

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 50-443/86-43

Docket No. 50-443

License No. CPPR-135 Priority - Category A

Licensee: Public Service of New Hampshire

P. O. Box 330

Manchester, New Hampshire 03105

Facility Name: Seabrook Station, Unit #1

Inspection At: Seabrook, New Hampshire

Inspection Conducted: July 7-11, 1986

Inspectors:	<u><i>Carl A. Manoly</i></u>	<u>7/30/86</u>
	K. Manoly, Lead Reactor Engineer	date
	<u><i>A. G. Varela</i></u>	<u>7/30/86</u>
	A. Varela, Lead Reactor Engineer	date
	<u><i>Carl A. Manoly for</i></u>	<u>7/30/86</u>
	R. McBrearty, Reactor Engineer	date
Approved by:	<u><i>J. Wiggins</i></u>	<u>7/30/86</u>
	J. Wiggins, Chief, Materials and Processes Section, DRS	date

Inspection Summary: Routine Inspection on July 7-11, 1986 (Report No. 50-443/86-43).

Areas Inspected: Routine unannounced inspection, by three region-based inspectors, of licensee activities in the following areas:

- As-built program and qualification of cable tray and support systems
- I.E. Bulletin 79-14 for seismic analyses of as-built safety related piping systems
- Pre-Service Inspection program including review of code relief requests and PSI data

The inspection also included a followup on licensee activities related to several outstanding unresolved items and construction deficiency report.

Results: No items of noncompliance were identified. One unresolved item was noted in the area of cable tray qualification and two items in the area of PSI. Unresolved items 85-15-04, 85-15-05, 85-29-01 and 84-12-01 were closed. CDR 81-00-10 remains open.

## DETAILS

### 1. Persons Contacted

#### 1.1 New Hampshire Yankee (NHY)

- \*G. McDonald, Construction QA Manager
- J. Singleton, Assistant QA Manager
- V. Sanchez, Site Licensing Supervisor
- D. Johnson, Senior Engineer, Mechanical Group
- \*R. Gregory, Licensing Engineer
- \*R. White, Supervisor, Mechanical/Structural Engineering
- \*R. Jeffrey, PSI Supervisor
- \*D. Icing, NDE Level III

#### 1.2 United Engineers and Constructors (UE&C)

- \*A. DuFault, Supervisor, Electrical Support Group
- O. Kalani, Supervisor, Piping Support Group

#### 1.3 Teledyne Engineering Services (TES)

- J. Rivard, Senior Engineer

#### 1.4 U.S. Nuclear Regulatory Commission (NRC)

- \*A. Cerne, Senior Resident Inspector
- D. Ruscitto, Resident Inspector

\*Denotes persons present during the exit meeting on July 11, 1986.

### 2. Licensee Action on Outstanding Open Items

#### 2.1 (Closed) Unresolved Item (443/85-29-01)

This item was related to the approach identified by the licensee for the seismic qualification of cable tray and support system installations by testing and bounding analyses. The item included four specific questions regarding the acceptance criteria and analytical assumptions in the licensee's approach. Further, a review of the final test reports by ANCO Laboratories for configuration and connection testing was required for NRC's evaluation in this area. The inspector reviewed NHY's report of March 1986 for Cable Tray Support Qualification Program and transmittal No. SBN-989 to the NRC which addressed the identified concerns. Details related to the licensee's current qualification approach are provided in Section 3.0 of this report. Summary of the response to the questions raised in this item is provided below:

- Acceptance criteria for configurations qualified by representative analyses were found to be addressed in Section 5.4 and 6.3 of NHY's report.
- The acceptance criteria for fatigue limits and moment resistance of connections tested were addressed in Section 4.2.2 of NHY's report and Section 4 of Volume 5 of ANCO's report on connection testing.
- The adequacy of the spring stiffnesses determined from connection testing in the predication of system response (i.e. resultant reactions and displacements) was addressed in sections 4.1.3 and 6.3 of the NHY's report. It should be noted that joint stiffnesses used in the analytical models represented the linear portion of the Force/Displacement or Movement/Rotation curves from connection testing. The assumption was found to be acceptable since system displacements were limited by means of axial and lateral bracings.
- Justification to insure that the three selected test connections for computation of spring stiffnesses, were sufficient for predicting model responses was addressed in Section 4.2.3 of the report in the correlation analysis of test samples.

