems which provide current information for decision making. These systems have historically been manually tracked and did not lend themselves to use in this manner. This allows the project to accurately predict manpower requirements and provide trained personnel in an orderly manner. It also provides a mechanism to track the status of safety related components. The use of these information systems for managing the project is viewed as a strength.

The current managerial staff has either been connected with the project or similar projects for several years. The staff has demonstrated their capability by their long association with the project or their roles in other nuclear projects. As an example of this, the superintendent of Field Quality Control has served in this capacity for over 10 years and the project manager in his post for 3 years. This stability is indicative of their capability to perform and certainly provides for continuity.

3.4 Conclusions

Based on the interviews and the document reviews, it is apparent that the licensee's management is deeply involved in the building of Millstone Unit No. 3. There is an adequate, experienced management staff that is compatable with one another. The decision making managers are all located on the site and are in daily contact with each other. These shortened lines of communication are supplemented by a computerized management information system which allows decisions to be made based on the latest information. The major weaknesses detected in the control of information was in NUSCO's failure to followup on directions to Stone and Webster for safety related design changes.

4.0 Quality Assurance (QA)

4.1 Areas Inspected

A review was made of the integrated Northeast Utilities (NU) and Stone and Webster (S&W) QA programs as they relate to construction of Millstone Unit 3. This review was designed to determine whether the program provided controls for monitoring quality related construction activities and identifying and correcting quality related problems, was developed consistent with Safety Analysis Report (SAR) commitments and regulatory requirements, and was being properly implemented. Specifically the following areas were inspected.

-- The interface responsibility and controls of the various S&W QA organizations and NU QA organization were reviewed.

-- QA organizational independence was verified.

-- The mechanisms used to effect changes caused by new regulatory requirements, audit and inspection findings, and construction experiences were reviewed.

- -- QA's role in project planning and review was determined.
- -- The programs used for planning and scheduling audits, surveillances, and inspections were reviewed.
- -- Managements internal audit programs were reviewed.
- -- The licensee's and architect engineer's corrective action programs were reviewed.
- -- Upper managements commitment to QA and the QA organization was determined and verified.
- -- The certification and training program were reviewed. QA auditors and QC inspectors qualifications were reviewed to verify compliance with national standards.
- -- The audit, surveillance, and trending programs were reviewed for adequacy in identifying problems, instituting corrective actions, and meeting regulatory requirements.
- -- The QC implementation of the inspection and surveillance program was reviewed.
- -- FQC inspectors were accompanied during their inspections of Category I systems to verify procedures were being followed, the adequacy of their training, and implementation of the corrective action program.
- -- Inspectors, engineers and crafts people were interviewed to determine any acts of management intimidation or bypassing of approved construction procedures, and the adequacy of training received related to their job responsibilities.
- -- The measuring and test equipment calibration program was reviewed.

4.2 Organization

4.2.1 Northeast Utilities Organization

Northeast Utilities (NU) takes a very active role in monitoring construction activities at Millstone Unit 3. Construction QA, the onsite QA group, uses the following three methods for monitoring the construction program: surveillances, in process verifications, and audits. Until last year Construction QA (CQA) relied mostly on audits for monitoring these activites. However, because audits are more formal and time consuming and less responsive to changes occurring during construction, CQA is reducing the number of audits next year while increasing the number of surveillances and in process verifications. (Note: In process verificatons are mini-audits which are less formal in implemention and more responsive to current plant activities). Primarily, audits will only be performed to verify that the architect engineer's (AE) QA program satisfies the 18 criteria of 10 CFR 50, Appendix B. By this method, NU hopes to be more responsive in identifying and correcting potential problems.

NU has established and maintains a strong management overview of the AE's program. This is evidenced by NU review and approval of all S&W quality related procedures and frequent project review meetings with S&W. NU upper management frequently participates in on site meetings with their staff and the AE.

4.2.2 Stone and Webster (S&W) Organization

Quality assurance functions and responsibilities are divided among six divisions, five of which are in the QA department and the sixth in the Engineering department. A Quality Assurance Program Administrator (QAPA) is the QA Departments project representative, responsible for ensuring proper implementation of all phases of the onsite QA program.

The inspector reviewed programs in four of the six divisions. The divisions inspected were the Engineering Assurance Division under the Engineering Department and the Field Quality Control Division, Quality Assurance Cost and Auditing Division, and the Quality Systems Division under the Quality Assurance Department.

4.2.3 S&W Engineering Assurance (EA) Division

EA performs audits of technical/engineering functions in the S&W Engineering Department related to designs and specifications. These audits are of two types - system audits and project audits. System audits look for design/engineering consistency and whether the design meets the design basis and SAR commitments. Project audits look at specific activities such as SAR changes, calculations, engineering/design interface, etc. EA also audits the Quality Assurance Cost and Auditing Division (QAC&A) and those vendors having engineering/design type projects.

Trending is done by EA on their audit findings. Each audit report is divided into six sections: procedures, control, review/approval, documentation, design consistency, and design adequacy. Trends are developed based on the number of findings in each section.

4.2.4 S&W Field Quality Control (FQC) Site

FQC is responsible for performing on site inspections of all quality related construction activities. In addition, FQC performs surveillances, administers the calibration program for measuring and test equipment, and trains and certifies QC inspectors. FQC provides to S&W headquarters a monthly report which includes trending information on acceptable inspection reports (IRs) versus unacceptable IR's per activity.

4.2.5 S&W Quality Assurance Cost Anc Auditing (QAC&A) Division

QAC&A audits the other QA divisions and EA; performs quarterly site audits of FQC and construction and performs annual audits of onsite contractors. FQC and construction are audited for compliance to applicable installation specifications, procedures, and codes.

4.2.6 S&W Quality Systems Division (QSD)

The Reports Section of QSD issues trend analysis reports periodically and generates special reports as requested The trend analysis reports are generated from analyzed IR's, Nonconformance and Disposition Reports (N&D's), report data bases, or computer reports. Key words or items (i.e., anchor bolts, housekeeping) are used as the basis for developing the trends.

4.3 Findings

4.3.1 Northeast Utilities

10 CFR Part 50, Criterion II, requires that "The applicant shall regularly review the status and adequacy of the quality assurance program". Northeast Utilities Quality Assurance Program Topical Report, Revision 5, QAP 2.0 paragraph 2.2.6 states in part "A management review of the program is conducted on an annual basis, by an independent audit group, to assess the scope, status, implementation, effectiveness and to assure compliance to NRC licensing commitments. The Management Review Committee is appointed by the NUSCO Senior Vice President - Nuclear Engineering and Operations".

NU uses the Joint Utilities Management Audit (JUMA) to satisfy this requirement. This audit is conducted by QA personnel from other utilities who spend approximately one week looking into areas previously identified by NU. The JUMA encompasses not only Millstone Unit 3 but also Millstone Units 1 and 2 and Connecticut Yankee. This type of audit is too broad in scope and too short in duration to provide NU upper management an in-depth overview of the QA program at each of the sites. This is considered a weakness in the management audit program (423/84-04-02).

In January, NU implemented a new trending program on a three month trial basis. A trend analysis input sheet is attached for each nonconformance identified in inspection reports, nonconformance report, surveillance reports, in-process verification reports, audits, or NRC inspection reports. The trend analysis input sheet consists of seven major categories. The inspector/auditor merely circles the appropriate items for each nonconformance. This information is then fed into an automated data management system. Monthly the supervisor CQA reviews and evaluates a summary sheet to determine if significant items have developed and to outline the status of nonconforming conditions throughout the plant. Trends are identified on a monthly basis by reviewing the current data against data previously generated.

The proposed system appears well organized, easy to administer and capable of quickly identifying short and long term trends. The trial QA trending program is a considered NU strength.

4.3.2 Stone and Webster

Field Quality Control has instituted an automated tracking system for administrating their continuing education and certification/recertification program. The training coordinator can format the output in any manner convenient for management control.

The manual training/qualification record keeping system is well organized and complete. The inspector reviewed a random sample of 10 individual's files against NRC and ANSI requirements and for consistency with the automated tracking system. No discrepancies were found. The administrative control system for FQC certification/recertification and training is a strength.

4.3.3 Site Interviews

The inspector conducted five interviews during the March 6-16, 1984 construction team inspection. All persons interviewed worked for Stone and Webster in the QC department. The purpose of the interviews was to determine if they perceived any actions by management to sacrifice safety concerns in order to meet construction schedules, whether they had been harassed or intimidated in the performance of their duties, and whether they felt they had received sufficient training in their areas of job responsibilities. There were no concerns identified by any of the five individuals.

4.4 Conclusions

The Quality Assurance program at Millstone Unit 3 is effective and strong. This can be mostly credited to NU constant involvement with the architect-engineer and the emphasis they place on quality assurance. Through discussions with all levels of individuals in both organizations and review of both QA organizations, it was determined that NU and S&W each have a strong QA organization that works well with the other and with project management.

4.5 Documents Reviewed

4.5.1 Northeast Utilities

-- NU Quality Assurance Program Topical Report Revision 5

-- NQA-1.01, Quality Assurance Branch Organization and Qualification of Personnel, Revision 1

-- NQA-1.05, NUSCO Quality Assurance Branch Indoctrination and Training Program, Revision 2

-- NQA-1.06, Northeast Utilities Quality Assurance Orientation and Training Program, Revision 0

-- NQA-1.07, Training and Qualification of NQA Lead Auditors and Surveyors, Revision 1

-- NQA-1.08, Selection, Training, Qualification and Certification of NUSCO Non-NDE Inspection and Testing Personnel, Revision 1

-- NQA-2.01, Trend Analysis of Category 1 Related Problems, Revision 0

-- JUMA audit, report for the Combined Utility Assessment of the NUSCO QA Program, June 6-10, 1983

-- GBD-8347, Annual NUSCO Quality Assurance Activity Report for 1982, February 7, 1983

-- GPD-83131, Quarterly Quality Assurance Department Activity Report for the Period Ending March 31, 1983 (1st Quarter), May 31, 1983

-- QA 83-091, Quarterly Quality Assurance Report for the Period Ending June 30, 1983, August 1, 1983

-- GPD-83270, Quarterly Quality Assurance Department Activity Report for the Period Ending September 30, 1983 (3rd Quarter), November 2, 1983.

-- GPD-8432 Quarterly Quality Assurance Department Activity Report for the Period Ending December 31, 1983 (4th Quarter) January 27, 1984

-- A40731, Receipt Inspection, August 18-20, 1982

-- A40732, Electrical Raceways, August 25-27, 1982

-- A40735, Preventive Maintenance and Storage on MP3, October 10-12, 1982

-- A40755, IS-217 Computer Tracking System, February 15-17, 1983

-- A40733, Structural Steel, January 24, 1983

-- A40795, Cable Pulling, July 12 - August 4, 1983

-- A40836, Criteria IX and XII, October 17-23, 1983

-- A40839, Calibration Program, October 26-28, 1983

-- S40007, Quality Verification System, February 24, 1982

-- S40012, Preventive Maintennace MP-3, June 7, 1982

-- S40019 (IPV), Corrective Action Follow-up of Significant Deficiencies, September 3, 1982

-- S40021, Cable Installation

-- S40041, SEG Training

4.5.2 Stone and Webster

-- EAP 2.4, Indoctrination, Continuing Education and Certification Requirements, Revision 2

-- EAP 12.1, Control and Calibration of Measuring and Test Equipment, Revision 1

-- EAP 16.1, Problem Report System, Revision 5

-- EAP 18.1, Audits, Revision 5

-- EATP 3.1, Internal Audits - Scheduling, Performing, and Reporting, Revision 6

-- EATP 3.6, Review Plant Development, Revision 2

-- EATP 3.7, Audit Data Analysis System, Revision 1

-- EATP 4.2, Post Award Audits of Engineering Services Suppliers, Revision 3

-- EATP 5.1, Orientation and Indoctrination of Engineering Assurance Division Personnel, Revision 1

-- EATP 5.3, Qualification and Certification of Engineering Assurance Auditors, Revision 5

-- SEG #12, Site Engineering Group Audit No. 12 January 10-14, 1983

-- SEG #13, SEG Audit No. 13 April 11-15, 1983

-- SEG #14, Engineering Assurance Audit Report Millstone Unit 3 SEG Audit #14, July 29, 1983

-- SEG #15, Engineering Assurance Audit Report Millstone Unit 3 SEG Audit No. 15 January 16-24, 1984

-- Project Audit #41, Engineering Assurance Audit Report Millstone Unit 3 Project Audit No. 41 November 2-24, 1982

-- Project Audit #42, Engineering Assurance Audit Report Millstone Unit 3 Audit No. 42 February 4 - March 30, 1983

-- Project Audit #43, Engineering Assurance Audit Report Millstone Unit 3 Project Audit No. 43 May 16 - June 10, 1983

-- Project Audit #44, Engineering Assurance Audit Report Millstone Unit 3 Project Audit No. 44 August 1 - September 12, 1983

-- QS-2.3, Stop Work Action, Revision A

-- QS-5.1, Quality Standard Procedural System, Revision E

-- QS-12.1, Stone & Webster Calibration Program, Revision C

-- QS-2.12, Qualification, Certification, Indoctrination and Continuing Education of Personnel, Revision B

-- WS-16.1, SEEC Problem Report System, Revision B

-- QS-16.2, Notifying Clients of Potentially Reportable Deficiencies under 10 CFR 50.55(e), Revision A

-- QAD-1.7, Quality Assurance Program Administrator, Revision A

-- QAD-1.8, Quality Systems Division Charter, Revision G

-- QAD-1.9, Field Quality Control Division Charter, Revision D

-- QAD-2.1, Quality Assurance Department Continuing Education System, Revision B.

-- QAD-2.5, Qualification and Certification of Personnel Performing Quality Assurance Activities, Revision G

-- QAD-3.1, Review of Stone & Webster Technical Documents, Revision G

-- QAD-5.1, Preparation, Issue, and Control of Quality Assurance Procedures, Revision F

-- QAD-12.1, Verification of Measured Data, Revision B

-- QAD-14.1, Inspection Report System, Revision C

-- QAD-18.1, QACA Audit System, Revision C

-- Audit #35, Millstone Unit 3, Site Audit Report No. 35 and Elwin G. Smith Corrective, August 22, 1983

-- Audit #36, Millstone Unit No. 3, Site Audit Report No. 36, November 2, 1983

4.5.3 References

-- Millstone Nuclear Power Station Unit 3 Final Safety Analysis Report (FSAR)

-- 10 CFR 50, Appendix B

-- ANSI/ASME N45.2 - 1977, Quality Assurance Program Requirements for Nuclear Facilities

-- ANSI/ASME N45.2.6 - 1978, Qualifications of Inspection, Examination and Testing Personnel for Nuclear Power Plants

-- ANSI/ASME N45.2.12 - 1977, Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants

-- ANSI/ASME N45.2.23 - 1978, Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants

-- Regulatory Guide 1.144 - 1980, Auditing of Quality Assurance Programs for Nuclear Power Plants

5.0 Design Control

5.1 Areas Inspected

Areas of design that were reviewed during this inspection are:

- design change control
- design document control
- revision to design documents
- post-turnover design control
- SWEC - Westinghouse design interface
- design change to original design basis

Procedures reviewed include the following:

- EAP 6.1 - Document Control
- EAP 6.5 - Preparation, Review, Approval and Control of E&DCRs
- FCP 124 - Processing Category I N&Ds and Risk Releases

- NEAM 68 - Handling of N&D Reports by Engineering and Design
- NEAM 38 - Authorization of E&DCRs
- EAP 5.4 - Review and Approval of Project Production Drawings
- MP3-2.02 - Control and Distribution of Design Documents
- MP3-3.04 - Review of Design Documents
- MP3.411 - Review & Approval of Nonconformances Dispositioned "Use-As-Is" and "Repair" and Unsatisfactory Inspection Findings
- NNECO Startup Manual

5.2 Organization

Stone & Webster Engineering Corporation (SWEC), Boston, provides the engineering, design and construction management services for Millstone Unit 3. Westinghouse has furnished the nuclear steam system (NSS), with the remainder of the plant being designed and constructed with the assistance of Northeast Utilities Service Company (NUSCO) and the architect-engineer, SWEC. Northeast Nuclear Energy Company (NNECO) is responsible for the operation, maintenance and testing of Millstone Unit 3.

