U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-443/85-08

Docket No. 50-443

License No. CPPR-135 Priority -- Category B

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: April 2-5, 1985

Inspectors: H. F. Van Kessel 5-7-85
H. F. Van Kessel, Reactor Engineer date

K. Manoly 5/7/85
K. Manoly, Lead Reactor Engineer date

Approved by: D. Horek for 5/22/85
L. H. Bettenhausen, Chief date
Operations Branch, DRS

Inspection Summary: Inspection on April 2 - 5, 1985 (Inspection Report No. 50-443/85-08

Areas Inspected: Routine, announced inspection of the reactor coolant system hydrostatic test, including review of the test procedure, checkout of test preparations and test prerequisites, test witnessing, participation of contractor's and licensee's QA/QC organizations in the test, observation of the precautions, as listed in the test procedure, by test personnel, and observation of general performance of test personnel during the test. Independent test measurements were taken of metal surface temperatures during the test. In addition, the status of some previous findings of NRC inspectors were determined and the progress made on these findings was determined and evaluated. The inspection involved 73 hours on site by two NRC region based inspectors.

Results: No items of noncompliance were identified during the reactor coolant system hydrostatic test. For the progress made on previous inspection findings see the attached details of the inspection report.

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DETAILS

1.0 Persons Contacted

1.1 New Hampshire Yankee (NHY)

1.1.1 Startup and Test Department (STD)

R. Anderson, Primary System Lead Engineer
R. Doyal, Mechanical Startup Supervisor
S. Dunphy, Technical Support Supervisor
R. Gwinn, Startup Test Engineer
*G. A. Kann, Test Group Manager
*W. J. Mackensen, Preoperational Test Supervisor
*D. Mc Lain, Startup Manager
D. Mueller, Plant Auxiliary Engineer
*K. W. Seitz, Special Projects
*J. G. Tefft, Project Engineer
*B. Temple, Quality Assurance Supervisor

1.1.2 Construction Quality Assurance

*D. L. Covill, Surveillance Manager

1.1.3 Nuclear Services Division

R. Tucker, Mechanical Engineering Group

1.2 Pullman Higgins (P-H)

*D. H. Wright, Test Engineer

1.3 United Engineers and Constructors (UE&C)

A. Dufault, Discipline Manager

1.4 U.S. Nuclear Regulatory Commission (NRC)

R. S. Barkley, Reactor Engineer
A. C. Cerne, Senior Resident Inspector
H. M. Wescott, Resident Inspector

* Denotes personnel at exit meeting

2. Licensee Action on Previous Inspection Findings

(Open) Violation (443/82-03-03) and Unresolved Item (443/81-09-03)

A review was performed of various documents pertaining to the above violation and unresolved item. The two subject items are closely related and have been linked in many licensee responses and subsequent NRC actions and reports. Therefore, they will be addressed jointly in this section. The violation had identified deficiencies in the licensee's QA inspection program of installed class 1E raceways on the basis of the FSAR endorsement of Regulatory Guide 1.30 and the requirement for compliance of safety related systems to IEEE-336, which includes raceways as part of class IE systems.

The unresolved item and the subsequent followup in inspection report 50-443/82-03 had raised concerns relating to the adequacy of the test program for raceways. The concerns included test tray configurations, boundary conditions of test spans, and their effect on the calculated capacity from the biaxial loading. Other related documents reviewed included the following:

1. PSNH response letter No. SBN-284 on June 23, 1982 to the Notice of Violation.

2. FSAR amendments 45 and 46 addressing the qualification of raceways and supports.

3. Memorandum from the Division of Projects in Region I to the Division of Licensing of NRR on August 16, 1983 regarding the transfer of lead technical responsibility for the Q-classification of raceways through a Task Interface Agreement (TIA).

4. Response from the Division of Licensing of NRR to Region I on November 1, 1983, providing NRR's evaluation and position to Action Plan items 1 and 2 of the TIA.

5. Independent Design Inspection (IDI) Report No. 99900510/83-02 of September 7, 1983.

6. United Engineers and Constructors Letter No. SBU-89620 on July 26, 1984, and attached Report No. 9763-ESG-WP-1 on the engineering program for cable tray supports at Seabrook Station Unit 1 and 2.

7. United Engineers and Constructors Report No. 9763-C-EE-IE-02F on "Static Testing of Cable Trays with Simulated Defects", performed by Metal Products Corporation, to verify site receipt criteria.