Four of the five test reports by ANCO were not available for review by the inspector. NRC evaluation of the test reports will be tracked with unresolved item 443/86-43-01 which is addressed - Section 3.0 of this report. This item is therefore closed.

## 2.2 (Open) Construction Deficiency Report (CDR) (443/81-00-10)

This CDR is related to the identified reduced slippage capacity of raceway support bolted strut nut fittings. The resolution of the CDR was addressed in NRC inspection report No. 443/85-29 and was open pending completion of the as-built verification program in the Balance of Plant (BOP) buildings.

The inspector reviewed the licensee's corrective action in the BOP buildings which are qualified by a combination of testing and analyses. The corrective action included:

- Replacement of all strut/nut slip fittings in all primary overhead and floor-to-ceiling connections by either welded or positive bolted connections.
- Bracing and wall mounted connections in system qualified by representative analyses were evaluated using the reduced slippage capacity of the strut/nut fittings determined by UE&C and Franklin Institute testing. Reaction loads which exceeded the allowable joint capacity were modified using stiffened brackets or Unistrut nuts.

- ° Secondary connection joints in tray support systems containing some strut/nut fittings with reduced capacity were qualified on the basis of configuration testing performed by ANCO laboratories.

The licensee's overall approach for resolution of the CDR was found to be acceptable. However, this item will remain open pending NRC review of the final close-out report of the CDR by the licensee.

### 2.3 (Closed) Violations (443/85-15-04 and 85-15-05)

ASME Section III, Subsection 3624.1(c) requires that pipe hangers and supports be designed to permit expansion and contraction of the piping between anchors. However on one RHR support a zero clearance was specified between the piping and the top member of the support structure (85-15-04). The licensee response of November 14, 1985 to this violation was reviewed and discussed with UE&C's assistant project engineering manager and, additional documentation was obtained and reviewed. This violation is interrelated and affected by Violation No. 85-15-05, - where pipe supports were found to be installed with zero clearance. This resulted from different interpretations by UE&C during fit-up and QC inspection of in process and completed support installations. The licensee response identified above provided appropriate corrective actions for both violations. Specifically they consist of the following:

- Violation No. 85-15-04 was corrected by revision to the Pipe Support Design Guidelines and the re-evaluation of the 56 supports that reinspection identified as having zero clearance.
- Measurements of As-built gaps for safety-related pipe supports and evaluation of their effects on the piping analysis and support designs is a part of the PAPSCOTT program. The 56 supports were redesigned with 1/16" gap and were specifically noted for monitoring of thermal movements during hot functional testing.
- The design agency and installation contractor both initiated an Interim Procedure revision to clarify design criteria and installation requirements in the installation and inspection of pipe hangers.
- Installation and control personnel were trained in the Interim Procedure JS-IX-6.

Based on the inspector's review of the above corrective actions and his discussions and evaluation of additional support records, the licensee responses are considered adequate to close violations 443/85-15-04 and 443/85-15-05.

#### 2.4 (Closed) Unresolved Item (443/84-12-01): Effect of Changes In Groundwater Chemistry on Rebar

The identified concrete wall cracks in the waste process building and detected leakage into the building was resolved by special repairs that were undertaken to prevent excess leakage of ground water as reported in IR #84-12. However the then detected non-saline condition of the ground water might change when the Unit #1 dewatering was terminated. The inspector expressed his concern that salt water infiltration might cause excess rusting of the steel reinforcing bars and affect the concrete as well.

Dewatering of Unit #1 is essentially ended. Studies undertaken May 30, 1986 by the licensee of ground water chemistry show the water at Seabrook is of fresh potable quality with a pH of 8.6. The licensee reports that no change in salinity of the ground water is expected in the future when Unit #2 dewatering is terminated and the water table returns to normal. The additional information reviewed by the NRC inspector indicated that no significant corrosion of the rebar or attendant damage of the concrete is expected due to changes in ground water chemistry. This item is resolved.

### 3. Review of Cable Tray Seismic Qualification

#### 3.1 Objective

The purpose of this review was to followup on the licensee's activities regarding implementation of the as-built program for cable tray and support installations.