Northeast Utilities has a force account contract with SWEC; therefore, all site personnel and craft (except Westinghouse) work for SWEC. There are no subcontractors. SWEC performs both QA/QC functions with NUSCO overseeing SWEC design and construction activities on a rigorous basis.

5.3 Findings

5.3.1 Design Change Control

The inspector selected a sample of Engineering and Design Coordination Reports (E&CDRs), Advance Authorized Approved (AAA) E&DCRs and Nonconformance and Disposition Reports (N&Ds). The sample was reviewed for the following:

- conformance to project procedures
- completeness and adequacy
- validity of use
- reference to calculations/justifications

Documents reviewed include the following:

E&DCRs	AAA-E&DCRs	N&Ds
FJ-28730	FJ-26396	4376
FJ-28680	FJ-25090	4310
FJ-28491	FJ-18117	4306

FJ-26321	FJ-23291	4302
FJ-25099	FJ-23260	3863
FJ-23696	FJ-19996	2808
FJ-18149	FJ-19985	3654
FJ-19968	FJ-19915	3842
FJ-19966	FJ-27902	3770
FJ-28169	FJ-24968	3754
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No discrepancies were identified.

The inspector also requested the calculations and/or justification for the dispositions of FJ-23696, FJ-26396, FJ-18149 and FJ-18117, and documentation of NUSCO's required review of N&Ds 4376, 4306, 3770 and 3863, which had been dispositioned by SWEC as "Use-As-Is" and/or "Repair".

No discrepancies were identified. Records were retrievable, and appeared complete and adequate.

5.3.2. <u>Document Control</u>

The inspector selected a sample of design drawings from eight field stations where controlled copies are used and maintained to ensure that craft and QC are installing and inspecting, respectively, to adequate design information. The status of each drawing in the field was then compared to that of the official "Record Cards" maintained by Document Control. The following drawings were selected:

EE-34EZ	EV-45F	BE-52CJ	2170-430-565-142
BZ-739F-25	EV-46L	BE-52JJ	S.O. 4-5302-32
BZ-739F-35	BZ-109A-44	EK-501118	2170-430-565-086
EE-34BL	BZ-109A-55	EK-501129	BK-16M-16
EE-34DL	EE-34EF	EK-501167	BZ-545J-85
BE-52CL	EE-34MZ	BZ-601A-130	BZ-545J-100
BZ-739B-127	EE-46L	BZ-601A-145	BZ-545E-29
BZ-739B-151	EE-55B	EK-1C	BZ-545E-33
BZ-739B-166	EE-57B	2472-710-392-122	S.O.4-5302-E1
EK-1A	BK-16M-53	2472-710-392-241	FSK-CB-2312
FSK-CB-2562	FSK-CS-1655	2211-221-090-016	FSK-CS-1756

One drawing from the above sample, BZ-601A-145, was not current; Revision 01 was in the field and Revision 02 in Document Control. However, the Record Card, a copy of which is also maintained at the pertinent drawing stations, is reviewed prior to drawing use to ensure revision currency. Review of the Record Card for BZ-601A-145 would have alerted the individual that Revision 02 was the most current, not Revision 01. The licensee corrected this discrepancy immediately. Based on the sample taken, this discrepancy appears to be an isolated case. No further discrepancies were identified.

The inspector also verified at three drawing stations that the following Record Cards were available and current:

BZ-110R-112-H003	EE-34AC
BZ-110R-115-H003	EE-34DP
BZ-074B-090	EE-37R
BZ-110R-512-H004	EE-46E
EC-750K	EE-57A
BZ-071A-008	EC-710A
BZ-002A-141	BZ-110R-000
BZ-108R-125	EE-27E
EE-34HE	

No discrepancies were identified.

5.3.3 Design Document Revision - Via E&DCRs and N&Ds

The inspector reviewed the licensee's program for design document revision via E&DCRs and N&Ds. The licensee has committed to incorporating these design changes within four months of the date of the sixth change document. All design changes and their status are entered into a computerized logging and tracking system, IS-305. The system's data is updated on a continuous basis. The printout includes every design change and corresponding status affecting a document via an E&DCR or N&D, and can easily be understood by inspectors, engineers, craft, etc., with a minimum of explanation. Besides the hard copies of the IS-305 log, Cathode Ray Tube (CRT) presentations are also available. An individual, with minimum instructions, can use the "browse" function of the program and retrieve the necessary information, or can simply request the information from one of the CRT operators. The licensee has already initiated training on the CRTs and has published a preliminary user's manual. The IS-305 system is considered to be a strength within the document control area.

The inspector reviewed the latest printout of IS-305 and identified several drawings which, upon revision, did not incorporate all E&DCRs that were required to be incorporated. No evidence of an exemption to the licensee's commitment for incorporation was found. The following drawings were identified as naving discrepancies.

Drawing/Revision	Latest Date of an Incorporated E&DCR	"To Be Incorporated Documents Not Incorporated	Date of Approval
BZ-110R-000/08	9-22-83	FJ-09645	7-16-82
		FJ-11555	11-09-82
		FJ-11556	11-09-82
		FJ-19803	9-12-83
		FJ-19923	8-20-83
		FJ-20268	9-20-83

BZ-019B-000, -039, -048/09	6-30-83	FJ-12662	3-02-83
BZ-019R-000/06	10-14-83	FJ-18515	10-10-83
		FJ-19605	10-10-83
		FJ-19822	9-22-83
		FJ-20505	9-22-83
		FJ-21144	10-03-83
		FJ-22139	10-06-83
		FJ-22281	10-13-83

The inspector held discussions with the SWEC Site Engineering Mechanics and Site Electrical Groups responsible for revising drawings. The inspector noted that besides the IS-305 system, each group had its own tracking system that would alert an individual, when entering the sixth "to be incorporated" change into the log, that a drawing revision was required. Failure to use the IS-305 system in conjunction with a group's own tracking system may have lead to the issuance of the above drawings minus all applicable design changes. Although the changes that were overdue for incorporation involved only minor changes, failure to incorporate all such documents is in conflict with the licensee's commitment, and is considered a weakness to the licensee's program (423/84-04-03).

Upon identification of the above discrepancies, the licensee took immediate action to correct the situation. Steps already taken include:

- A 100% review of all BZ site-generated drawings. Deficient BZ packages have been identified.

- All site-issued drawings will be reviewed against IS-305 prior to issuance. A job site instruction will be developed to implement this requirement.

- Site-personnel have been instructed to use IS-305 as a tool.

5.3.4 <u>Design Document Revision - Without E&DCRs</u>

While conducting an inspection of cable tray supports, an NRC inspector identified a support, C013, that did not reflect its drawing's current revision, EE-34KW/Rev. 04. Upon further investigation the inspector found that support C013 had been installed and QC-inspected to Rev. 02 of EE-34KW. The change to C013, made in Rev. 03, was not encircled as required by instruction EDTS-AG19-1-1. Because the change was not encircled, nor was an E&DCR generated for the change (making the change untrackable), the new design for support C013 went unnoticed until identified by the NRC inspector. Construction nor QC was aware of the discrepancy.

Failure to review and approve a design drawing such that adequate information is transmitted to the affected parties is a violation of 10 CFR Part 50, Appendix B, Criterion VI (423/84-04-04).

The licensee informed the inspector that in the past changes to design documents were not necessarily incorporated into revisions via an E&DCR. Changes were allowed to be made, encircled as a change on the affected drawing, and noted in the Record of Drawing Changes, which is attached to the revised drawing. As a result of this system, the potential for discrepancies, such as the one discussed above, existed. Without a means for tracking the change, such as an E&DCR, this type of situation could possibly go unnoticed until the preliminary and/or final walkdown.

The licensee had already recognized the potential for error in the above system, and approximately six months ago instructed individuals responsible for drawing revisions that design changes could not be made without an E&DCR. The procedure for this new requirement was in the final review and approval stage at the time of this inspection.

5.3.5 Post-Turnover Design Control

The inspector reviewed the licensee's program for control of design changes made to systems and components turned over to NNECO from SWEC. Changes to systems or components turned over to NNECO are made via Design Change Requests (DCR), Design Modification Requests (DMR), Design Deficiency Requests (DDR), and/or Unsatisfactory Reports (UNSAT). All of these change documents, except UNSATs not involving a design change, are sent back to SWEC for review. Under SWEC's QA program, the NNECO change documents become T-E&DCRs. Upon final disposition the SWEC Advisory Operations (ADOPs) group, and NNECO determine who implements the final disposition. If work is to be completed by SWEC, it is turned over and tracked via a Construction Work Package (CWP) under SWEC's own QA/QC program.

The inspector reviewed UNSATs to determine the degree to which these were not being transmitted to SWEC for review. Most UNSATs involved non-Category I items. Of the UNSATs that were Category I, over 90% had been sent to SWEC, with the remainder involving only administrative issues. The licensee pointed out that although not all UNSATs are sent back to SWEC, they all undergo SWEC review via the Joint Test Group (JTG) which has two members from SWEC. If a decision to not send an UNSAT to SWEC had been incorrectly made, the JTG would reverse that decision during its review.

No discrepancies were identified.

5.3.6 SWEC - Subcontractor Design Interfaces

The inspector reviewed the program used by SWEC and Westinghouse, for ensuring that changes to the NSS are properly reviewed and approved by SWEC for impact on the balance of plant (BOP), the responsible subcontractor for the NSS.

Westinghouse uses a Field Change Notice (FCN) to generate changes to the NSS design. FCNs are sent to SWEC for review, at which point they become Project Change Requests (PCRs). Following approval of the PCR, an E&DCR is generated. Each of these steps is tracked through a computerized logging system maintained by Westinghouse with copies sent to SWEC.

The number of FCNs generated has increased in the past year; however, the number is still relatively low. Between August 1, 1983, and February 28, 1984, fifteen FCNs were generated. SWEC stated that because of the small amount of changes by Westinghouse, there has never been an interface problem concerning design of the NSS and BOP.

No discrepancies were identified.

5.3.7 Incorporation of Design Changes

Via licensee commitments and/or PCRs the inspector reviewed the licensee's program for tracking and incorporating design changes made through licensee commitments and/or PCRs. (Not all licensee commitments are made via a PCR). Changes to the original design basis stated in the FSAR can be made either through licensee commitments (generally done through written correspondence with the NRC) or a PCR (generated by either NUSCO or SWEC). An approved PCR results in a Work Package Change Notice (WPCN) and "fragnet", which are both scheduling and cost documents. Both the WPCN and fragnet delineate the activities required for the change in work scope.

The inspector noted that the PCRs and licensee commitments are logged into separate computer programs and tracked to the point of approval. Between that time and the point at which an E&DCR may be required, there exists no quality program to track these design changes to ensure that required E&DCRs are indeed generated, and the work performed. (NOTE: As discussed in Section 4.3.6, Westinghouse tracks FCNs to the PCR stage and finally the E&DCR stage).

Failure to provide a quality program to track licensee commitments and PCRs is considered a licensee weakness (reference paragraph 3.3).

5.3.8 Site Interviews

While conducting inspection activities, the inspector also interviewed five individuals from SWEC concerning their impressions of management philosophy and conduct in ensuring that construction activities are of a quality that provides for the public health and safety. Each individual interviewed expressed the opinion that management emphasized quality to be of utmost importance. No individual had ever felt harassed, intimidated or threatened in relation to performance of quality duties.

5.4 Conclusions

In the area of design, the following strengths, weakness, and violation have been identified.

Strengths:

5.4.1

The IS-305 system provides a reliable source of design information to craft, engineers, inspectors, etc. for use in installing, designing, and inspecting safety-related items. The system's data is updated continuously, and its printout can be understood with a minimum amount of explanation. Use of CRTs as well as instructions/user's manual (for other than the CRT operators) complements the hard copy printout.

5.4.2

The licensee appears to have very good system for design document control. Staffing levels in Document Control are adequate to ensure timely distribution (24-hour turnaround) of approved drawings and other design change documents. Record cards affected by changes are updated daily, and copies of the design document and Record Card are distributed to the affected work stations. Each week Document Control performs a 100% audit of the prior week's work - this audit being above and beyond the required NUSCO and SWEC audits. This audit in conjunction with the Record Card system and adequate staffing provide for timely control and distrution of design documents.

Weakness: Failure to incorporate all design changes made via E&DCRs and N&Ds is in conflict with the licensee's commitment to incorporate all changes, regardless of their nature, upon drawing revision. Lack of incorporation could possibly lead to a situation in which a craftsperson or inspector could install or inspect, to inadequate design information.

Violation: Failure to review and approve a design drawing such that inadequate design information was transmitted to construction and QC is a violation of Appendix B, Criterion VI.

6.0 Pipe Installation, Welding and Nondestructive Examination (NDE)

6.1 Areas Inspected

The objective of this NRC inspection of pipe installation, welding and NDE was to determine if these activities were and are being performed in accordance with design requirements, SAR commitments, applicable codes, specifications and procedures. Completed work, work in progress, records of completed work including QC inspections, reports of NDE and qualification records of both welders and inspection/examination personnel were included as areas examined during this inspection.

6.2 Organization

Installation, welding, NDE and QC inspection of piping is performed by the Stone and Webster Engineering Corporation. Site Engineering produces a weld data sheet (welding record form) for each pipe weld to be made. The weld data sheet is checked by Field Quality Control (FQC) where inspection hold point requirements are identified. The completed weld data sheet is reviewed by the Authorized Nuclear Inspector (ANI) and is then held at one of the weld material issue stations until the construction department initiates welding work. Actual welding is initiated by issuance of a weld material requisition that permits issue of the required welding material, weld data sheet and welding technique sheet from the weld material issue station. The welders name, identifying symbol and weld material type, size and heat number are entered on the weld data sheet by the welding supervisor. The welder's qualification for the work to be performed is checked by the weld material issue attendant and the welding supervisor. Field QC inspectors perform inspections and/or NDE prior to welding, during welding and at the completion of welding as indicated by hold points on the weld data sheet. A separate level of inspection coverage is provided by QC surveillance inspections. Performance of the weld control system is audited by the S&W Boston QA group and the NUSCO on-site quality assurance group.

6.3 Findings

The inspector examined portions of the component cooling water piping (CCP); specific welds of piping; the program controlling pipe installation; welding and inspection; qualification of personnel; evaluation, disposition and correction of rejections; and reviewed selected radiographs, weld records and procedures. Interviews were held with welders, welder supervision and QC inspectors.

6.3.1 Component Cooling Water Piping Walkdown

The inspector performed a walkdown inspection of portions of the CCP piping as identified below to compare as built conditions to the design drawings and ASME Code Section III and ANSI B31.1 requirements. The inspection included observation of components, weld and pipe location, pipe configuration, pipe identification, ASME Code data plates, general appearance, positioning of temporary supports and pipe clearances. The CCP lines inspected were those lines to and from the seal water heat exchanger, CCP pump B, the excess letdown heat exchanger and from the reactor coolant pump. The piping and components examined are shown on the S&W piping and instrumentation drawing 12179-EM-121-B-1, drawings CP372029/372075 and CCP drawings numbers 7, 9, 10, 33, 34, 58, 269A/B, 450A/B, 451A/B, 580, 520 and 629.

One pipe section, tack welded in place but not welded, was rejected on fitup by QC (N&D P3003467) and tagged as a rejection. The N&D was noted to be in the disposition stage with work on hold pending disposition.

Construction revision notices were noted to be issued for portions of piping shown on drawings CP-372029, CCP-10 and CCP-33. Where applicable, the as built condition of these lines was compared to the construction revision notice.

The CCP lines inspected conformed to the applicable referenced drawings, or revisions and noted rejections were shown to be both documented and under control by the contractor.

No violations were identified.

6.3.2 Examination of Specific Welds and Records

The inspector selected ten welds for examination of the weld surface, review of weld data sheets and review of non destructive testing and weld inspection. The weld sample and supporting documentation were examined and reviewed to determine that the requirements of ASME Section III and Specification M968 for Field Fabrication and Erection of Power Piping were being met.

The welds examined in this sample were:

DWG	Weld	DWG	Weld
CCP-33	FW-1	CHS-3	FW1
CCP-10	FW-19	CCP-34	FW5
CP-372029-002	FW-9-1	CCP-264	FW2
CCP-7	FW-3	CCP-264	FW1
CCP-7	FW-6-1	CCP-269A	FW2

The weld data sheets, condition of completed welds and NDE/Inspection Reports were in conformance with the ASME Code and pipe installation requirements.