Discussions were held with cognizant licensee representatives following the review of some of the documents listed above. The testing report was not available prior to the discussions with the licensee; however, it was available for review in the NRC regional office. In addition, the licensee indicated that other design related documents, which provide the detailed approach to the design of raceway supports and bracing system, will be forwarded for NRC review. The following questions arose from the review of the above documents and during the discussion with licensee representatives on site.

I. United Engineers report (Reference #6 above) provides a description of the engineering effort on cable tray supports at Seabrook Station and outlines briefly the design philosophy for the seismic qualification of cable tray systems. Particular attention has been focused on the generic approach employed in addressing the bracing system of raceway supports, and on the interaction between the trays, supports and axial bracings.

1. Are the connections (friction type) between the trays and the frames capable of transmitting the self weight excitation loads of the frames in the out-of-plane direction to the trays?

2. Has the slip capacity of these connections been tested for cyclic loading?

3. Is the utilization of friction connections in providing an out-of-plane brace to support frames documented in any acceptable design standard? Bolted and welded joints are typically used to connect bracing members to raceway support frames.

4. Are the trays qualified to transmit axial compression loads between axial bracing systems (approximately 40 feet long)?

5. If the trays are used in the design of the support frames, as a bracing system to reduce the unsupported member lengths, should they not be treated as safety related items? As such they will be subject to the same material requirements, QC inspections, and stress limits as those required for any Q-items.

6. Are any of the raceway support frames braced out-of-plane by means other than utilizing the trays to provide the restraint? If such a condition exists, has the increased stiffness of the frames in the out-of-plane direction been considered in the re-distribution of axial loads between support frames and axial bracing systems?

7. How is the interaction between axial braces and support frames addressed for sloped raceways when the analysis and design of each is performed independent of the other?

8. What material properties are used for the trays in the analysis of raceway and support systems when they are supporting dead weight and safe shutdown earthquake loads to stresses beyond the proportional limit of the tray material?

9. What is the technical justification for considering the equivalent static load method in determining the fundamental frequency of the support system? In many complex configurations, this approach will yield higher mode frequencies.

10. How does the equivalent static approach used by the licensee in determining the fundamental frequency and corresponding g-level from the amplified response spectra reconcile with the requirements in the standard review plan (SRP) section 3.7.2.II-b which recommends the use of a factor of 1.5 to the peak acceleration of the applicable floor response spectra?

II. United Engineering Static Testing Report (Reference #7) of cable trays specimens containing defects simulating actual installed configurations.

1. The majority of tests were conducted on specimens whose ends were constrained from rotations (fixed-fixed). How could the load rating obtained from these specimens be an indication of the capacity of actual configurations which are essentially continuous beams?

2. How does the limit load (ultimate capacity) for the tested specimens compare with that of actual configurations, and also of simple beams with free unrestrained ends as required by NEMA-VE-1 standard?

3. The load limits for deadweight plus SSE combination is not explicitly defined since it is described in Appendix B of reference 6 to be equal to the proportional limit plus one third of the load difference between the proportional limit and the applied maximum loading. The applied maximum loading varied throughout the testing.

4. What are the safety factors used in determining the allowable vertical and lateral loads for both deadweight plus OBE and dead weight + SSE loading combinations?

The staff will review other relevant design documents relating to the qualification of raceways and support systems at Seabrook Station when they are provided by the licensee. Upon completion of this review, all remaining concerns will be addressed in a future meeting between the NRC staff and representatives from the licensee and United Engineers and Constructors.

3.0 Reactor Coolant System Hydrostatic Test (Cold Hydro)

3.1 Scope and Objectives

The Reactor Coolant System (RCS), including the reactor coolant loop (RCL) piping, the reactor coolant pump (RCP) housings (4), the primary side of the steam generators (4), the pressurizer, and the welded parts of RCS instrumentation and associated tubing, are subjected to an integrity test at 3200 psig and a leak test at maximum operating pressure. Some piping, interconnected with the RCS and designed for RCS pressure, is included within the hydrostatic test boundary. The scope of this inspection was to witness the Cold Hydro and to verify that the licensee performed the test in accordance with their own approved procedure and the test requirements of ASME Code, Section III, Class 1.

3.2 References

(1) "RCS Hydro Boundary Graphic", by J. Wood.

(2) 1-PT(I)-35, Revision 1, "Reactor Coolant System Hydrostatic Test", TPI-62-F02, Revision 2, approved by Joint Test Group on March 22, 1985.

(3) ASME Boiler and Pressure Vessel Code, Section III, 1977 Edition.

(4) Seabrook Station FSAR, Chapters 3.9, 5.2, and 14.2; and table 14.2-3.

(5) RC-IT-01, "RCS Integrity Test", Revision 0, Field Change 7, implemented April 3, 1985.