The review was also intended to assess the final approach selected by the licensee for the qualification of system installations in the Balance-of-Plant (BOP) by means other than analysis as described in the FSAR (before ammendment) and implemented by UE&C in the Closed-out-Buildings (COB). To achieve this objective the inspector reviewed the status of the as-built program and qualification activities with the cognizant licensee representative and performed a walkdown for verification of the as-built configuration of selected system installations. Further, a review of some qualification packages of installations verified during the walkdown was also performed during this inspection. Since the QA/QC interface in the as-built effort was evaluated during a recent NRC inspection (443/86-36) as part of the close-out of the CAT violation No. 443/84-07-01, it was not addressed during this inspection.

#### 3.2 Overview of Cable Tray System Qualification

The licensee activities in this area were reviewed in several NRC inspections. Inspection Report No. 443/85-29 provided details of the licensee's approach and status of activities at that time. During that inspection, several questions were raised regarding

the licensee's proposed approach for qualification of cable tray installations and were subsequently addressed in the resolution to unresolved item 443/85-29-01.

The licensee adopted any of the following approaches for the qualification of cable tray system installation in BOP buildings in conjunction with the as-built program which depicted the as-constructed configuration of all system installations

- ° Correlation to system configurations tested by ANCO Laboratories.
- ° Correlation to any of the twenty-six (26) representative configurations analyzed by Bechtel.
- ° Specific analyses of system configurations which could not be directly correlated to testing or representative models.
- ° Typical analyses similar to that employed by UE&C for the qualification of system installations in the COB.

Qualification of system installations was performed by different organizations depending on the type of approach (or approaches) adopted for that purpose. Teledyne Engineering provided qualification of tray installations using combination of the first and second approaches in the following plant areas:

- Reactor building at elevation 0'-0" (Trays supported from floor at elevation 25'-0")
- Electrical tunnel (A train) at elevation 0'-0"
- Primary Auxiliary Building (PAB) at elevation 53'-0" north of column line #3.
- Containment Enclosure.

Cable tray and support system installations in the control building were qualified by EQE Inc. using specific analyses. The qualification involved performing dynamic (modal) analyses of the systems using the amplified response spectra as input. Four models were developed for installation at elevation 21'-6" and one model for installation at elevation 50'-0" of the control building.

Installations qualified by UE&C using the original analysis approach described in the FSAR included the Control Building at elevation 75'-0" and elevation 50'-0" (Column lines 4-5), the Reactor Building at elevation 25'-0" and the Main Steam/Feed Water pipe chase.

The major changes in the licensee's activities in this area can be summarized as follows:

1. All installations are currently qualified with some provision of axial bracing (along tray longitudinal axis). This was necessitated in order to limit system displacements which would otherwise exceed tolerances available between safety related installations. To accomplish this design change, many of the support frames which were designed for vertical and transverse loadings (in-plane), were reevaluated to accommodate the contribution of axial loads transmitted by tray systems.
2. Reliance on rotational stiffness of primary connections was no longer required to insure system stability.
3. Some modifications were required to accommodate additional loads on supports which are providing the primary load path or axial bracing of tray systems. The modification involved replacement of primary strut/nut connections and/or providing stiffened angle brackets. Tray system installations which did not contain supports capable of providing axial restraint (i.e. horizontal runs with no bends), such as tray installations crossing adjacent buildings with seismic separation, were provided with cross bracing to satisfy axial restraint requirements. The cross bracing modifications were performed for tray systems in the PAB walkway and Containment Building below elevations 0" - 0" and 25" - 0".
4. The approach for qualification of tray systems using bounding analyses was no longer valid. Representative models were developed in place of the bounding analyses approach. Variations in loading or geometry, between actual configurations and models selected for comparison, were evaluated in the qualification packages.
5. Utilization of modal response spectra analysis of installations qualified by EQE Inc. as described above.

The status of activities related to the cable tray qualification program was found to be as follows:

- Walkdown and documentation of the as-constructed configuration of installations of raceways and supports was complete.
- Documentation of support evaluations is complete except for minor modification changes which were not yet completed by construction and QC.
- Evaluation of embedded plates with tray support attachments in the containment and PAB were incomplete.