The inspector selected welder symbols and inspector names for review of the qualification files for qualification documentation per ASME section IX and ASNT-TC1A as applicable.

No violations were identified.

6.3.3 Independent Verification of Construction Piping Materials

Samples of pipe and welding materials typical of those used in safety related pipe systems were obtained for independent analysis. The materials included:

Carbon Steel E-7018 Weld Electrode
Stainless Steel E-308 Weld Electrode
Stainless Steel E-316 Weld Electrode
Stainless Steel Type 316 Pipe, 4" Diameter
Stainless Steel Type 316 Pipe, 2" Diameter

Carbon Steel SA 106GRB Pipe, 4½" Diameter
Carbon Steel SA 106GRB Pipe, 2" Diameter
Carbon Steel A500 Tube Steel, 2" Square

The weld electrodes were deposited as standard chemical analysis pads by a qualified site welder using applicable safety related pipe weld procedure parameters.

The inspector reviewed the material certifications for the above materials and examined the results of NRC independent chemical analysis. The materials were verified to be representative of the material types specified.

No violations or deviations were identified.

6.3.4 Review of Radiographs and Weld Repair Control

The inspector reviewed radiographs of current piping weld work including first time radiography and radiography of weld repairs. This sample included radiographs of welds FW6-1 on CCP-7, FW1 on CCP-264 and FW1-1 on CHS-3 which are discussed in paragraph 6.3.2 of this report. The other radiographs and weld data records reviewed included the following.

Radiographs Ready for ANI Final Review

CIMSS-32	FW3	3MSS-008-52-2
3TFM-4	FW2	3TFM-006-3-4
TFM-3	FW1	3TFM-006-5-4
3TME-33	FW008	GE 838E893
3TME-32	FW001	GE 838E893
3DSR-12	FW-02	3 DSR-024-19-4

Radiograph Packages Requiring Additional Radiographs (in progress)

3TME-13	FW4	3TME-004-6-4
3TME-13	FW3	3TME-004-6-4
3MSS-5	FW3	3MSS-018-73-4

Radiograph Packages Waiting for Rework Completion

CCP-264	FW1	3CCP-010-265-2
CCP-6	FW1	3CCP-010-263-2
CCP-8	FW5-1	3CCP-010-261-2
CCP-8	FW5	3CCP-010-261-2

The weld data records were examined for conformance to the ASME Code Section III or ANSI B31.1 as applicable to identify the required visual testing (VT), penetrant testing (PT) and radiographic testing (RT) and to determine if these examinations or inspections were complete or planned for completion as required. The weld material was compared to that required by the applicable weld procedure for the base metals being welded. The radiographs were evaluated for conformance to ASME Code, Section III requirements.

During this inspection it was noted that the densitometer, for measuring the density of radiograpns reached its calibration due date. At this time, the densitometer was removed from the work area for calibration leaving a second but calibrated unit for use by radiograph readers.

No violations were noted.

6.3.5 Work in Progress, Safety Related Piping and Hangers

The inspector observed work in progress on the following examples of safety related piping or pipe supports.

Weld	Weld Tech Sheet	Line Reference	DWG
FW55-1	W3-53	3RCS-150-32-1	CP-408023
FW0026	W3-53	3CHS-002-618-2	CP-407018
FW18	W3-53	3SIH-002-146-1	CP-407027
FW13-1	W3-53		CP-40752
FW0100, etc.	W3-41(9018B3)	3BDG-004-012-2	CI-BDG-515
FW29,	W3-02	3MSS-030-92-2	CI-MSS-502
FW19,	W3-02	3MSS-030-94-2	CI-MSS-503

Weld preheat was required on two (FW 0100, FW 19) of the three pipe supports being welded. The requirement for preheat was clearly shown on the weld data sheet and appropriate controls were observed to be in place to maintain preheat within the required limits. The conditions of weld fitup, welding in progress, qualification of welders, presence of weld technique sheets and weld documentation as required by the ASME Code and Contractor Specification 968 were examined by the inspector.

No violations were identified.

6.3.6 Interviews

The inspector conducted interviews with QC inspection personnel and welders in their work areas. The interviews were conducted to determine if those interviewed were knowledgeable and qualified in the functions of their jobs, to determine if they were or knew of situations where work quality or safety was sacrificed for any reason such as to meet construction schedules or if they had been threatened or harassed in relation to performance of quality duties. The summary of seven documented interviews as supported by other undocumented interviews, is that a high level of skill and knowledge of work functions was exhibited. Also, the summary reply to the questions of obtaining good quality work without harassment, intimidation or threats was that the emphasis by management is to have work meet or exceed quality standards.

No cases of sacrificing quality for schedule or intimidation were identified by either those interviewed or by the inspector.

6.4 Conclusions

Based on the review of procedures, observation of ongoing work including welding, walkdown of CCP piping, examination of specific welds and records, evaluation of weld material and weld instruction issue and review of selected radiographs and weld data sheets, the inspector concludes that the site welding function is under control by site supervision and management utilizing a core of competent, qualified craftsmen. The inspection functions of site QC including NDE are in evidence as is overcheck of the system by QA.

No violations were identified.

6.5 Documents Reviewed

Portions of the following were reviewed in conjunction with the piping and welding inspection.

Weld Technique Sheet W1.1-01 for AWS D1.1 welding.
Quality Standard QS 10.17 - Structural Steel Erection
Attribute List for Inspection Dated 3/7/84
Engineering Assurance Audit Report No. 14 of 7/29/83
Welding Material Control P-CMP 6.4
ASME Code Section III, NB
Mechanical Equipment Specification M914
Radiography Specification QAD-9.4ML Rev A
Weld Technique Sheet W31.1-01 ANSI B31.1 Welding
Weld Technique Sheet W31.1-51
Weld Technique Sheet W3-02 ASME III
Weld Technique Sheet W3-24 ASME III
Weld Technique Sheet W3-52 ASME III
Weld Technique Sheet W3-53 ASME III
Weld Procedure W3 Rev. 3 ASME III
Field Fabrication of Power Piping Spec M968
Pipe Welding Inspectors Handbook
S&W QA Program, Section 9, Control of Special Processes

7.0 Mechanical and Electrical Supports and Structures

7.1 Areas Inspected

The scope of inspection in this section covers the following areas:

- Pipe supports and restraints
- Piping stress analysis
- Conduit Supports
- Cable Tray Supports
- Structural Steel

The objective of this inspection was to assess the various functions and activities contributing to the design and construction of structures and supports in the areas identified above and to determine whether acceptable engineering practice, regulatory requirements and licensee commitments had been met.

7.2 Organization

Engineering and construction activities related to structures and supports for mechanical and electrical installations, inspected within the scope of the Construction Team Inspection (CTI), are performed by Stone and Webster Engineering Corporation (SWEC), the Architect/Engineer (A/E) of record.

Depending on the type of engineering activity inspected, they fall into one of the two following disciplines:

- Structural Division: Structural steel, baseplates and embeded plates, conduit supports and cable tray supports.

- Engineering Mechanics Division: Pipe stress analysis and pipe supports/restraints design.

Site related engineering activities in the above areas are performed by the Site Engineering Group (SEG) under the supervision of the assistant superintendent of engineering. The major engineering groups which comprise site engineering and construction activities are listed below, with a brief description of their major responsibilities:

- SEG Field Engineers

  Responsibilities include: familiarity with construction schedule; resolution of questions and interpretation of engineering documents; proposition of engineering solutions; solving engineering problems; providing feedback to principal discipline engineers and area engineers; resolving interpretation problems with specifications, drawing and FWC; identification of quality problems; identification of work in progress not conforming to plans and specifications; performance of pre-installation check as directed by the Area Engineer.

- Area Engineers

  Responsibilities include: Ultimate authority for equal alternatives (interdiscipline); expediting engineering support, scheduling responsibility (fix-its), maintaining master SEG Engineering Deficiency List.

- Construction Field Engineers

  Responsibilities include: Review of all documentation, prints and correspondences assigned to area of responsibility; inspection of components for conformance to specifications and standards; supervision of field survey parties in the layout of lines and grades; performance of locally required designs for temporary facilities; coordination of construction activities with the Quality Control function to satisfy the requirements of engineering codes; maintaining accurate records of work progress, problem areas and delays; interface with Q.C., and effective disposition of unsatisfactory IR's and N&D's; requisition of material; vendor coordination; field routing of conduits; answering E&DCRs for CAT II and III items.

7.3 Findings

7.3.1 Pipe Supports and Restraints

The component cooling piping system was selected for the purpose of assessment of pipe supports and restraints to determine compliance with the applicable codes, standards and specifications. This was accomplished by examining quality documents, programs and installed equipment.

Applicable sections of the following documents were reviewed in part to verify that adequate controls are in-place that meet the appropriate codes and regulatory requirements:

- Specification M-968 for Field Fabrication and Erection of Power Piping, ASME III, Class 1, 2, 3 and ANSI B31.1 and Class 4.

This specification covers the technical and quality assurance requirements for field fabrication and installation of power piping and pipe supports. Mandatory appendices include appendix (N) for pipe support field fabrication and erection tolerances.

- Instruction report NETM-28 for surface mounted base plates retained by Richmond inserts and Hilti anchor bolts.

This procedure provides guidelines for installation and design verification of surface mounted baseplates.

- Field Construction Procedure for Installation of Drilled-in Expansion Type Concrete Anchors (FCP-299).

This procedure covers the technical requirements necessary to install categories I, II, and III drilled in expansion type concrete anchors for securing attachments to hardened concrete structures.

- Specification for Design and Fabrication of Power Plant Piping Supports (M152).

The specification provides the requirements to vendors (ITT Grinnell) for the design and furnishing of pipe supports for Millstone 2&3. Section 1 of the document addresses the technical requirements, design and erection tolerances, shop painting, provisions for storage and quality assurance program and audits.

- Specification for Fabricated Piping Sketches and Standard Drawings (procedure #627)

- Specification No. 2199.142-924, Drilled in Expansion Type Concrete Anchors.

No violations were identified.

Discussions were held with Stone and Webster's representatives responsible for training of site personnel. The training program offered onsite includes construction crafts, site engineering group, and field quality control (FQC) personnel and supervisors of these disciplines. Its objective is to provide orientation training for new personnel on site and to respond to identified problem areas such as high rejection rates of completed supports by FQC. The indoctrination of new SEG personnel is described in SEG Procedure No. 10, which provides the procedure for implementing this requirement. According to this procedure, the applicable Principal Engineer will issue to newly assigned personnel a record of assigned reading, accompanied by the appropriate material and the required completion date. The review of these documents should be completed within 60 days after assignment to SEG. The procedure also requires that personnel changing assignment within the SEG update their indoctrination as required. The depth of the document review is to assure that the individual has knowledge of the topical contents to allow future reference to specific sections for the accomplishment of project activities and to provide a detailed knowledge of the specific sections that apply to his (or her) immediate assignment.

The CTI members performed interviews with site engineering personnel to verify their indoctrination and their awareness and knowledge of applicable design and QA procedures.

No violations were identified.

A review of Field Quality Control activities was performed as part of this inspection. It involved a review of relevant documents and discussions with FQC personnel. Documents reviewed included Quality Assurance Directive QAD-10.43 which delineates the requirements for inspection of hangers and supports for piping, ductwork, electrical conduits, cable trays and the inspection of drilled-in expansion type concrete anchors. The directive provides the attributes list for anchor bolt hanger installation inspection. It also provides a procedure for verification and implementation of these attributes. Also reviewed during this inspection was the FQC handbook which is utilized by FQC personnel during actual walkdown inspection of completed supports. The handbook is a compilation of instruction and various sections from installation specifications. The interviews conducted by the CTI members with some FQC personnel were intended to determine the degree of their understanding and knowledge of the procedures and specification and assess their capabilities in performing their work. Upon review of QC forms for completed supports, it was apparent that some supports which were marked as satisfactory, were reinspected by FQC and found unsatisfactory and were tagged as rejected. The second FQC inspection of accepted supports was conducted on a random basis and did not appear to be structured. It should be noted that there were no requirements for performing this random inspection.

No violations were identified.

Discussions with cognizant S&W representatives were held to determine the various dimensions of their trend analysis and corrective action program. Field Construction Procedure (FCP-335) which addresses this subject was also reviewed. The purpose of the program as specified is to establish measures for determination of root causes and to assure that recurring conditions adverse to quality are tracked and evaluated for possible generic causes. It is also intended to assign and monitor the appropriate corrective action. According to the procedure, the corrective action committee is established and consists of top level SWEC site management personnel and NUSCO's superintendent of construction. A corrective action sub-committee is established by the corrective action committee. The sub-committee consists of SWEC's construction, site engineering group, and field quality control personnel. The sub-committee's task is to review each Nonconformance and Disposition Report (N&D's) after it is initiated and to code each report for a trend. The sub-committee's responsibility is to review the Nonconformance and Disposition Report Trend Analysis computer printout and indicate potentially adverse trends for review by the Corrective Action Committee members. The committee members would then review, evaluate, determine the cause and effect, and establish new or continued corrective action for each trend. The committee prepares a report which is transmitted to the cognizant organization including the reported trend and the committee's recommended action. Responses to committee reports are reviewed and evaluated by committee members for closing when considered satisfactory.

No violations were identified.

A walkdown inspection of selected large bore pipe support and restraint installations on the component cooling piping (CCP) system was performed. The inspection involved a visual and physical examination of twelve (12) seismic CAT I support installations for conformance to design drawings and requirements.

The inspected installations and corresponding piping systems line numbers are listed below:

Line No.	Installation Mark No.
3-CCP-010-496-3	3-CCP-2-PSR-062
3-CCP-010-496-3	3-CCP-2-PSST-018
3-CCP-018-20-3	3-CCP-2-PSR-069
3-CCP-018-2-3	3-CCP-2-PSR-222
3-CCP-018-3-3	3-CCP-2-PSSH-205
3-CCP-018-3-3	3-CCP-2-PSR-223
3-CCP-016-467-3	3-CCP-2-PSR-039

3-CCP-004-450-3	3-CCP-1-PSR-662
3-CCP-003-161-3	3-CCP-2-PSST-204
3-CCP-003-161-3	3-CCP-2-PSR-116
3-CCP-010-629-3	3-CCP-1-PSST-156
3-CCP-004-296-3	3-CCP-1-PSA-152

The verification of the CCP system hanger installations included the following attributes:

- Checking actual configuration against support drawing, including dimensions;
- Checking directions in which hangers restrain piping and clearances between pipe and hangers;
- Checking connections to the proper structure;
- Checking sizes of weld on hangers; including welded attachments to pipe;
- Checking baseplate dimensions and location of structural attachment on the baseplate;
- Checking baseplate bolts for tightness, edge distance, and minimum bolt embedment for a representative sample of anchor bolts;
- Checking that restraint bleed holes are open and free from foreign material;
- Checking that spring hangers are locked prior to performance of hydrostatic testing.
- Checking proper grounding of floor mounted supports; and
- Checking that movement of piping due to vibration, thermal expansion, etc., would not likely contact other pipes, supports, equipment or components.

While performing the installation inspection of pipe hanger No. 3-CCP-2-PSST 018 (vertical sway strut), it was noted that the pipe was resting on a structural steel beam approximately 4 feet away from the support according to the design drawing, a clearnace between the pipe and the beam should have existed. Stone & Webster indicated, that this observation had been identified while performing line walkdown for reconcilation of piping as-built isometrics. They presented the piping isometric reconcillation drawing for line No. 3-CCP-101-496-3, on which it was noted that the piping was resting on the structural beam at the identified location. This identification of piping as-built deviations from original design drawing was indeed effective in detecting the above deviation.

The installation inspection of pipe hanger No. 3-CCP-2-PSR-039 (horizontal sway strut) shown on drawing No. BZ-72C-54-3, identified that the rod end of the ITT Grinnell strut was jammed against the weld on the inside of the rear bracket. The installed configuration of the support, which had been inspected and approved by FQC did not allow for the required angular movement of ± 5° of the rod. This requirement is specified in Appendix N of installation specification M-968 which addresses pipe support field fabrication and installation tolerances. The licensee FQC initiated Nonconformance and Disposition Report (N&D) No. 6741 to report the condition on the identified support.