3.3 Review of Test Procedure

References (2) and (5) were used for the performance of Cold Hydro. Reference (2) contains the operational part of the test program. The execution of this procedure is under the responsibility of the Startup Test Department (STD). The execution of the Integrity Test and the Leak Test remains the responsibility of construction. Reference (5) is used by construction. The inspector reviewed the two test procedures, references (2) and (5), and verified that code requirements would be met, static heads were accounted for, pressure plateaus defined, test pressure tolerances stated, test pressure hold time stated, leak test pressure hold time stated, nilductility temperatures for the RCS components at the test pressure identified, RCS pressure temperature relations to be adhered to during the test clearly identified, heat up and cooldown rates of RCS defined, pressurization and depressurization rates stated, and data recording requirements given.

The inspector also verified that overpressure protection was included, valve alignment sign-offs were in place, test equipment specified, and step by step instructions for the test with sign off requirements were included.

The inspector noted that the test procedure accounted for the RPV design pressure at the top of the vessel and that the pressure at the "RPV Zero" location will be the design pressure plus the static head of water. It was also noted that the maximum hydrostatic test pressure includes the FSAR tolerance and gage error adjustment.

3.4 Test Organization

A Test Director, assisted by two Shift Test Directors, led the (STD) test organization as far as the test operations, and test coordination with the contractors, is concerned. The operational portion of the test, as performed in accordance with procedure 1-PT(I)-35 (ref. 2), was their responsibility. The actual performance of the RCS Integrity Test and the Leak Test, in accordance with RC-IT-01 (ref. 5), remained the responsibility of the construction contractors involved i.e. Pullman-Higgins (PH), United Engineers and Constructors (UE&C), and Westinghouse Electric Company (NSSS Supplier).

Each contractor had their inspection team(s) assigned to perform the inspection work within the available time of the test period. PH had 12 inspection teams. Each team had one ANI inspector, two PH QC inspectors and one UE&C QA inspector. UE&C had 6 inspection teams (I&C). Each team had one ANI inspector, two UE&C QC inspectors and one UE&C QA inspector.

One STD engineer was in charge of the Hydro Laser, another STD engineer was assigned to take equipment vibration measurements. STD, also, coordinated all of the inspection team efforts in close communication with the Test Director. This coordination took place in a staging area close to Containment.

The Westinghouse team witnessed the test and performed the RCP inspection during the extended test pressure holding period (after the initial 10 minutes for the Integrity Test).

Dry runs were organized and executed with the inspection teams to make the teams familiar with the inspection work assigned to each team and the sequence of events during the actual tests.

3.5 Test Witnessing

The inspector witnessed the establishment of the various pressure plateaus prior to reading test pressure and verified that the precautions, identified in the procedure (ref. 2), especially with regard to RCS pressure and temperature, were observed. Independent temperature measurements were taken by the inspector upon reaching and holding at approximately 2500 psig prior to the Integrity Test (for details See 3.6).

The Integrity Test was witnessed by the inspector in the vicinity of the Test and Backup Gage on top of the RPV. Independent RCS pressure - time data were taken by the inspector for comparison with the official data after completion of the test.

The inspector then witnessed the inspection of the RCPs by the Westinghouse Team in the holding (pressure) time period following the first 10 minutes of the Integrity Test (at 3200 psig).

Following the Integrity Test and the RCP inspection (at test pressure), the RCS pressure was brought down to the maximum operating pressure level and held there for the Leak Test. The inspector witnessed the Leak Test (more than 10% of welds and joints). Observations were recorded for future comparison with the test exceptions listed per Ref. (5).

During the pressurization and depressurization of the RCS particular attention was paid to actual heat up and cool down rates, pressurization and depressurization rates as recorded in the control room. As part of the test records a graph was developed to record the RCS water temperature versus elapsed time. Independent temperature readings by the inspector were compared with the data of this graph.

The inspector verified that the RCS metal temperatures prior to the test would permit the performance of the test, (expected to last at least 5 hours) without these temperatures falling below the minimum of 150° F (as set by the steam generators and pressurizer) as a results of heat losses from uninsulated RCS metal surfaces.