### 3.3 Verification of As-built Installations and Seismic Qualification Documentation

Verification of As-built system configuration was performed during this review by conducting a walkdown inspection and performing physical measurements of selected installations to insure their conformance to applicable drawings and procedures. Systems were selected from installations in the Reactor Building, Main Steam/ Feed Water Chase, Electrical Tunnel, Containment Enclosure Ventilation, Control Building and Primary Auxiliary Building. The selected systems were qualified by the three contractors involved in this activity. The walkdown and documentation of the as-constructed configurations were performed by UE&C. The inspector utilized the as-constructed drawings of those selected installations in addition to the applicable installation and inspection procedures for the purpose of this review. The procedures used were:

- ° Procedure No. FEP-503 for Installation and Inspection of Cable Tray supports.
- ° Instruction No. ESG-3 for Engineering Acceptance Inspection of Cable Tray Supports.
- ° Instruction No. ESG-4 for Engineering As Constructed Inspection of Cable Tray Supports.

Installations verified during this inspection are identified in Attachment 1 to this report.

In addition to the as-built verification, the inspector performed a review of the evaluation criteria and selected support system qualification packages prepared by Teledyne Engineering and EQE Inc. Documents reviewed are identified in Attachment 2 to this report.

### 3.4 Observations and Findings

Based on the sampling inspection of the cable tray qualification program the inspector concluded that the as-built program has reasonably addressed its intended purpose in depicting the as-constructed configuration of cable tray system installations. The qualification packages reviewed were also found to be detailed and comprehensive except for one finding which is addressed below. Summary of observations and findings is provided below.

1. Qualification of installations performed by Teledyne was based on the breakdown of areas containing common configurations of tray and support systems (i.e. trapeze, wall-to-ceiling, etc.) which would closely resemble one of the twenty-six representative models established and analyzed by Bechtel. Parameters requiring evaluation for the proper selection of test or representative configuration were identified in specific check lists and included in the engineering evaluation procedure.

2. Tray loadings were based on the "CASP Tray Loading and Voltage Drop Check Program" reports developed by UE&C.
3. Representative models developed by Bechtel were analyzed using broadened ( $\pm 20\%$ ) floor amplified response spectra curves based on 20% of critical damping.
4. Documentation of installations qualified by Teledyne and EQE focused on the evaluation of the primary, wall and bracing connection capacities in addition to the evaluation of slenderness ratio of frame members. Structural integrity of members and secondary connections was not evaluated based on results from testing and/or analysis of representative models.
5. Specific evaluation of system displacements in configurations qualified by Teledyne was not provided to the inspector. The acceptance of tolerances between some cable tray systems and other structures during the seismic interaction review, was based on licensee judgment regarding the limited extent of displacements of tray systems. Determination of anticipated system displacements is required to insure the adequacy of these tolerances. This item is unresolved pending licensee evaluation and NRC review of cable tray system displacements for installations qualified by testing and/or representative analysis (443/86-43-01). This unresolved item will also include the review of ANCO testing reports which were not available during this inspection (carry over from unresolved item 85-29-01).

No violations were identified.

4. Closeout of I.E. Bulletin 79-14 - Seismic Analysis For As-Built Safety Related Piping Systems

The licensee's administrative controls in assuring quality in construction and quality control of ASME pipe supports consists initially of in-process surveillance of construction activities. Surveillance reports of in-process work observed by NHY were reviewed. Craft construction activities were observed to be in compliance with engineering design and construction requirements. The reports provide assurance of craft qualifications for unique features of construction and indicate engineering approval of field changes, the acceptability of engineering design changes and, resolution/corrective actions and closeout of identified non-conforming conditions observed and reported by licensee's QA inspectors. These surveillance reports of ASME pipe supports pertain to work performed by Pullman and by UE&C. They cover the period from December 1982 through July 1986. QA inspectors used check lists based on ANSI N 45.2, revision 3.