The failure of the installed support to meet the installation specification tolerance requirement, is a violation of 10 CFR 50, Appendix B, Criteria V (423/84-04-05).

Review of calculations pertaining to the analysis and design of pipe supports on the component cooling piping system was performed. Six design packages were selected from the above supports inspected for installation. The design packages were reviewed to verify that the calculations were performed according to project engineering and design procedures and that they meet regulatory requirements. The design calculation packages reviewed, and corresponding support numbers are listed below:

Calculation No.	Support No.
Z107C-152	3-CCP-1-PSA-152
Z72C-069	3-CCP-2-PSR-069
Z72C-18	3-CCP-2-PSST-018
Z72C-062	3-CCP-2-PSR-062
Z107C-156	3-CCP-1-PSST-156
Z72A-662	3-CCP-1-PSR-662

The review of design calculation No. Z107C-152 for pipe anchor No. 3-CCP-1-PSA152, identified that the anchor design seismic loads were calculated by using the square root, sum of of the squares (SRSS) of the respective pipe support loads obtained from the piping stress analyses of piping on both sides of the anchor. The licensee was informed that Stone & Webster's approach for combination of piping seismic support loads at anchors appears to be less conservative than the standard practice, which is to combine the seismic loads from both analyses using the absolute summation of support loads. This unresolved item is open pending further NRC review (423/84-04-05).

During the review of design calculation No. Z107C-152 for the pipe anchor No. 3-CCP-1-PSA-152, it was identified that the designer had used loading combinations which resulted in a positive vertical reaction on the embedded plate. The positive reaction induces compressive stresses which are not the governing design load for the embedded plate. In addition, the magnitude of the support vertical reaction at the embedded plate was lower than that of the governing seismic component alone. The inconsistency identified in the design calculation results in a less than conservative determination of governing design load. This item is unresolved pending revision of the design calculation (423/84-04-07).

7.3.2 Piping Stress Analysis

A review of aspects related to the seismic analysis of piping systems was examined in this team inspection. Pipe hangers are mounted to either concrete floors (or walls) or to steel beams (or columns). The following supports are examples of pipe hangers supported from steel beams:

Line No.	Hanger No.
3-CCP-010-496-3	3-CCP-2-PSST-018
3-CCP-010-251-3	3-CCP-1-PSST-092
3-RHS-012-33-1	3-RHS-1-PSR-005
3-CCP-010-629-3	3-CCP-1-PSST-156

In performing the seismic analysis for these piping systems, Stone & Webster performed a decoupled analysis which utilizes amplified response spectra as the forcing function input at supports and anchors of the piping system. The response spectra is determined from the representative mass point (or points) in the structural mathematical seismic model. When piping systems are supported from steel beams, the ratio of the tributary mass of the pipe support and attached piping to the mass of the support steel could be of a magnitude such that the assumption of decoupled analysis is no longer valid. This observation is apparent since the dynamic response of the pipe support and attached piping will influence the dynamic response of the support steel. The standard review plan (SRP) addresses the above issue in Section 3.7.2.II.3.b and provides a procedure for the decoupling criteria of subsystems.

In performing the seismic analysis for piping systems supported from structural steel beams, Stone & Webster did not address the above concern to substantitate the validity of the assumption of performing a decoupled seismic analysis of piping. This is an unresolved item pending further evaluation by the licensee and review by the NRC (423/84-04-08).

7.3.3 Conduit Supports

Inspection of electrical conduit support installations was conducted as part of this construction team inspection. Support installations in the control building at elevation 4'-6" were selected for this purpose.

Applicable sections of the following documents were reviewed in part:

- Structural Design Criteria for Conduit Supports for Northeast Utilities Service Company, Millstone Unit 3, NETM-47, Rev. 0.

The criteria provides, along with applicable codes and standards, the basis for the design of Category I rigid and flexible conduits. It is also applicable for the design of non-category I conduits supports in Category I areas.

- Seismic Design Procedure for Conduit Systems; EMTG-3-A. This document is a Stone & Webster's Engineering Mechanics Technical Guideline which provides a procedure for the design of seismic CAT I rigid steel and aluminum conduits and conduit support.

- BE-52 series drawings. These drawings provide typical details for various types of conduit runs and attachments and the details for all standard conduit supports.

A walkdown inspection of selected conduit support installations in the control building was performed. The inspection involved a visual and physical examination of nine (9) conduit installations for conformance to design drawings and specification requirements. The inspected conduit supports and types are listed below along with conduit numbers and sizes.

Conduit No. & Size	Support No.	Support Type
3CC441-OB-3"	CB1941	Direct attachment
3CC441-OB-3"	CB1942	Direct attachment
3CC441-OB-3"	CP1943	Direct attachment
3CC441-OB-3"	CB1944	Direct attachment
3CC441-ON-2"	CB1944	Direct attachment
3CC441-ONC2-1½"	CB1944	Direct attachment
3CC419-OA-4"(AL)	CB-4100	Cantilever
3CC419-OA-4"(AL)	CB-4098	Direct attachment
3CC419-OA-4"(AL)	CB-4097	Direct attachment
3CL950-RC-3"	CB-1780	Trapeze
3CL950-RD-3"	CB-1780	Trapeze
3CL400-NA-4"(AL)	CB-4177	Trapeze

The walkdown inspection was also intended to verify the implementation of the following procedural requirements:

- Maximum support spacing of 8'-0"

- Conduits are to be supported as closely as possible to their termination points at cable trays, walls or equipment, and that the unsupported length of a conduit from the termination point must not exceed 3'-0".

A sample review of E&DCRs was also performed as part of this inspection to verify the technical adequacy of the engineering disposition of construction problems relating to conduit supports.

The following E&DCR's were reviewed:

- E&DCR No. F-E-26394 issued by field requesting a revision of the axial bracing detailed for CB-1061 on E&DCR No. F-E-26081 since it could not be installed due to interferences. A proposed revision of the bracing was provided for approval.

- E&DCR No. F-E-13142 issued by field requesting approval for supporting the following conduit supports to cable trays C-011A, C-014, C-014A, C-009A, C-016A, C-168A, C-185 and C-198 on drawing No. EE-34-KW.

The above document was requested by the NRC team to verify whether an E&DCR was issued to permit supporting of conduits from cable tray supports as required by procedure. Some of these conduits were observed to be supported off cable tray supports during the walkdown of raceway installations.

No violations were identified as a result of conduit support installations inspection.

7.3.4 Cable Tray Supports

Inspection of cable tray support installations was performed for trapeze type supports in the control building at elevation 4'-6" between the emergency switchgear and battery rooms.

Applicable sections of the following documents were reviewed in part:

- Structural Design Criteria for Category I Cable Tray Supports, NETM-46 (Rev. 0)

The criteria provides, along with other applicable codes and standards, the basis for the structural design of all category I cable tray supports.

- Specification for Electrical Installation (E350), Section 3 covering installation of raceway, cables, connections and supports.

A walkdown inspection of selected trapeze type cable tray supports was performed. The inspection involved a visual and physical examination of support components in ten (10) installations for conformance to design drawings and specification requirements. The inspected supports are as follows: C088, C183, C172, C026A, C026, C027A, C072, C072C, C013, and C014.

The following drawings were utilized for providing location of supports, elevation of trays, support details, and material description:

EE-34DN-10
EE-34DP-5
EE-34KW-4
EE-34LD-4
EE-34LJ-7
EE-34KX-5

While performing the installation inspection of cable tray support No. C013, a discrepancy was identified between the installed configuration and the support detail provided in drawing No. EE-34-KW-4. When the licensee was informed of this finding, it became apparent that the support configuration was inspected by FQC to revision No. 2 of the above drawing and was found to be acceptable. In revision No. 3 of the drawing, the support detail was changed to the same detail found in revision No. 4. Revision 3 of the drawing was issued without encircling the changed detail as required by procedure EDTS-AG19-1-1.

Stone & Webster's construction and Q.C. personnel indicated that a modification and reinspection of the support was not performed since no E&DCR's were issued against the drawing for the subject support. This fact was verified by reviewing the document control card for E&DCRs and N&Ds issued in the time period between the second and third revision of the drawing.

The failure to issue an Engineering and Design Coordination request (E&DCR) against revision 2 of drawing No. EE-34-KW with regard to the design change of the subject support, and subsequent failure to implement the modification to the requirements of revision 3 of the above drawing is a violation. (Reference paragraph 5.3.4)

7.3.5 Structural Steel

Structural steel installations in safety related structures were reviewed for conformance to design drawings, code, and specification requirements to determine the quality of construction and to evaluate the FQC accepted installations.

The following documents were reviewed for compliance to design codes and NRC requirements:

- Structural Design Criteria for NUSCO - Millstone Unit No. 3, NETM-34
- Evaluation of Eccentric Attachments to Flanges of W-Shapes NETM-27.
- Specification for Structural Steel 2199.330-970.

A walkdown inspection of selected structural steel installations was performed in the Main Steam Valve Building and the Reactor Building. The inspection involved visual and physical examination of hardware installations for implementation of the following:

- Structural steel is erected to the most current drawings.
- Specified clearances are being maintained.
- Edge finishes and hole sizes are within tolerances.
- For bolted connections: nuts, bolts and washers are of the specified type and that bolts are torqued and thread engagement is as specified.
- Coping of flanges of W-Shapes is in accordance with specified limits.

Specific areas inspected in the walkdown include the following:

- Main Steam Valve Building floor framings at elevations 49'-0", 53'-0", 58'-0", 71'-2" and 74'-6".
- Reactor building annulus area at elevation 14'-10", pressurizer cubical at elevation 72'-0", and the CRDM missile shield platform over the hoist bay at elevation 51'-4".

Design drawings reviewed for the purpose of conducting the walkdown include: ES-31H, ES-31J, ES-50A, ES-50C, ES-53A, ES-53B, and ES-53D.

During the walkdown inspection of the hoist bay platform, it was apparent that many of the W-shape member flanges had deep copes. When Stone & Webster FQC was notified, it was apparent that these beams were received from the fabricator with gouges in the web which violated ASTM A-6 standards. An E&DCR No. 19891 was issued against the design drawing of the missle shield. It appeared that these gouges were being made in the shop during flame cutting of the single-bevel and preparation of the flanges. The NRC team reviewed the solution for disposition of the E&DCR which recommended grinding the webs and reshaping all re-entry corners to a radius of at least ½ inch and performing a visual inspection of the ground areas. During the visual and MP inspection of FW84 and FW 88, holes were found in the snipe area of beam 1-1186B1. E&DCR No. 3007 was issued to identify the finding. The disposition of the E&DCR was reviewed by the NRC for evalution of the recommended fix and found acceptable.

The inspection of structural steel floor framing in the Main Steam Valve Building at elevation 53'-0", identified a discrepancy in the end connection of a floor beam. The connection of beam #34B1 is located 1'-0" west of column line F.3 on the concrete wall on column line 47. The connection is composed of clip angles to an embedded plate in the wall and a T-shape beam seat. Design drawing ES-31J-3, detail AJ, shows complete bearing of the beam on the beam seat. Contrary to this, a continuous gap was visible between the bottom flange of the beam and the seat which resulted in no bearing between the two surfaces. Another finding of improper contact was identified in the seating connection of beam No. 33B3 to the other side of the concrete wall. The beam was partially bearing on the seat (approximately 1-3/4"). Stone & Webster FQC was informed of the findings. A reinspection of the same area was conducted by FQC, resulting in the identification of a third improper bearing of beam No. 33B1 to the same concrete wall. These findings were reported in a Nonconformance and Disposition Report (N&D) No. 4788.

The failure to properly install the beam seat connections according to the details of design drawing No. ES-31J-3 along with the failure of FQC to identify the discrepancy during inspection is a violation of 10 CFR 50, Appendix B, Criteria V (423/84-04-09).

A walkdown inspection of the reactor building annulus area steel framing at Elevation 14'-10", identified a pipe hanger, No. 3-CCP-1-PSST 092 that was supported from two floor steel beams between column lines 2&3. The hanger beams are simply supported using clip angle connections to the web of one floor beam and fixed (welded) to the web of the other floor beam. Review of the pipe hanger design loads indicates that a high concentrated moment will develop at the welded end connection of the hanger beam to the web of the floor beam. Without local stiffening of the web, this beam would be overstressed. Stone and Webster site engineering personnel were notified of the finding. The NRC was informed that evaluation of hanger attachments to webs of structural steel beams is not presently addressed in the structural design specification. However, it is the practice of the site engineering group which performs the evaluation of attachments to structural beams for supports designed onsite to apply the common rules of engineering design practice when attachments to W-shape webs are evaluated. The NRC was also informed that Stone & Webster is developing criteria to be utilized for the evaluation of web attachments to W-shapes, analogous to the criteria for evaluation of eccentric attachments to flange of W-shapes (NETM-27). From review of the design calculations of the annulus platform and elevation 14'-10", it was evident that the design which was performed in S&W Boston office in 1977 accounted for only an anticipated maximum gross appendages load of 30 kips acting at the center of span of the floor beam. This was done according to design specification requirements. However, according to the procedure, local stresses induced by attachments will remain unevaluated as long as the piping hanger loads remain below the assumed design fictitious gross loads. This item is unresolved pending resolution of this finding and the subsequent implication of other floor beams in safety related structures which are supporting pipe hangers without a specific evaluation of local attachment stresses (423/84-04-10).

The AWS Code D1.1-1972 to the 1973 Revision is the applicable welding code for structural steel welding. Site Quality Standard, Q.S. 10.17 established the program for control of Category I structural steel erection, including by reference Q.S. 9.2, Control of Structural Field Welding.

The inspector examined completed structural steel welds, including adjacent base metal, reviewed the applicable weld procedure (WP W1.1), the inprocess QC inspection plan, weld data sheets for specific welds, and welder and NDE qualification documentation. The above aspects of structural welding were compared to the requirements and program established by the AWS D1.1 Code and approved quality standards. The inspector also interviewed field quality control personnel with regard to the structural steel welding program and QC inspection documentation. Portions of the Main Steam Valve Building structural steel, refuel pool crane, hoist well platform and steam generator structural steel welds were examined. One material defect was identified by the NRC, a tear near a weld which was previously identified by QC and properly documented as a reject condition.

No violations were identified in the AWS structural steel welding or weld inspection area.

7.4 Conclusion

A review of supports, and structural steel installations was performed for the Millstone Nuclear Power Station - Unit No. 3. The review also encompassed engineering and design related activities in piping analysis, supports and structural steel design. The review of supports included large bore piping and conduit and cable tray supports. The review of pipe supports for the component cooling piping system, received a more detailed and multifaceted evaluation. It covered such aspects as document reviews, site personnel training, field quality control review, trend analysis and corrective action review, walkdown inspection of installations and review of related design activities. The review of conduit and cable tray supports and structural steel was limited to the evaluation of hardware installations for conformance to design drawings. Design related findings, of a more generic nature, arose as a result of this inspection. Specifically, unresolved item 84-04-06 relating to combination of pipe anchor loads; unresolved item 84-04-08 relating to decoupled seismic analysis of piping supported off structural steel; and unresolved item 84-04-10 relating to evaluation of local attachment stresses of steel wide flange beams supporting pipe hangers, should be addressed by the licensee to the extent required by its generic implications.

8.0 Electrical

8.1 Areas Inspected

As part of the electrical inspection performed at this site, the construction team members selected the component cooling water system as the system that each members would perform an inspection in their respective disciplines.

The electrical inspection of the component cooling water system consisted of verifying the installation of equipment from the 4160 volt bus, switchgear, motor control centers, cables, and raceways to the valve operators.

In addition to the component cooling water system, an inspection was made of the installation and the quality inspection records associated with the following: electrical switchgear, motor control centers, raceway and cable installations, equipment storage, protection and cleanliness requirements, nonconformance systems, audits and the turn-over controls associated with the electrical safety-related equipment.

8.2 Organization

The Stone & Webster Engineering Corporation (S&W) is providing the engineering, construction and inspection function for the field installation of the electrical equipment at this site. Also, the electrical connections from the field installed hardware to the nuclear steam system (NSS) supplied equipment is inspected by S&W quality control inspectors.

8.3 Findings

8.3.1 4160 Volt Buses and Switchgear

The inspector selected the following motor operated valves (MOV's) associated with the 3ENS-SWG-A and 3ENS-SWG-B, 4160 volt safety related buses for inspection and installation verification.