3.6 Independent Measurements

RCS metal surface temperature measurements were taken by the inspector at the maximum operating pressure plateau (approximately 2500 psig) prior to the Integrity Test. These readings were taken at the same or similar locations as those of the temporary TCs installed by the licensee to measure RCS metal surface temperatures throughout the test. These locations were as follows:

TC No.	Location in RCS
1	RPV head flange (top)
2	RPV head flange (bottom)
3	RPV Bottom
4	C - Steam Generator Channel flange (bottom)
5	D - Steam Generator Channel flange (bottom)
6	A - Steam Generator Channel flange (bottom)
7	B - Steam Generator Channel flange (bottom)
8	Pressurizer Bottom
9	Pressurizer Top

The most critical locations were the locations 4 to 7 of the steam generator channels. The TCs for these locations, initially, were at the top of the bottom flange close to the shell. Later, during the data collection, the TC location was changed from the top to the bottom of the steam generator flange. This was done with the concurence of Westinghouse. The reason for this change was the low temperature reading obtained in the top location i.e. 152° to 155° F. These temperatures are too close to the 150°F minimum to permit adequate time (5-10 hrs.) for the Leak Test. In the bottom location the temperature was found to be 10°F higher. The inspector noted the decision by the Licensee to move the TCs for the steam generators to the bottom of the flange (near the channel).

The top location does not truly measure the metal temperature of the channel because the T/C location is too close to the shell of the steam generator, which is cooled by containment air on both sides. The results of the independent temperature checks were compared with the strip chart readings from the temporary dedicated temperature recorder located in the Leak Test staging area. All of the readings indicated a comfortable margin allowing ample time to perform the Leak Test (See Attachment A). The temperature readings were taken by the inspector with a hand held thermocouple thermometer, Omega 450 AET, type E, FLS 806, calibrated on March 19, 1985 (due for recalibration on September 19, 1985).

Independent shaft vibration readings were taken on two operating RCPs by the inspector with a hand held vibrometer, IRD Mechanalysis, model 810, FLS 563, calibrated on January 18, 1985 (due for recalibration on July 18, 1985), serial number 118216154. The D pump showed 14 mils, the C pump 4 mills. Upon inquiry about the high reading for the D pump, the Westinghouse specialist informed the inspector that the initial reading for this pump had been much higher earlier (approx. 28 mils) but that their installation of an extra coupling bolt had brought it down to the 14 mil level. Further balancing of the D Pump would be pursued by Westinghouse after the Cold Hydro.

During the Integrity Test the inspector took independent pressure and time readings. These readings were compared favorably with the data from the test record. The independent data are shown in Attachment B.

The inspector made independent observations during the Leak Test. These observations were checked against the test records (test exceptions). No deviations from the test records were observed.

The inspector witnessed the visual inspection of the four (4) reactor coolant pumps as well as the subsequent ASME code stamping of the pumps by the Westinghouse representative and the designated ANI representative.

As specified by procedure RC-IT-01, the minimum RCS hydro test pressure was maintained for 10 minutes before the inspection was begun. The following components on the pump were inspected for leakage at the hydrostatic test pressure:

(1) RCP main flange gasket
(2) Thermal Barrier inlet and outlet lines up to their field connections
(3) #1 seal housing gasket
(4) #1 seal injection line to field connection
(5) #1 seal leakoff line to field connection

No leakage on any of the pumps was detected.

The inspector observed the code stamping of the pump. He verified that the ASME National Board Number and NPSH requirements also stamped on the pump agreed with the QA documentation of the pump. The inspector reviewed the ANI inspector's qualification card and determined that his certification was valid and up-to-date. The NPV-1 Manufacturers' Data Reports for the RCP's were also reviewed and found in order.

3.7 Licensee Identified Items

All exceptions observed by the PH teams and the UE&C teams, as recorded in the test package of RCIT-01 (ref. 5), were accepted by the ANI people. The test, therefore, is considered valid by ANI and retesting of the RCS (and RPV) will not be required for any of the listed items. A total of 17 exceptions were identified by P-H and 18 exceptions by the UE&C teams.

3.8 QA/QC Interface

As stated in Paragraph 3.4, construction QC people were assigned to each inspection team. QA maintained assigned personnel coverage and audited the entire test performance. Evidence of QA and QC coverage was apparent throughout this inspection.

3.9 Findings

The inspector determined by direct observation, test witnessing, records review, and independent measurements that testing was effectively conducted and met acceptance criteria in accordance with approved procedures, code requirements, and FSAR commitments.

No items of noncompliance were identified.

4.0 Exit Interview

The NRC inspector met with the licnesee representatives (denoted in Section 1) at the conclusion of the inspection. The inspector summarized the scope of the inspection and the findings. No written material related to the inspection findings was tramsitted to the licensee.