Additional administrative controls by the licensee's NHY QA inspectors covered the PAPSCOTT As-Constructed Verification Program. UE&C performed an audit of the PAPSCOTT program for the first six months of 1986. The NRC inspector's review observed thoroughness and effective licensee involvement in the pipe support As-built verification program. The NHY division performed two audits in 1986 of UE&C to verify compliance to, and the adequacy of, the pipe support close-out task team (PAPSCOTT) and the team's implementing procedures. Both audits found deficiencies. Responses to these findings and the corrective actions were reviewed by the NRC inspector.

#### Summary and Conclusion

Based on the above administrative controls and the NRC independent inspection efforts identified in inspection reports number 85-15 and 86-14 for pipe systems in the RHR, SSW and CCW systems, NRC/IE BU 79-14 is considered to be closed. The NRC report number 85-29 provides further review of the as-built stress reconciliation of Westinghouse analyzed piping systems for its conformance to FSAR commitments and NRC regulations.

#### 5. Preservice Inspection PSI Program Review

The inspector reviewed the licensee's PSI Program to ascertain that ASME Section XI requirements and regulatory requirements were met.

The following were included in the inspector's review:

- ° Document No. 80A8980, Revision 2, "Balance of Plant Preservice Inspection Program Plan General Reference Text For Seabrook Nuclear Power Station, Unit 1"
- ° Document No. 80A8982, Revision 3, Feedwater System PSI Program

The program at Seabrook complies with the ASME Code Section CI, 1977 Edition up to and including the Summer 1978 Addenda. The licensee is permitted by 10 CFR 50.55a (b)(2) to use the PSI requirements of Section XI, 1971 Edition through Summer 1972 Addenda, but has elected to invoke the requirements of the 1977 edition, which is permitted by 10 CFR 50.55a.

The inspector's review disclosed that weld number 1-FW-4606-03-10 is listed in the feedwater system program as the 18" penetration X-5 process pipe to pipe weld and also as a pipe forging to pipe weld. The weld is identified on the UE&C drawing number 9763-D-804606 ISI and on the NES drawing number B-01 as the X-5 penetration weld, and on the UE&C drawing 9763-F-202396 ISI and the NES sketch B-05 as the pipe forging to pipe weld. The X-5 penetration and the pipe forging to pipe weld are located at opposite ends of the pipe run. In addition, the NES Data Log identifies the X-5 penetration weld as weld number 1-FW-4606-03-01. Examination data are available for both weld numbers, but the data are not clear as to which weld is represented.

The inspector determined that the licensee is aware of the problem and has initiated action to resolve the discrepancies. The inspector informed the licensee that confirmation is required that each weld has been subjected to the code required examinations in addition to correcting the applicable paperwork. The item is considered unresolved pending completion of the licensee's action and subsequent NRC review (443/86-43-02).

No violations were identified.

### 5.1 PSI Data Review

The inspector reviewed selected PSI data to ascertain that the data were complete and accurate, and that ASME Code and regulatory requirements were met. Data related to the following welds were included in the inspector's review:

- ° Feedwater system weld 1-FW-4608-04-01, 18" x 16" reducer to pipe
- ° Feedwater system weld 1-FW-4606-04-20, 16" pipe to feedwater nozzle.

#### Primary Loop Piping Cast Stainless Steel Welds

- ° Loop 2, welds 5-1-3, 5-1-4 and 4-1-2

The feedwater system welds were examined by Nuclear Energy Services (NES) personnel, and the cast stainless steel welds were examined by personnel employed by the Westinghouse Electric Corporation.

Using the licensee's data, the inspector re-plotted ultrasonic indications to ascertain the accuracy of the indication locations as depicted on the data sheets.

The feedwater system data were found to be complete, indications were accurately plotted, and each data sheet was reviewed by NES, the licensee and by the ANII.

Examination data associated with the cast stainless steel welds showed no evidence (by signature) of review by Westinghouse, the licensee or by the ANII. In addition the inspector found that the plots were inaccurate in that angle beam and straight beam indications which were plotted at the same point on the inside surface and did not agree with information recorded on the data sheets, nor did the plotted beam exit point and beam angle agree with that information. Indications were attributed to the counterbore, but it was unclear from the data precisely where the counterbore was located in each weld. To make this determination the inspector measured the location of the counterbore in accessible primary piping in unit 2. The inspector found that the shape of the slope varied from pipe to pipe, but that the measured length of the counterbore was essentially uniform in each pipe. The inspector's measurements confirmed that reported straight beam indications were attributable to the counterbore.