MOV's associated with the 4160 volt A bus were 45A, 48A, and 49A; while, 45B, 48B and 49B were associated with the 4160 volt, B bus. In each case, the inspector verified that quality control records for equiment installation, raceways, cable termination records and test data of the inspected hardware were complete and accepted by the responsible quality organization. The inspector, using a cable signal tracer, verified that selected cables were in the proper raceways and terminated in the designated locations.

During the inspection of the installed limitorque motor operator valves, 45, 48, and 49, the electrical component compartment of MOV 45A was exposed to the construction environment and dirt had penetrated into the electrical compartment area. In the same area of MOV 45A, ASCO controls had their sealed electrical penetrations open to the environment. Throughout the site, the inspector found electrical and instrumentation equipment not being protected from dirt as required by Stone and Webster Electrical Specification E350.

It appears that four types of conditions have occurred which have allowed dirt to enter electrical penetrations of installed equipment and equipment stored in place:

Conduit Connections

When conduit connections are made to electrical equipment the conduit covers are not put in place and dirt enters the electrical compartment through the open conduits.

Electrical Connector Protection

Plastic plugs and covers protecting the electrical penetration were broken or missing allowing dirt to enter the electrical compartment.

Conduit Installations

Conduits connected to electrical equipment from electrical junction boxes that were not covered. Dirt from the junction box enters the conduit and into the electrical connection area.

Interface Control

Electrical equipment turned over to the startup and test group was not being protected while construction work was being performed in the area. This was evident in the control room where dirt and dust were penetrating the electric equipment from area construction work. Also connector covers were missing from connectors with cable ends not protected in their plastic bags.

The inspection of the control room disclosed that electrical and instrumentation equipment was not being protected from construction dirt and dust. The control panels, both inside and outside, had dirt and dust covering the unprotected surfaces and metal grinding was in progress in proximity to an open control panel. A check of the environmental sensors for the area determined that the temperature indicator and the humidity controller being used were not within the site calibration program and were not calibrated. A calibration of the devices was performed by the licensee and found to be within ± 1% of the readings. The failure to properly protect the main control boards from dust, dirt, and humidity is contrary to the S&W specification for the Main Control Board (I245) and is a violation. The failure to protect electrical equipment from dirt and dust is contrary to S&W Electric Specification, E-350 and ANSI N45.2.2 and is a violation (423/84-04-11).

On March 14, 1984 the licensee issued a memorandum describing the NRC findings and the action that was to be taken by the site organization in maintaining the equipment as required by specification and vendor instructions. The licensee assigned a responsible person for various site areas with a 48 hour requirement to correct any items or area which is identified as unsatisfactory.

The NRC Construction Team completed its inspection on March 16, 1984, therefore the effectiveness of this memorandum could not be evaluated.

8.3.2 Equipment Quality Control Records

The inspector reviewed the quality control installation records for the following switchgear associated with the listed motor operated valves of the component cooling water system. The review verified compliance with the QA program and regulatory requirements.

Equipment Nc.	Voltage Rating	Associated MOV
3ENS*SWG-A	4160	
3EJS*US-3A	4160	45A, 48A, 49B
3EHS*MCC-3A1	480	
3EHS*MCC-3A2	480	
3EHS*SWG-B	4160	
3EHS*US-3B	4160	45B, 48B, 49A
3EHS*MCC-3B1	480	
3EHS*MCC-3B2	480	

No violations were identified.

8.3.3 Raceways and Cable Installations

The inspector reviewed the records for the raceways installations and verified by inspection that the raceways from the 4160 volt switchgear to the 480 volt motor control centers were complete and installed per the drawings.

The Orange (O) and Purple (P) cables were traced by the inspector from the 4160 volt switchgear to the 480 volt motor control centers (MCC). The cables had not been pulled from the 480 volt MCC cubicles to the selected MOV's of the component cooling water system listed in paragraph 8.3.1 of this report.

Using the cable pull tickets and a cable signal tracer, the inspector verified that the following cables were in the assigned raceways and were located as listed on the pull cards.

Cable Color	Cable No.	Raceway Nos.
(P)	3CCPBK040	3CK119PA, 3TK119P, 3TK125P, 3TK139P, 3TK136P
(O)	3ENSAOH3375	3CH4010B, 3TH3000, 3TH1020, 3TH4010, 3TH1050, 3TH1000, 3TH1070, 3TH1070, 3CH1000A
(P)	3ENSBPH375	3CH413PB, 3TH411P, 3TH100P, 3TH413P, 3CH100PB, 3TH102P, 3TH412P, 3TH301P
(O)	3EJSAOL210	3CL1070A, 3TL1060, 3TL1070, 3TL1100, 3CL1100A, 3TL1100, 3TL1150

The following cable pull tickets were reviewed and a visual walkdown of the cables was performed by the inspector, but the signal tracer was not used.

Cable Color	Cable No.	Raceway Nos.
(O)	3EJSAOL225	3CL1070C, 3CL1080A, 3TL1070, 3TL1080
(O)	3EJSAOL226	3CL1070D, 3CL108PB, 3TL1070, 3TL1080
(P)	3EJSBPL226	3TL108P, 3CL105PB, 3TL118P, 3TL105P
(P)	3EJSBPL226	3TL108P, 3CL105PB, 3TL118P, 3CL104PA, 3TL118P
(P)	3EJSBPL210	3CL108PA, 3TL104P, 3TL108P, 3CL105PB, 3TL118P

No violations were identified.

8.3.4 Nonconformance and Disposition Reporting System and Engieering and Design Coordination Report System

The inspector reviewed and verified that the nonconformance and disposition system (N&D's) and the Engineering and Design Coordination Reports (E&DCR's) in the electrical area were reviewed by management, closed in a reasonable time, action was completed and closed and that a Stone and Webster tracking system does identify N&D's that are not closed within 30 days.

The following electrical N&D's were selected for review to verify the type and timeliness of disposition action taken.

N&D No.	Action	Subject	Date Issued	Date Dispositioned	Date Closed
4768	Replace	Cable Installation	3/13/84	3/13/84	3/14/84
3878	Evaluation	Cable Insulation	12/1/84	OPEN	OPEN
4002	Evaluation	Damaged Load Center Breakers	1/5/84	OPEN	OPEN
4237	Rework	Motor Lead Termination	2/3/84	2/16/84	OPEN
2978	Repair	Substation Bus Wiring	9/1/83	9/8/83	11/15/83
4723	Evaluation	Aluminum Lugs in Containment	3/12/84	OPEN	OPEN
4720	Evaluation	Damage to Electrical Components	3/9/84	OPEN	OPEN

During inspection of the electrical components of the motor operated limitorque valves (MOV's) N&D 4723 and 4720 were written which identified generic problems within those two units. In paragraph 8.3.7 of this report the licensee program of MOV inspection and findings is discussed.

8.3.5 Engineering and Design Coordination Report (E&DCR's)

During the review of the following E&DCR's the inspector verified that the affected documents referenced were to be changed at the next revision cycle of the document. In most cases the electrical specification E-350 was being affected by the E&DCR's that were reviewed by the inspector.

E&DCR No.	Action	Subject	Date Opened	Date Closed
F-E-26751	Specification Change	Sealing Requirements	1/3/84	1/24/84
F-E-27098	Specification Change	MCC-Terminal Extension Problem	1/20/84	OPEN
F-E-27728	Specification Change	NNECO Termination	2/2/84	OPEN
F-E-29118	Specification	Splice Design	2/24/84	OPEN
F-E-29119	Specification	Splice Design	2/27/84	OPEN
F-E-28710	Specification Change	Termination	2/19/84	OPEN

The above E&DCR's are in the process of being closed and each is tracked by the licensee's and Stone and Webster's management system.

8.3.6 Quality Assurance Inspection Reports (QAIR's)

The inspector reviewed the following QAIR's for compliance with specification criteria. The attributes inspected by these QAIR's are as follows:

-- Installation Documents
-- Identification
-- Physical Integrity
-- Protective Measures
-- Connectors
-- Cleanliness
-- Seals
-- Grounding
-- Buswork
-- Protective Devices

In the listed IRs the attributes were acceptable and verified or the identified problems were reinspected and closed by the quality control organization.

IR No.	Equipment	Status
E3002278	3EJS*US-3A Switchgear	Completed 9/16/83
E3002923	3EJS*US-3A & 3B Switchgear	Completed 9/16/83
E3002367	3EJS*US-3B Switchgear	Completed 9/13/83
	3EJS*US-1A Switchgear	Completed 9/13/83
	3EJS*US-1B Switchgear	Completed 9/13/83

E3000406	3EJS*US-2A Switchgear	Completed 2/24/83
	3EJS*US-3B Switchgear	Completed 2/24/83
	3EJS*US-4A Switchgear	Completed 2/24/83
E1000173	3EHS*MCC-3A1 Switchgear	Completed 5/21/81
	3EHS*MCC-3A2 Switchgear	Completed 5/21/81
	3EHS*MCC-3B1 Switchgear	Completed 5/21/81
	3EHS*MCC-3B2 Switchgear	Completed 5/21/81
E3002604	3EHS*MCC-3A1 Switchgear	Completed 11/07/83
	3EHS*MCC-3A2 Switchgear	Completed 11/07/83
	3EHS*MCC-3B1 Switchgear	Completed 11/07/83
	3EHS*MCC-3B2 Switchgear	Completed 11/07/83

The above listed equipment was inspected by the inspector and found to be installed as required by drawings. The QAIR reports were complete and verified by the quality organization. Open items were listed, corrections identified and the date action was completed and accepted.

No violations were identified.

8.3.7 Inprocess Inspection

During an inspection of inprocess construction work, the inspector determined that the potting of a Litton/VEAM CIR connector being performed by the electrical craft was not in accordance with the vendors instruction sheet, VAP-201, nor was the E&DCR directions adequate for the craft to perform acceptable potting on this connector.

E&DCR F-E-16874, dated June 6, 1983, did not provide shelf life requirements for potting compound ingredients, storage requirements, method for cleaning the connector prior to potting and protection from the construction site environment during the potting and curing time. The E&DCR did discuss the site environmental conditions that must be complied with during the potting process but it appeared that the craft did not understand the E&DCR requirements and the supervisor did not provide the protective material required when potting in a dirty environment.

The licensee issued E&DCR F-E-29927 on March 16, 1984, which has corrected the problem identified above. The licensee has held special training sessions with the electrical craft and QC personnel who will perform this connector potting and inspection operation. Also, additional instruction has been given to the craft supervision for protecting the potting compound ingredients during the storage and use cycle.

Quality assurance inspection report IR E4A01121, March 9, 1984, listed the Litton/Veam connectors that have been rejected due to improper preparation.

The failure to follow or issue appropriate instructions is a violation (428/84-04-12).

8.3.8 Service Water System - Electrical QAIR's

During a review of the electrical QAIR's associated with the Service Water System the inspector noted that twenty-four out of twenty-six Limitorque MOV's failed to comply with vendor drawings.

NRC Information Notice 83-72, titled, "Environmental Qualification Testing Experience", addressed the Limitorque MOV problem associated with a construction deficiency reported as a 10 CFR 50.55(e) report for Docket Nos. 50-329 and 50-330.

Stone and Webster and Northeast Utilities Equipment Environmental Qualification Group prepared a program for the inspection of safety-related Limitorque MOV's. The inspection program included an inspection checklist which was used by the licensee's inspection organization to evaluate the condition of the safety-related Limitorque units at this site.

The testing began during February, 1984 and is expected to be completed by April, 1984. The conditions listed in the IR's appeared generic in nature and were repeated in the 24 Limitorque MOV's of the Service Water System. The following is just a sample of the type of problems listed in the IR's.

-- Nicked, broken and crushed wires
-- Voltage shield caught under cover
-- Compartment oily and dirty
-- Missing hardware
-- Wiring lugs damaged
-- Terminal points missing hardware, and
-- All 4 rotors chipped

At the completion of the inspection program, the licensee plans to issue a report which will, as a minimum, define the rework scope, the schedule and the method of performing the identified rework. The licensee will also address the method of testing and the qualification status of the Limitorque MOV's.

8.3.9 Electrical Audits

The inspector verified that audits of the electrical program were performed by the licensee and the Stone and Webster organizations. The audit defined the scope, instructions, findings and resolutions of findings.

Audit of Logic Diagrams No. 304 was conducted September 9, 1981. The audit check list covered the areas of format, requirements, documentation control and quality assurance criteria. Followup to findings appear adequate and timely.

Electrical Audit No. 14 was conducted from June 13 - July 13, 1983. The audit reviewed electrical E&DCR's, N&D's and a field walkdown of various plant areas. The audit group selected a sample of E&DCR's and N&D's for follow-up and verification. Findings were identified with close out actions listed in the follow-up audit report.

No violations were identified.

8.3.10 Site Interviews

The inspector conducted interviews with licensee and construction craft personnel in both the office and field work areas. The interviews were conducted to determine if those interviewed were knowledgeable in their job function, quaified for the work they were performing and if threats or harrassments had been made regarding their performance of a task due to schedules, time or any other reason.

The summary of nine interviews is that the personnel were qualified and trained for the jobs they were performing. The inspector's questions were answered without any fear of harassment from their management.

The quality assurance licensee personnel were well satisfied with their present management and indicated that the changes that occured a few months prior to this inspection had made significant improvements in the licensee's quality control organization.

The inspector did not identify any problems.

8.4 Conclusion

The licensee has established various tracking systems which identify both electrical problems and FSAR deviations. The systems are audited by management and it appears that timely corrective action is being taken.

The cleanliness and protection of electrical equipment requires increased management attention. The licensee was made aware of the concern and on March 14, 1984 the licensee issued a memorandum to initiate corrective actions.

8.5 Documents Reviewed

The following documentation was used by the inspector during this Construction Team Inspection effort.

-- Final Safety Analysis Report, Sections 7.0 and 8.0
-- Safety Evaluation Report, February 24, 1984
-- Institute of Electrical and Electronics Engineers (IEEE) Standards:

  - IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations

- IEEE Standard 308-1974, Standard Criteria for Class 1 Power Systems for Nuclear Power Generating Stations,

- IEEE Standard 317-1976, Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations

- IEEE Standard 323-1974, Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations

- IEEE Standard 323A-1975, Supplement to the Foreword of IEEE Standard 323-1974

- IEEE Standard 336-1971, Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment during the Construction of Nuclear Power Generating Stations

- IEEE Standard 344-1975, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

- IEEE Standard 379-1972, Trial Use for the Application of the Single Failure Criterion to Nuclear Power Generating Station Class 1E Systems

- IEEE Standard 382-1972 Standard for Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating stations

- IEEE Standard 384-1974, Trial use Standard Criteria for Separation of Class 1E Equipment and Circuits

- IEEE Standard 420-1973 (ANSI N41.17), Guide for Class IE Control Switchboards for Nuclear Power Generating Stations

-- Regulatory Guides (RG) 1.22, 1.29, 1.30, 1.32, 1.53, 1.75, 1.89. 1.100 and 1.131.