Attachment A

To Inspection Report 50-443/85-08

Independent Temperature Measurements (ITM) During RCS Hydro
(Taken April 3, 1985)

TC No/Loc.	Readings from Temporary TR Stripchart -F 651 a.m.	7:21 a.m.	8:20 a.m.	9:44 a.m.	ITM Time	ITM Bottom/(Top)
1. RV Head	165.0	165.1	165.1	165.4	8:25 a.m.	164.0
2. RV Flange	165.0	165.1	165.0	165.3	8:30 a.m.	162.3
3. RV Bottom	173.8	172.2	170.4	174.9		167.3
4. SG-"C"	159.1	158.1	166.9	170.3	9:24 a.m.	165.0 (155.3)
5. SG-"D"	156.9	155.9	154.2	168.1		162.3 (153.8)
6. SG-"A"	155.9	155.0	153.3	166.5		162.3 (152.3)
7. SG-"B"	156.9	155.3	154.0	169.0		164.0 (153.6)
8. PR2R-Bottom	173.6	172.3	170.7	171.6	9:41 a.m.	170.0
9. PR2R-Top	167.0	166.7	165.2	167.8		171.3

*Readings taken at curvature between flange and steam generator channel (bottom) or shell (top)

Steam Generator TC readings still obtained with TCs in top locations.

Attachment B

To Inspection Report 443/85-08

RCS Hydro Pressure Versus Time During Escalation to Test Pressure

(Data Date: April 3, 1985)

RCS Pressure (PSIG)	Time	Remarks
3000	2:24 p.m.	
3100	2:28 p.m.	
3140	2:29 p.m.	
3190	2:30 p.m.	
3180	2:32 p.m.	
3190	2:33 p.m.	Start to hold
3200	2:34 p.m.	Hold
3210	2:35 p.m.	Hold
3218	2:36 p.m.	Hold
3220	2:37 p.m.	Hold
3218	2:38 p.m.	Hold
3215	2:39 p.m.	Hold
3215	2:40 p.m.	Hold
3210	2:41 p.m.	Hold
3210	2:42 p.m.	Hold
3210	2:43 p.m.	Hold
3205	2:45 p.m.	Start hold extension period. for RC Pump Inspection.
3200	2:53 p.m.	
3200	2:57 p.m.	
3200	2:58 p.m.	RC Pump Inspection Complete

Attachment C

To Inspection Report 443/85-08

RCS Hydro Boundary Leak Inspection

(Data Date April 3, 1985) Sheet 1 of 2

Weld joints and components examined (No deviations found):

System	Isometric Dwg	Weld and Component Number
Reactor Coolant (RC)	1-RC-146-1	F0101, F0102, F0103, F0104 RC-V-446 (valve)
RC+RV (hot leg)	RC-10-01	FW0102
RC+RV (cold leg)	RC-12-01	FW0102
RC	RC-9-1	FW0101
CVCS	CS-368-02	FW0202
CVCS	CS-368-03	FW0201, FW0301, CS-V-177 (valve)
Safety Injection (SI)	SI-273-1	FW0101, FW0102 FW0103, FW0104, SI-273-03 (flange), SI-V-147 (valve)
SI	SI-275-02	FW0201, FW0202, FW0204, FW0206
SI	SI-275-03	FW0301, FW322, FW326, FW327, FW321, FW313, FW314, FW315, FW325, FW328, FW318
SI	SI-256-05	SI-V-128 (Valve)
Residual Heat	1-RH-162 -01, 03, 04	FW0106, FW0103, FW0302, FW0308
Removal (RHR)		FW0310, FW0312, FW0401, FW0402
RC	1-RC-1-01, 05	FW0101, FW0103, FW0104, FW0501 FW0502, FW0503, FW0504, FW0505 FW0506, FW0507, FW0508
SI	1-SI-261-02, 04	FW0204, FW0205, FW0402, FW0404 FW0406, FW0408

Attachment C

To Inspection Report 443/85-08

RCS Hydro Boundary Leak Inspection

(Data Date April 3, 1985) Sheet 2 of 2

Flow Orifices (and checkvalve) found to be leaking at gasketed faces:

System	Isometric Dwg	Component/Joint Number
SI	1-SI-272-11	SI-FE-924; JTR 1101*
SI	1-SI-260-02	SI-FE980; JTR0201*
SI	1-SI-261-04	SI-FE986; Temporary Installation
SI	1-SI-261-01	SI-261-V-87; JTR-0101*

*Test exceptions. JTRs 1101 and 0201 were retorqued above design pressure (2485 psig) contrary to requirements of Pullman Higgins procedure IX-5, paragraph 6.2.4 (filed NCR 9851). Joints were reexamined below design pressure. JTR 1101 was OK but JTR 0201 had to be retorqued to stop the leakage. JTR-0101 was retorqued and found acceptable.