The inspector was advised that Westinghouse, the licensee and the ANII had reviewed the data as a package. Additionally, the licensee stated that the apparent plotting discrepancies noted by the inspector were attributed to material characteristics such as beam redirection (wave guiding) and velocity changes in the cast material, and although a refracted longitudinal wave was used to minimize the problems caused by the material characteristics, it could not completely eliminate them. The inspector was further advised by the licensee that his concerns would be addressed in the final report. This item will remain unresolved pending the availability of the final report and subsequent review by the NRC (443/86-43-03).

#### 5.2 Requests For Relief From Preservice Inspection Requirements

The inspector reviewed the licensee's requests for relief from ASME Code requirements which are considered by the licensee to be impractical to meet to ascertain that the request accurately described the condition which rendered the requirements impractical.

Relief Request PR-7 regarding the RHR Heat Exchanger nozzle to shell welds states that the weld geometry involved is of a configuration which cannot be examined with currently available ultrasonic examination techniques. The inspector found that the welds in the unit 1 heat exchangers were not accessible to visual observation, but that the unit 2 components were of the same design, and were accessible to the inspector's observation. The configuration was found to be as described by the licensee in its request for relief. The welds received volumetric examination by radiography and surface examination during fabrication in accordance with ASME Section III. Those examinations were used to meet the preservice inspection requirements, and the licensee has committed to develop ultrasonic examination techniques such that maximum coverage of the welds will be achieved at the first refueling outage.

No violations were identified.

#### 6. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable, violations or deviations. Unresolved items are discussed in paragraphs 3.4, 5, and 5.1 of this report.

#### 7. Exit Meeting

The inspectors met with licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on July 11, 1986. The inspectors summarized the purpose and the scope of the inspection and the findings. At no time during this inspection was written material provided by the inspector to the licensee.

ATTACHMENT NO. 1

CABLE TRAY AND SUPPORT SYSTEM INSTALLATION INSPECTION

<u>Area</u>	<u>As-Constructed Drawing No.</u>	<u>Sheet No.</u>	<u>Notes</u>
Primary Auxiliary Bldg. (El. 53'-0")	9763-6-370134	31 & 31A	Plan & Section N-17
Control Bldg. (El. 75'-0")	9763-L-370128	5, 5A, 5B, 7, 7A, 21 and 21A	Plan and Section N-1, N-3 and N-16
Control Bldg. (El. 75'-0")	9763-L-370128	25, 25A, 25B 25C, 26, 26A, 31 and 31A	Plan, Section S-15, S-15A and S-20
Control Bldg. (El. 50'-0")	9763-L-370101	5, 5A & 5AA	Plan, Section NW-10 and Details
Control Bldg. (El. 21'-6")	9763-L-370101	9, 9A, 9AA and 9AA-1	SW-11 and sections
Control Bldg. (el. 21'-6")	9763-L-370108	5, 5A, 5B, 5C and 5D	Plan, section NW-2 and details
MS/FWC (El. 0'-0")	9763-L-370150	16, 16A, 16B 16C	Plans, Section 50
MS/FWC (El. 3'-0")	9763-L-370131	51, 51A & 51B	Plan, section and details
Containment Enclosure Ventilation Area (El. 25'-0")	9763-L-370152	11, 11A and 11B	Plan, section S-29 and details

ATTACHMENT NO. 2

CABLE TRAY PROCEDURES AND QUALIFICATION REVIEW

1. Representative Models: Description, Isometric Drawings and Summary of Analyses (26 models) by Bechtel.
2. Procedure to Evaluate the Adequacy of the As-Built Configuration of Seismic Category I Cable Tray Supports (EP-2-058) By Teledyne Engineering Services.
3. Evaluation of Seabrook 1 Unit Cable Tray Supports. Documents No. CI-143, CI-144, CEVA-152, MSFW "A" - 150 and PAB-134.
4. Cable Tray Evaluation Criteria - Switchgear Room (8224-04-CRT-01) By EQE Inc.
5. Seismic Analysis of Safety Related Cable Tray Supports In Longitudinal Director Inside Switchgear Room, N-W Quadrant.