-- Licensee Engineering and Program Documentation

- Millstone 3 Program Manual, Revision F dated 4/6/81

- S&W Quality Assurance Program

- S&W Electrical Installation Specification E350

- Engineering Drawings EE-345, Cable Tray Supports

- 527 - Electrical Cable Schedule Information System

- Engineering Drawings EE-42B-57 Conduit Drawings

-- Field Construction Procedures (FCP's)

-	121	Equipment Storage History Cards	Rev 4	5/28/80
-	122	Preparation and Correction of Permanent Plant Records	Rev 1	3/5/82
-	124	Processing Category I Nonformance and Disposition Reports and Risk Releases	Rev 3 Rev 4 Rev 5 124.5-1	4/25/83 7/1/83 10/6/83 1/16/84
-	125	Receiving, Marking, Storage, and Control of Special Tools, Permanent Plant Test Equipment, and Consumable Materials received with Equipment Orders	Rev 2	6/16/81
-	151	Control and Documentation of Modifications to Vendor Supplied Equipment	Rev 2	3/18/82
-	297	Seismic Conduit Routing and Support Installation	Rev 1 297.1 297.1-2 Rev. 2 297.2-1 297.2-2	1/23/82 3/10/82 7/29/82 4/28/83 7/22/83 10/24/83
-	330	Installation of Cable in Ducts, Conduits, or Trays	Rev. 1 330.1-1	1/17/83 5/20/83

-- Quality Documentation

- Quality Standard QA-10.51ML, Revision 0, July 18, 1983 - Electric Equipment Installations
- Quality Standard - QS-10.53ML, Revision 0, June 1, 1983 - Cable Terminations and Connections
- Quality Standard - QS-14.2, Inspection Reporting System
- Quality Standard - QS-10.61ML, Quality Verification System
- Quality Standard - QS-15.1, Nonconformance and Disposition Report Field Quality Applications
- Quality Control Instruction - FM3-S10.51-010, Inspection of Equipment Subject to NNECO Pre-Turnover Checkout Program, March 22, 1982

- Inspection Hold Point Form T-272
- Inspection Attribute List T-225C
- QAD-10.17 - Cable Termination and Connection Inspections

9.0 Mechanical Equipment

9.1 Areas Inspected

Inspections of mechanical equipment were made based on identifying areas where past problems have been noted. This was accomplished by identifying a number of inspection targets suitable for the overall inspec.ion plan, inspect the as installed condition and reviewing the inspection records for evidence of problems. This was supplemented by repeating some of the holdpoint inspections in the presence of the NRC inspector.

In addition to the foregoing, a review was made of design conditions of some selected inspection targets and these were compared to the controlling documents such as the FSAR, name plate data, and the purchase specification. Concurrent with this comparison, the records were reviewed to assure that the licensee satisfied the requirements for receiving, storage, design and installation.

The equipment selected for this inspection is listed in Table 9-1.

TABLE 9-1

Selected Mechanical Equipment Inspection Targets

Title	Ident. No.	Code; Class	Location	Remarks
RX Plant Component Cooling Water Pumps	3CCP*P1 A, B, C	ASME III Class 3	Aux. Bldg. El. 24'-6"	Bingham
RX Plant Component Cooling Water Heat Exchangers	3CCP*E1 A, B, C	ASME III Class 3	Aux. Bldg. El. 24'-6"	YUBA
Cont. Isol. Valves; Flow Entering Containment	3CCP*MOV -45 A, B	ASME III Class 2	Outside Containment	Limitorque MOs
Cont. Isol. Valves; Flow Leaving Containment	3CCP*MOV -48 A, B	ASME III Class 2	Inside Containment	Limitorque MOs
Cont. Isol. Valves; Flow Leaving Containment	3CCPMOV -49 A, B	ASME III Class 2	Outside Containment	Limitorque MOs
RX Plant CCW Outlet Relief Valve Excess Letdown HX	3CCP*RV-39 (V413)	ASME III Class 3	Inside Containment El 10'	Lonergan
RX Plant CCW Outlet Relief Valve Seal Water Heat Exchanger	3CCP*RV.85 (V436)	ASME III Class 3	Aux. Bldg. El. 24'-6"	Lonergan
Pressurizer Safety Relief Valves	3RCS*SV-8010 A, B, C	ASME III Class 1	Inside Containment	Crosby
Charging Pumps - CVCS	3CHS*P3 A, B, C	ASME III Class 2	Aux. Bldg. El. 24'-6"	Pacific Pumps
Residual Heat Removal Pumps	3RHS*P1 A, B	ASME III Class 2	ESF Bldg. El. 4'-6"	Ingersoll Rand
Control Room HVAC Damper	3HVC*MOD 33 A, B	SMACN/A; ARI; AMCA	Control Bldg.	Motor Operated

*Safety Related

9.2 Organization

All mechanical equipment installations within the scope of inspection have been and will be accomplished by the Stone & Webster Corporation (S&W). Inspections of these installations are accomplished by the Field Quality Control Group of Stone and Webster. All design work for these installations has been done by Stone and Webster as well. Much design support is still being supplied by S&W's Boston office in the form of field modification decisions and backup calculations

Equipment Qualification (EQ) for Class 1E electrical equipment is coordinated by a NUSCO employee (the EQC). All of the procedures for the EQ program have been developed by S&W.

9.3 Findings

9.3.1 Pump Nozzle Loads and Pump Coupling Alignment

The item of primary interest is the proper alignment of the pump nozzle flanges with their mating pipe flanges. Misalignment of these flanges will introduce additional stress on the pump casing which is usually not included in the vendor's stress calculations nor in the A/E's piping analysis. In extreme cases, the pump casing distortion could lead to pump bearing failures. Coupling alignment is affected by these extra nozzle loads.

The coupling alignment of the Component Cooling Water Pump 3CCPP1B was checked with the piping connected on the suction and discharge nozzles. The piping was filled with water and another check was made with the suction flange disconnected. Data were obtained for the latest coupling alignment on this pump (P1B). The inspector reviewed E&DCR No. F-P-25170 (Engineering and Design Coordination Reports) for the spacers used on the suction flanges of two of the component cooling water pumps. The inspector reviewed S&W's procedure CMP-7.2, "Installation of Mechanical Equipment" Flange alignment checks were made at the suction and discharge of the component cooling pump P1B and the charging pump P1A. The coupling alignment checks of CCP-P1B showed parallel offset, angular alignment, and runouts to be within allowable ranges. The results of the alignment checks are tabulated in Table 9-2.

The E&DCR (No. F-P-25170) for the resolution of the experienced pump suction flange gap and misalignment problem, showed that all three pumps, 3CCP*P1A,B,C, had major gap problems as well as angular misalignment. It was decided to solve both problems via the use of custom fit spacer rings of tapered thickness to fit the gap as measured at each bolt hole. In the case of pump P-1B, this was not possible (too thin to manufacture). For this pump the suction piping was cut and refitted to align properly with the pump suction flange. The inspector questioned the propriety of using spacers for the given purpose, and the licensee investigated the matter. The project piping specification does not mention spacers at all nor does the more general S&W piping specifications. The ASME Code does not expressly forbid the use of spacers; however, the licensee indicated that, as a general rule, they will not allow the use of spacers, but that under difficult conditions, such as the ones related above, they may be used after obtaining engineering's approval. The inspector obtained the material certifications for the steel plates, from which the spacers were made, to verify that specified materials had been used for the spacers. The inspector had no further questions concerning this matter.

The review of mechanical equipment installation procedure CMP-7.2 revealed that there were no acceptance criteria for the alignment of pump (or any other mechanical equipment) nozzle flanges and their mating pipe flanges. There also is no "hold point" required for this installation activity. This means that there is no assurance that Field Quality Control will be involved at all in this activity. That FQC, in fact, is involved in this matter, became clear when the flange alignments were checked on the suction and discharge flanges of the CCP and Charging Pump. The means, used by the inspector to check the flange alignment, consisted of checking the free movement of all bolts in the bolt holes. These checks revealed that all bolts could move freely in their holes. The licensee indicated that FQC used the same method during their inspections. However, in view of the experienced difficulties with the nozzle alignments of these and other pumps (RHR pumps) it is necessary from a quality assurance point of view that acceptance criteria be defined in the installation procedure and that inspections be added to the procedure for this check. The failure to provide installation alignment and inspection acceptance criteria for pumps is a violation of 10 CFR 50, Appendix B, Criterion V (423/84-04-13).

TABLE 9-2

COUPLING ALIGNMENT CHECKS 3CCP*P1-B

Date of Check	3-8-84	3-14-84	1-12-84	1-12-84	
Alignment Checks	Before Disconnect Suction Piping	After Disconnect Suction Piping	IR-M4A00024 Before Pipe Connection	IR-M4A00024 After Pipe Connection	Allowables
Parallel Offset mills(rel)					4 mills TIR
At 12:00	0	0	0	0	
At 3:00	+2.5	+2.5	-3	-2	
At 6:00	0	-1	-6.5	-6	
At 9:00	-2.5	-3	-3.5	-4	
Angular Alignment: (mills)					6 mills TIR
At 12:00	0	0	0	0	
At 3:00	0	0	-1	-1	
At 6:00	0	+.5	0	0	
At 9:00	+.5	+1	+.5	+1	
Runouts: TIR					
Driver Rim	2	N/A		1	
Driver Face	.5	N/A		1	
Driven Rim	2	N/A		2	
Driven Face	4	N/A		3	
Coupling Gap, (inch)	6.982	7.035	6.998		7

9.3.2 Pump Nozzle Load Reconciliation

The piping stress analysis, as performed by the A/E for the connected suction and discharge piping, will yield nozzle loads which have to be reconciled with the allowable nozzle loads as calculated by the vendor for his equipment. Such reconciliation should be achieved for the same reasons as stated under 9.3.1 above. The inspectors reviewed the history of nozzle load reconciliation for the RHR Pumps and Heat Exchangers. He also reviewed the project procedures for nozzle load reconciliation to determine if, how, and when this is done. The existing project procedures, guiding the reconciliation effort, are:

(1) NETM-49, "Procedure for Verification/Resolution of Equipment Nozzle Loads and Valve Accelerations, MNPS - Unit 3", dated November 18, 1983.

(2) Project Test Program Directive 5.7, "Pressure Testing", prepared January 5, 1984, Rev. 0

(3) Project Test Program Directive 5.1, "Installation Completion and Turnover to NNECO", Rev. 2 prepared January 11, 1984

The first procedure determines basically how it should be done while the other two determine when it should be done. Procedure (1) instructs that the designer of the piping system must obtain vendor approval/concurrence of his imposed nozzle loads. It usually requires a few rounds of negotiations and calculations to arrive at acceptable loads.

The review of the nozzle load reconciliation history for the RHR Pump and Heat Exchangers indicate that procedure (1) above is followed and that reconciliation was achieved. The documentation used for this review is listed in Section 9.5, References.

The review of procedures (2) and (3) revealed that there are sufficient checks and balances available in these procedures to prevent the use of the equipment for testing without the proper degree of pipe support completion or prior to the achievement of stress reconciliation at the nozzles of the equipment.

The review of the stress reconciliation history of the service water system, a turned over system, revealed that special care is taken to assure that piping supports and snubbers, needed to take care of fluid dynamic loads (such as waterhammer) and piping stability, are completed and installed properly prior to turnover. All such supports and snubbers are listed together with their existing deficiencies. In the case of the Service Water System, the system was officially released on the basis of the presented data in the file.

No violations were identified.

9.3.3 Environmental Qualification for Class IE Electrical Equipment

The primary item of concern is the Equipment Qualification (EQ) program and the licensee's involvement. A good EQ program will be controlled by the licensee and will have good organization and procedures for the processing of the vendor's EQ reports. The status of any given hardware item should be readily available.

Another potential problem area is the revision of the FSAR tables for the environmental conditions resulting from the implementation of Regulatory Guide 1.89. Some "mild environments" may have changed to "harsh environments". The concern is the responsiveness of the EQ organization in revising the FSAR tables and in revising the specifications of affected equipment. There should be a follow through with the vendor to determine the impact of the environmental changes on the EQ Status of the particular equipment.

The inspector reviewed existing procedures to determine how the licensee conducts their EQ program and the licensee's involvement. He also reviewed procedures and data to determine if the environmental conditions have been revised in accordance with Regulatory Guide 1.89, as interpreted by NUREG 588, and that these revised conditions have found their way into the FSAR and the effected equipment specifications. He also, reviewed the EQ file for the motor drivers of the Component Cooling Water Pumps (Reactor Plant) to determine how effectively the above mentioned procedures are being implemented. Finally, the inspector reviewed a typical EQ report where the environmental conditions for the equipment changed from mild to harsh.

The inspector obtained and reviewed S&W document NEAM-112, Rev. 2, dated December 31, 1980, entitled "Environmental Qualification of Class 1E Equipment". In this document the EQ program is delineated and it shows that NUSCO is committed to fulfill "the requirements of IEEE 323-1974 and its daughter standards as endorsed by Regulatory Guide 1.89 and interpreted by NUREG 588".

The entire program is coordinated by the Equipment Qualification Coordinator (EQC). The EQC is a NUSCO employee.

Equipment Specification revisions are to be accomplished in accordance with Attachment 1A of NEAM-112 which describes in detail how any new environmental conditions are to be incorporated in the specification.

The new environmental design conditions have been developed some time ago and have been consolidated in document NETM-26 REV 1, "Environmental Design Conditions" dated October 29, 1982. The data of NETM-26 were put into Section 3.11 of the FSAR, according to the EQC. A subsequent comparison of the data in NETM-26 with those in FSAR section 3.11 showed this to be the case. The Responsible Engineer (RE) incorporates these new environmental conditions in the pertinent equipment specifications.

An example of equipment for which the environment changed from "mild" to "harsh", was identified. Westinghouse supplied pressure transmitters, which were not qualified for High Energy Line Break (HELB) environments as required by R.G. 1.89 and were replaced by Rosemount transmitters as supplied under existing specification 2472.510-662. These Rosemount transmitters were qualified to perform in this harsh environment. The change was accomplished via PCR No. S-323B.

The EQ file for the motors of the component cooling water pumps was perused. This file has accumulated all of the EQ program material and correspondence for the motor specifications to which these motors belong and demonstrates that these motors were qualified for their environment. The file was well organized and contained the EQ Reports as submitted by the vendor and the review material as developed by the EQ organization in accordance with NEAM-112.

Discussions with the EQC revealed that NUSCO and SWEC are developing a computerized EQ program status report. This report will identify the equipment within the EQ program by location in environmental zones and their overall status in the completion of EQ.

No violations were identified.

9.3.4 Design Control

What is shown in the FSAR may not agree with what is shown for the same item in the associated specification, drawings, instruction manual, or on the name plate of the equipment. Comparison of the data from all of the sources for selected hardware targets should supply some impression of how good design control is. In the case of design changes, there should be good followup in the revision of the specification and the construction drawings.

The inspector collected and compiled design and service data from equipment nameplates, the equipment specifications, pump test curves, and operating/instruction manuals, for a number of inspection targets, for comparison with the data in the FSAR. The results are shown in Table 9-3 through 9-9. For the FSAR comparisons, apart from some minor discrepancies, all data from different sources are identical.

TABLE 9-3

FSAR COMPARISON
COMPONENT COOLING PUMPS

	FSAR	Name Plate	SPEC-M336	Test Curve
Identification No.		3CCP-P1B	3CCP-P1B	3CCP-P1B
Design Pressure, PSIG	250	250	250	
Design Temperature, °F	150	150	150	
Design Capacity, gpm	8100	8100	8100	8100
rpm		1760		
No. of stages		1	1	
Size		14x14x18	14x14x18	
Hydrost.Test Press, psig		375	375	
Head, FT, TDH		284	284	284
N Stamp		yes	yes	
ASME III Class	3	3	3	
Power @ rated gpm			581	650(BHP)
Req'd/Avail NPSH-FT			45/66.8	45/-
Motor Driver				
Rated HP		800	750	
Volts		4000		
Amps		104		
rpm		1780	1760	
Phases of Power		3		
Frequency, cycles		60		
Code		F		
Frame		8210S		
Insulation Type		K		
Time rating		Cont.		

TABLE 9-4

COMPONENT COOLING HEAT EXCHANGERS
FSAR COMPARISON

		FSAR	Name Plate E-1B	SPEC-2214 413-446	OIM*	Spec + OIM
Circ Fluid	shell	Comp Clng Wtr		Comp Clng Wtr	Comp Clng Wtr	
	tube	Service Wtr		Service Wtr	Service Wtr	
Fluid Flow	shell	4,050,000		4,050,000	4,050,000	
lbs/hr	tube	4,000,000		4,000,000	4,000,000	
Temp.In.°F	shell			113.8	113.8	
	tube			75	75	
Temp.Out°F	shell			95	95	
	tube			94	94	
Oper.Press	shell			115@inlet	115@inlet	
psig	tube			65@inlet	65@inlet	
Number of				Split Flow	Split Flow	
passes				2	2	
Velocity,					7	
ft/sec/tube						
Press Drop	shell			15 max.	15 all;15calc	
psi	tube			20 max	20 all;10calc	
Fouling	shell				.0005	
Resist	tube				.0001	
Heat Exchanged,				$76(10)^6$	$76(10)^6$	
BTU/Hr						
MTD °F					19.2	
Design P,	shell	150	165	150	150	
psig	tube	100	100	100	100	
Test P, psi			250		225	
			150		150	
Design T, °F		200		200	200	
		200		200	200	
Connections, in.				24	24	150 lb RF
Shell in/out				24	24	150 lb RF
Channel in/out					24	
					24	
Code Reqts					ASME III	TEMA A
					Class 3	Cl. "R"
Allow Cont.				35F Inlet TS	35F Inlet TS	
Operation for				150F Inlet SS	150F Inlet SS	
Min. Hydro. Test					70F	
Temp °F					Shell side	
Serial No.			73N005-1B			
N Stamp,						
Class 3			Yes			
Identification			3CCP-E1B	3CCP-E1A,B,C	EA-1,A,B,C	

*Data sheet dated 5/10/73

TABLE 9-5
RHR PUMPS, 3RHS*P1A
FSAR COMPARISON

	FSAR	Name Plate	SPEC	OIM	Test Curve
Identification No.		3RHS*P1A			3RHS*P1A
Design Press, PSIG	600			600	
Design Temp, °F	400			400	
Design Cap, gpm	4000	4000	4000/5500	4000/5500	4000/5500
rpm		1780		1766@F.L.	1780
No. of Stages					
Size		8x20			8x20
Hydrost Test Pr. psig		936			
Head, FT	350	350		350/260	360/280
N Stamp		yes			
ASME III Class					
Power @ rated gpm	400				
Req;d/Avail NPSH-FT	18/				
Motor Driver					
Rated HP		450	450	450	
Volts		4000	4000		
Amps		56			
rpm		1766	1800 (synchr)	1766@F.L.	
Phases		3	3		
Freq., cycles		60	60		
Code					
Frame		5010P39		5010P39	
Insul Type					
Time Rating		Cont 90°C			

TABLE 9-6
FSAR Comparison
Safety Relief Valve
Seal Water Heat Exchanger

	FSAR	Name Plate	Spec M-186	Vendor Dwg*
Ident. No.		3CCP*RV85	3CCP*RV85	3CCP*RV85
Manufacturer		Lonergan	Lonergan	Lonergan
Model		LCT-11	LCT-11	LCT-11
Size, No., 0, inch		3/4 x 1	3/4 x 1	3/4 x 1
Serial No.		407487-8-1		
Capacity, gpm		12	12	
Set Press, psig	Not** Available	150	150	150
Back Press, psig		0	0	0
ΔP, psi, cold		150	150	150
Relief Pr., psig			150	
Design Pr., psig			150	
Design T, °F			150	
ASME III, class			3	2
Seismic Cat.			1	1

*DWG No. A-2375, REV F, 12-7-72
**Normally shown on PEID or Flow Diagram in FSAR but not by SEW

TABLE 9-7
Safety Relief Valve
Excess Letdown Heat Exchanger

	FSAR	Name Plate	Spec M-186	Vendor Dwg*
Ident. No.		3CCP*RV39	3CCP*RV39	3CCP*RV39
Manufacturer		Lonergan	Lonergan	Lonergan
Model		LCT-11	LCT-11	LCT-11
Size, No., O, inch		3/4 x 1	3/4 x 1	3/4 x 1
Serial No.		407487-1-1		
Capacity, gpm		12	12	
Set Press, psig	Not** Available	150	150	150
Back Press, psig		0	0	0
ΔP, psi, cold		150	150	150
Relief Pr., psig			150	
Design Pr., psig			150	
Design T, °F			150	
ASME III, class			3	2
Seismic Cat.			1	1

*DWG No. A-2375, REV F, 12-7-72
**Normally shown on PEID or Flow Diagram in FSAR but not by S&W

Table 9-8
Pressurizer Safety Valves
FSAR Comparison

	FSAR	Name Plate	Spec *	Vendor Dwg	S&W Dwg**
Identification No.		6RV88MSC	SV-8010	6RV88MSC	SV8010
Manufacturer		Crosby		Crosby	
Model		HB86-BP		HB-BP-86	
Size, inches nom.			6x6	6x6	6x6
Serial No.		N-56964-07-0060			
Capacity, lbs/hr		407,843			
Cap w/3% overpr. lbs/hr	420,000	420,006	420,000		
Set Press. psig	2485		2485		2485
Relief Press. psig					
Design Pr.Inlet,psig		2485	2485		2485
Design Pr.Outlet,psig			500		
Design T.Inlet °F	650		650		680
Design T.Outlet °F			570		
ASME III, Class		1	1	1	
N Stamp		yes	yes		

* W Spec G-678838
**S&W DWG No. 12179-FSK-25-1E

Table 9-9
Charging Pumps, 3 CHS-P1A (Pacific Pumps)

	FSAR	Name Plate	Spec	OIM	Test Curve
Identification No.		NEU-CSA-PCH-01		NEU-CSA-PCH-01	
Design Press, psig	2800/-	2800/200		2800/200	
Design Temp °F	300/-	300/300		300/300	
Design Cap, gpm	150/-	150/550		150/550	150/555
rpm		4850		4850	4860/4840
No. of stages					11
Size		2½ RL			2½ RL
Hydrost Test Pr,psig		4200/380			
Head, FT	5800/-	5800/1400		5800/1400	5800/1400
N Stamp		yes			
ASME III Class		2	2		
Power @ rated gpm				670 max	490/660
Req'dAvail NPSH-FT					
Motor Driver					Westinghouse
Rated HP		600		600	
Volts		4000	4000	4000	
Amps		76(FL)		76(FL)	
rpm		1774		1774(FL)	
Phases		3	3	3	
Freq., cycles		60	60	60	
Code		G		G	
Frame		5808-S		5808-S	
Insul.Type		Class B Amb 40°C	Class B AMB 40°C		
Time Rating		Cont. 90°C Rise	Cont. 90°C Rise		

9.3.5 Field Modifications

Many field modifications are initiated to solve physical interference problems. The primary concern for any such modification is the involvement of the designer in evaluating the impact of the modification on his design intent. The engineers in the field may not be aware of the consequences of the modification in terms of design intent.

Design control in such matters can be achieved only if good control procedures exist. In most cases backup calculations should be made to support the decision for modification.

In the course of the installation inspection of the mechanical equipment inspection targets, as listed above, the inspector identified some changes which had been made. These changes were examined to determine if they received engineering review and approval prior to their adoption and to determine if the associated drawings and documents reflect the as built status.

One of the support plates of the RHR pump support assembly was found to have a chamfered corner isolating an anchor bolt which, in its isolated condition, cannot participate in load bearing. Examination of S&W Dwg. No. 12179-EV-52A-5 revealed that this bolt had been removed from the drawing. E&DCR-PS-1957 had been written on 12-1-78 to investigate the problem of this and other bolts. Calculations were made and it was determined that the as built status was acceptable.

Motor operated valve (MOV)48-A&B were found to be mounted in a position rotated 180° from the position intended by the vendor. This puts the motor operator (Limitorque) in the horizontal position; thereby, increasing the seismic loading on the piping in which it is mounted. The inspector was advised that this was done to resolve a physical interference problem. E&DCR-P-P-5699 was written on 5-25-83 to resolve this problem. A calculation was made to determine how pipe stresses would be affected by this change. Load increases were found to be acceptable. The calculation (calc. No. 12179-NP(B)-X10725) was reviewed by an independent reviewer and signed by him. The acceptability of the new position was also discussed with Henry Pratt Co., the manufacturer. Pratt responded with a Telex accepting the new valve position.

9.3.6 Receiving Inspection and Storage

The concern is how well the equipment was inspected upon arrival at the site and how it was stored prior to installation. Were the manufacturer's instructions for storage followed? Was there a nitrogen purge requirement for the heat exchangers while in storage? How good are the records? Is QC involved? Some answers can be obtained from the history records. Others, from the way the equipment, still in the warehouse, is being treated by the warehousing people.

The following receiving inspection records were reviewed:

Equipment	QA Inspection Report No.
Comp. Cooling Water Pumps	M7050990, 6-3-77
Comp. Cooling Water Pumps Motors	E9050920, 8-7-79
Comp. Cooling Water Heat Exch. 1A	M7051360, 9-8-77
Comp. Cooling Water Heat Exch. 1B	M7051485, 9-22-77
Comp. Cooling Water Heat Exch. 1C	M7051548, 10-03-77
Resid. Heat Removal Pumps, 1A,B	M7051477, 9-26-77
Charging Pumps, 3A,B,C	M9000041, 7-31-79*

*This is a pre-installation verification IR, which indicates that receiving inspection was satisfactory as well as this inspection.

All of the above records indicated that the equipment was inspected for the required and listed inspections, including shipping damage of containers and equipment, identification and marking of equipment, protective covers and seals, cleanliness, and documentation. Some unsatisfactory findings were assigned action. Followup on these action items was noted on the same report in all cases. It was noted, however, that a dimensional check of the equipment for system or structural interface items was not made for any of the equipment items nor was it required. A Nonconformance and Disposition Report, N&D 1482 and 800, for the CCW-Heat Exchanger E1B, deals with the problem of inadequate bolt holes as found prior to the installation of the equipment, 4 years later. Another 2 years went by before the problem was finally resolved to everbody's satisfaction. The manufacturer, Yuba Heat Transfer Co., was kept informed of proposed actions and granted their approval of the design modifications as executed by others.

The following storage records were reviewed:

Equipment	Record	Date
Component C.W. Pumps, P1A,B,C	ESHC*	6-6-77
Component C.W. HXs, E-1A	ESHC	9-9-77
Component C.W. HXs, E-1B	ESHC	9-23-77
Component C.W. HXs, E-1C	ESHC	10-04-77
Charging Pumps P-3A,B,C	ESHC	9-22-77
Pressurizer Safety Valves, SV-8010,A,B,C	ESHC	1-06-77
Component C.W. Pumps, P1A,B,C	IR-M3001237	10-06-83
CCW Heat Exchangers, E1A,B,C	IR-M2000381	6-25-82
CCW Heat Exchangers, E1A,B,C	IR-M3001238	10-06-83

*Equipment Storage History Card (ESHC), form T-141

The ESHCs for the CCW Pumps call for the dessicant in the suction and discharge nozzle to be checked every 6 months but the signoffs on the card do not appear every 6 months.

The CCW Heat Exchangers were required to have a Nitrogen purge while in storage. The ESHCs for this equipment indicate that checks on the N-purge were made at the required intervals from the time of receipt until the carry-in date. The units E-1, A, B, C were stored in the yard for a while, but the N-purge was continued. After removal of the N-purge (July 1981) the units were not left without checks for cleanliness. The listed inspection reports indicate that cleanliness checks have been made in June 1982 and October 1983.

A similar cleanliness check was made for the CCW Pumps after carry-in on 10-06-83. The inspector inquired if there was a purge release for the equipment, such as the CCW Heat Exchangers. There is such a release (an internal office memorandum). Such releases are made by the responsible engineer. In the case of the CCW Heat Exchangers these releases were made on 7-8-81 (for E-1A,& C) and on 7-15-81 (for E-1B). The pressurizer relief valves were found in warehouse #2 correctly stored (level B). This level has heat control but no humidity control. The valves were standing up in their wooden crates on the warehouse floor in a wooden storage section. Cleanliness was evident in the area, as it was throughout the warehouse. Labeling and marking were found to be correct. The equipment looked clean and undamaged. It appeared well protected from inadvertent physical abuse. The ESHC for the valves indicate that all required checks had been made at the correct intervals.

The ESHC for the Charging Pumps (3) indicate that all checks were made at the correct intervals.

No violations were identified.

9.3.7 Anchor Bolts for Mechanical Equipment Supports

Examinations were made by the NRC of selected mechanical equipment supports to assure that they were properly installed. This was accomplished by torqueing selected baseplate anchor bolts on the component cooling water pump, P-1B, and the heat exchanger E-1C to 80% of their required torque.

Structural steel drawings were checked for size and type of bolts and referenced to the pertinent Bolt Joint Data Sheet. Checks were made against the Bolt Joint Data Sheet for bolt identification and material marking. Further checks were made of the anchor bolt arrangements on one of the RHR pump support feet to determine if the correct material was used.

Anchor bolts F5,6,7 and 8 of CCP-P1B as shown in detail J-1-1B of Dwg. CT-CCP-P1A-C, sheet 1 of 2, were torqued to 80% of their required value. No nut rotation was observed. It was noted that the drawings, used to identify the bolts, were "black on green" as required for construction drawings used in the field. The torque wrench, No. 05313, showed that its re-calibration was due on 3-10-84 or 2 days after the measurements were taken.

Anchor bolts A262 and A264 of component cooling water heat exchanger E1-C, as shown on detail AG of control isometric drawing CH-CCP-SP-1C, were torqued to 80% of the required value (1000-1050 ft/lb). No nut rotation was observed, It was noted that the drawings used to identify the bolts, were "black on green" as required for construction drawings used in the field. The torque wrench (sticker No. 05336) showed a re-calibration due date of April 2, 1984. Heat code numbers as stamped on the tested bolts and nuts were K1 and F0, respectively. This information agreed with the numbers as specified on the mentioned drawings. The same observations were made for anchor bolts A266 and A268 as shown on BJ4-1, detail A-H.

Anchor bolts 87, 88, 89, and 90, as shown on sheet 3 of 7 of control drawing 12179-CH-CCP-SP-1C in detail J-3JDS, were torqued to 80% of their required value (2450-2550 ft/lb), or approximately 2000 ft/lb. No nut rotation was observed except for bolt No. 88. The inspector observed 20-30 degrees of nut rotation at an applied torque of 2000 ft/lb. A scribe mark was made on the nut of No. 88 to observe if further rotation would occur by applying additional torque up to 2439 ft/lb. No further nut rotation was observed after applying the additional torque. A subsequent calculation done by S&W engineering showed that nut rotation would have been in the order of 22 degrees had actual nut tightening, before the application of the additional torque, been for the 2000 ft/lb only, as applied earlier in the test.

A hydraulic wrench, manufactured by Raymond Engineering Co., was used for this torque test. It had been calibrated on October 23, 1983, and was due for recalibration on April 20, 1984. A pressure gauge, indicating psi, provides the measured ft/lb during the torque application. The relationship between psi and ft/lb of measured torque is linear; 2500 ft/lb is equivalent to 4100 psi. The heat code stamping for all units was N-1 and A490 (material) which agreed with the data on the drawing.

Anchor bolt arrangement of the pump feet of RHR pump 3RHS-P1A was compared with that shown on S&W Dwg. No. 12179-EV-52A-5. No significant deviations were observed. Inspection Record M2000513, dated 8-24-82, indicates that all bolts (except F23) were torqued to 460 ft/lbs for the bolts connecting the tiedown plate to the guide plate, as required by drawing EV-52A-5. Similarly, the 3 bolts, connecting the pump feet to the alignment plate, were torqued to 1020 ft/lbs as required by Dwg. EV-52A-5. The inspector noted that both groups of bolts had bolt marking B-7 which agrees with the material shown on Dwg. EV-52A-5.

The basic anchor bolt arrangement of the RHR pump wall support plate agreed basically with that shown on S&W Dwg. No. 12179-EV-52A-5. The plate, however, has two chamfered top corners while one of the bolts in these corners was completely free from the plate and, obviously, was not carrying any support load. Drawing EV-52A-5 shows this bolt missing which agrees with the observation that this bolt is nonload bearing. Further inquiry by the inspector revealed that this problem had been addressed in E&DCR No. PS-1957, dated 12-1-78.

Approval had been granted by engineering to ignore the two corner bolts for load bearing purposes. Calculations were made to support this position.

No violations were identified.

9.3.8 Component Cooling Water Heat Exchanger Cleanliness

The Component Cooling Water Heat Exchangers were selected for verification of its storage protection. While equipment is in storage, before it is installed, there are protective requirements imposed to preclude deterioration. Once the equipment is installed, the storage environment changes along with the ability to protect the equipment. The inspector determined what the corrosion protection requirements were for the heat exchanger and requested that the shell and tube sides be opened for his inspection.

The operation and maintenance instruction manual (OIM 446-1A) of the manufacturer, Yuba Heat Transfer Corp., indicates under paragraph 5.1 of the general instructions that "it is preferred in most cases, and essential in the case of carbon steel tubed units, that nitrogen be admitted to the shell during drainage (after hydro) to keep air out of the unit". The tubes of these units are copper-nickel tubes. The Yuba recommendation, therefore, is "preferred" rather than "essential". The inspector found that nitrogen is not admitted to the subject heat exchangers after such drainage. He inquired if there existed a procedure to authorize the ommission of a nitrogen purge, and act contrary to the recommendation of the manufacturer. There does not exist an official procedure for this purpose. There is, however, an understanding that a memorandum (an IOC) is to be generated by the responsible engineers to document the removal of a purge at the time the equipment is removed from storage. Such an IOC was issued, (Inter Office Correspondence) in the case of the subject heat exchangers, on July 8, 1981 indicating that a nitrogen purge was no longer required after installation for units 1A and 1C. The IOC for unit 1B was issued on July 15, 1981. The IOC's indicate that authorization was given for the purge removal but there was no indication that there was any backup investigation for the decision to remove the purge.

Since all of the heat exchangers are connected to the system piping and since there are no manholes (or handholes) on the shell side, it was decided to inspect only the tube side by removing one of the end covers of unit E-1B. This was done, at a convenient moment in the ongoing hydrostatic test program of these units, after draining the water on the tube side. The plenum surfaces and the tubes were inspected for evidence of corrosion such as pitting or scales. There was no such evidence; the plenum and tubes appeared very clean.

A review of inspection reports (IR's), pertaining to the subject heat exchangers, was made to determine what kind of cleanliness inspections were performed after carry-in of the units and what the findings were, if any. IRs reviewed were:

IR No./Date	Hx Unit No.	Observations
M2000381 6-25-82	E-1A,B	Checked through channel inlet (N-1) and outlet (N-2) OK
M3001217 9-23-83	E-1A,B	Check through nozzle C5 (vent) OK Done prior to field weld FW0014E004
M3001238 10-06-83	E-1A,B,C	Check through nozzle C5&C6. OK
M3001393 11-02-83	E-1A,B,C	Check OK through nozzles FW8&6 for E1A; FW9&7 foe E1B; FW3&9 for E1C

These visual observations all indicate that cleanliness was not a problem.

No violations were identified.

9.3.9 Mechanical Equipment Quality Assurance Audits

The inspector reviewed the Stone and Webster (S&W) quality assurance requirements for the mechanical equipment area and reviewed prior audits to verify that the program was being implemented.

S&W's Quality Assurance manual, QAD 18.1, REV C, paragraph 4.21 shows compliance with the 18 criteria of 10 CFR 50, Appendix B, which implies that the entire QA program is to be audited every year. Quality Standard QA 18.1, Rev. B, paragraph 4.5.1A, states: "Applicable elements of the S&W (internal) quality assurance program shall be audited at least annually". Audit reports for several different audits on mechanical equipment installation were shown to the inspector. These audits were held at approximately yearly intervals. There were no significant findings in the last two audit reports.

9.4 Conclusions

Reference 9.3.1 Pump Nozzle Loads and Pump Coupling Alignment

The coupling alignment data obtained present indirect evidence that the alignment problems at the suction flanges have been successfully resolved, at least for pump P1B, With regard to the spacers the licensee has committed, via the issue of a new E&DCR (F-P-29929), to add a paragraph to specification M968 (on pipe installation) which, in special cases, will permit the use of spacers at flanged connections "with the prior approval by the Engineers".

The licensee has not provided adequate instructions nor inspection criteria for the equipment flange alignment. However, the licensee, also, has committed, via the issue of another new E&DCR (No. F-P-29930), to formulate acceptance criteria for flange alignments at the pump nozzles. Notwithstanding this fast, effective response by the licensee, the facts indicate a violation of the requirements under 10 CFR 50, Appendix B, Criteria V.

Reference: 9.3.2 Pump Nozzle Load Reconciliation

Procedures are in place to guide the reconciliation efforts on equipment nozzles. The review of the RHR pump history and the turnover documents on the service water system reveal that the procedures are used and are effective.

Reference: 9.3.3 Environmental Qualification for Class 1E Electrical Equipment

NUSCO appears to have a good EQ program. They have a good grip on the management of the program as evidenced by the fact that the EQC is a NUSCO Employee. EQ and the reviews of these reports are well documented and controlled. The new environmental conditions resulting from the implementation of RG 1.89 have been placed into the FSAR and the equipment specifications affected by these changes in environment. The EQ program is considered a strength.

Reference: 9.3.4 FSAR Comparisons

For the FSAR comparisons, apart from some minor discrepancies, all data from different sources are identical, indicating good design control.

Reference: 9.3.5 Field Modifications

In both identified changes, there was good follow up via E&DCRs. In both cases, calculations were made to support the change. Calculations were reviewed by an independent reviewer and, in the case of the MOVs, the manufacturer was contacted to obtain approval for the new valve position. All of these findings add up to good design control and quality assurance for the areas inspected.

Reference: 9.3.6 Receiving Inspection and Storage

Good quality control of receiving inspection and storage of equipment was evident from the samples taken. Followup on negative findings was thorough and efficient.

Reference: 9.3.7 Anchor Bolts for Mechanical Equipment Supports (ME)

No significant deviations, omissions or errors were found. The licensee appears to have good drawing control, quality control during installation and good tool calibration control as observed in relation to anchor bolt installations for ME supports within the inspection scope.

Reference: 9.3.8 Component Cooling Water Heat Exchanger Cleanliness

The subject heat exchangers were supplied with a nitrogen purge for more than 4 years while in storage, in the warehouse and, later, also in the yard. After the units were carried into their final locations (1981) the purge was removed even though the manufacturer prefers to keep the air out of these units during their storage in situ. There is no official procedure to guide the authorization of purge removals. The visual inspection of the tube side of unit E-1B, and the inspection reports reviewed, indicate that all is well with cleanliness.

Reference: 9.3.9 Mechanical Equipment Quality Assurance Audits

The licensee is meeting the audit requirements as specified in their own QA manuals as well as those in 10 CFR 50, Appendix B.

9.5 Documents Reviewed

9.5.1 Equipment Storage History Cards (ESHC)

(1) ESCH for 3CCP*P1B, dated 6-6-77
(2) ESCH for 3CCP*E1B, dated 9-23-77; 10 cards
(3) ESCH for 3CHS*P3A,B,C (Charging Pumps)
(4) ESCH for 3RCS*P3A,B,C, dated 1-6-77; Pressurizer Safety Valves
(5) ESCH for 3CCP*MOVs - 45A,B; 48A,B; 49A,B, dated 1-21-77 (Containment Isolation Valves)

9.5.2 Component Cooling Water Pumps, 3CCP*P1A,B,C

(1) Drawing FD-230420/22, Rev. 2, Bingham Willamette Co. 9-20-74, Outline Drawing
(2) Drawing B33203, Rev. A, Bingham, Cross Sectional, 5-30-75
(3) Memo Change Item #5 for P.O. 2214.412.336-9, dated 5-5-80, revised seismic calculations for latest pump nozzle loads
(4) Operation Instruction Manual, OIM 336-1A, for 3CCP-P1A,B,C, P.O. 2214.412-336
(5) E&DCR No. F-P-25170; 12-8-83, "Mismatch CCP Pump Suction", approved 12-23-83, problem solved by applying "spacers".
(6) Inspection Report IR 3000001, 1-3-83, Levelness Check and Pre Grout Coupling Alignment
(7) Inspection Report IR-M-4A00024, 1-30-84, Coupling Alignments Before and After Pipe Connection
(8) Inspection Report IR-M-2000698, 11-11-82, Levelness Readings on Base Pad
(9) Pump Performance Curves, S&W Transmittal dated 6-22-1976, for 3CCP*1A,B,C
(10) Document P-CMP 7.2, Rev. 0, 8-19-83, S&W "Construction Methods Procedure, Installation of Mechanical Equipment"

9.5.3 Component Cooling Water Heat Exchanger 3CCP*E1A,B,C

(1) OIM 446-1A, "Operating and Maintenance Manual for Reactor Plant Component Cooling Water Heat Exchangers", Yuba Heat Transfer Corp., S&W P.O. 2214.413-446.
(2) Specification M446, Yuba, 5-10-73
(3) Dwg. 73N-005-1-1, rev. 7, dated 9-22-76, Yuba, outline drawing for EA-1A,B,C, size 49-504, type CGN
(4) Dwg. No. 12179-C1-SWP-23, 3 sheets, rev. 1, 7-24-82, piping isometric for piping connected to heat exchangers, S&W, Work Package No. 410-2308.
(5) Dwg. No. 12179-EC-36G-7, rev. 7, 3-19-83, S&W "Equipment Support Details Floor Slabs Auxiliary Building"
(6) Dwg. no. 12179-EV-42A-6, 4-20-82, S&W, "Reactor Plant Component Cooling Heat Exchanger Supports", sheets 1 and 2
(7) Inspection Report IR M7051360, 9-8-77, E-1A all re-inspected items satisfactory on 10-25-77.
(8) Inspection Report, IR M3000779, 7-6-83, E-1A,B,C, N&D 1482 - enlargement of bolt holes in heat exchanger feet.
(9) E&DCR F-J-17434, 6-14-83, E-1A,B,C; deals with enlargement of bolt holes
(10) Memorandum A. M. Prusi to Distribution, dated August 24, 1981, "Purge Removal from Equipment", accompanied by two "Interoffice Correspondence" memorandums releasing the purge on 3CCP*E1,A,B,C

9.5.4 Containment Isolation Valves for RX Plant CCW 3CCP* MOV45A,B; 48A,B; 49A,B

(1) Dwg. C7194, rev. 1, 1-5-80, Henry Pratt Co., "8 through 14 - 1400 Nuclear Valve cross Section and Material List", ASME III Cl. 2, for 10" butterfly valve, 3CCP*MOV45A
(2) Inspection Report IR X3000383, 6-4-83, 3CCP*MOV48A,B; 49A; report shows large number of rejects including mentioned valves. Involved with E2DCR2713 dealing with actual/potential damage and seal conditions.

9.5.5 Relief Valves of RX Plant CCW Heat Exchanger 3CCP*RV-39 and 85

(1) Dwg. No. A-2375, rev. F, 12-7-72, Lonergan, "Composite Drawing Model LCT-11, Relief Valve (flanged) for nuclear service", for 3CCP*RV-39 and 85.

9.5.6 Pressurized Safety Valves; 3RCS*SV8010A,B,C

(1) Equipment Specification 952182, rev. 2, 10-15-74, Westinghouse, "Pressurizer Safety Valves"
(2) Dwg. 12179-FSK-25-1E, rev. 11, 11-17-83, S&W, "Flow Diagram Reactor Coolant"
(3) Dwg. DS-C-56964-7, rev. A, 11-14-83, Crosby, "Nozzle Type Safety Valve", Cross Sectional Drawing with List of Materials
(4) Dwg. 12179-C1-RCS516, 2 sheets, rev. 1, S&W, 2-1-83; piping isometric drawing for piping connected to valves.

9.5.7 Charging Pumps - CVCS; 3CHS*P3A,B,C

(1) Equipment Specifiation 678815, rev. 2, 9-6-73, Westinghouse, "Class 2 Pumps" ANS Safety Class 2, Auxiliary Pumps 205
(2) Dwg. No. 12179-FSK-26-2J, rev. 9, 12-6-83, S&W, "Flow Diagram Chemical and Volume Control".
(3) Test Performance Curve No. 37861A, 10-19-77, Pacific Pumps, for pump No. 51907 (P-3A)
(4) OIM-001-13A, Pacific Pumps, for P3A,B,C
(5) Inspection Report IRM2000648, 10-20-82, for 3CHS*P-3A,B,C
(6) Inspection Hold Point Form, 1-16-82, 3CHS*P-3A.

9.5.8 Residual Heat Removal Pumps; 3RHS*P1,A,B

(1) Inspection Report M3001056, 8-30-83, for P1A
(2) Inspection Report M7051477, 9-26-77, for P1A.
(3) Equipment Specification 678815, rev. 2, 9-6-73, Westinghouse, "Class 2 Pumps", ANS Safety Class 2, Auxiliary Pumps 205.
(4) Dwg. No. 12179-FSK-27-7A, rev. 8, 5-25-83, S&W, "Flow Diagram Residual Heat Removal".
(5) Test Performance Curves Nos. N92829, dated 8-19-77, Ingersoll Rand, for pump Nos. 077639 and 40.
(6) Dwg. No. 12179-EV-52A-5, rev. 5, 10-24-79, S&W, "Residual Heat Removal Pump Support".
(7) Dwg. No. CS-76253, 9-3-76, Ingersoll Rand, "General Arrangement".
(8) Letter from NUSCO to Westinghouse, dated 4-25-79, "RHR Heat Exchanger and Pump Nozzle Loads", with attachments of data.
(9) E&DCR F-J 10-144-84-82, "Sliding Feet of RHS Pump Pads", 3RHS P1A,B, tie plate clearance problem.
(10) N&D 1236, 3-4-82, base plate tolerance problem.

9.5.9 Control Room HVAC Dampers; 3HVC*MOD 33A,B

(1) Dwg. 12179 FSK-22-9B, S&W, "Control Building Air Conditioning".
(2) Dwg. 14392, rev. D, 9-17-82, "ITT Actuator w/External Limit Switch Mounting Detail", American Warming and Ventilating Inc. (AW).
(3) Dwg. 14388, rev. F, 9-21-82, "DAA-P-7402 Damper w/Ext. Linkage, Q Dampers", AW.
(4) Dwg. 14389, rev. D, 9-21-82, "Johnson 3244 83246 Series Actuators", AW.
(5) Dwg. 14388-904, Sheet 6, rev. E, "Performance Schedule for Dwg. No. 14388, Q-dampers, DAA-P-7402", 4-29-82.

9.5.10 Stress Reconciliation at Equipment Nozzles

(1) Procedure NETM-30, rev. 1, 11-30-83, S&W, "Procedure for the preparation, review, approval, and control of power, hydraulic and environmental div. stress data packages and Engineering Mechanics Division PSAS Documents for MNPS-3".

(2) Document NEТM44, rev. 0, 12-5-83, "Pipe Stress Analysis Criteria Document", S&W.
(3) Document PTPD 5.7, rev. 0, 1-5-84, S&W, a Project Test Program Directive, "Pressure Testing".
(4) Document PTPD 5.1, rev. 2, System turnover of Service Water System, No. 3326.

9.5.11 Equipment Qualification

(1) Job Book 7-14, "Environmenral Qualification of Class 1E equipment, Spec. No. 2472.510-662", Westinghouse supplied pressure transmitters.
(2) Job Book 7-14, "Environmental Qualification of Class 1E equipment, Spec No. 2241.003-009", prepared 2-28-83, GE supplied motors of water pumps, includes motors for 3 CCP*P1A,B,C.
(3) Job Book G-2, "Environmental Qualification of Class 1E equipment", Qualification Document B0058, prepared by Limitorque on 1-11-80, accompanied by letter dated 9-22-83, "Qualification information P.O. 639011", to NUSCO, applies to 3CCP*MOV45A,B, and 49A,B.
(4) Document NEAM-112, rev. 2, 12-13-80, revised 9-4-81, "Environmental Qualification of Class 1E equipment", describes EQ program.
(5) Document NETM-26, rev. 1, 10-24-82, "MNPS-Unit 3 - Environmental Design Conditions", contains parameter profiles and data sheets for all plant environmental zones, same as FSAR data.

10.0 Summary

The results and conclusions of the inspection indicate that the licensee's construction program is being adequately managed and appropriate controls have been implemented. The five violations are diverse in nature and do not represent a general breakdown in any specific area. However, there are several unresolved items dealing with design practices and specific guidance to design engineers that are of concern to the NRC. The licensee should independently examine this area to assure there is no bases for these unresolved items.

11.0 Unresolved Items and Program Weaknesses

Unresolved items are matters about which more information is required to ascertain if it is acceptable, a violation, or a deviation. Unresolved items are discussed in paragraphs 7.3.1, 7.3.2, and 7.3.5.

A significant weakness is a matter which is not a violation, unresolved or a deviation. It represents a condition, that if left uncorrected, could contributed to the violation of a regulatory requirement. Significant weaknesses are discussed in Sections 3.3, 4.3.1, and 5.3.3.

12.0 Entrance and Exit Interviews

Entrance and exit interviews were held on March 5, 9, and 16, 1984 with the licensee representatives listed in paragraph 1. The inspectors discussed the scope and findings of the inspection at these meetings. No written material was transmitted to the licensee by the NRC during this inspection except that which is formally transmitted by official letters.