PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
Engineering Office:
1671 Worcester Road
Framingham, Massachusetts 01701
(617) - 872 - 8100

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SBN-401
T.F. B7.1.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

References:
(a) Construction Permits CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444
(b) USNRC Letter, dated June 18, 1982, "Request for Additional Information - Mechanical Engineering Branch," F. J. Miraglia to W. C. Tallman
(c) PSNH Letter, dated September 30, 1982, "Response to 210 Series RAIs; Mechanical Engineering Branch," J. DeVincentis to Ms. Janice B. Kerrigan (SBN-337)

Subject: Response to Mechanical Engineering Branch RAI 210.89

Dear Sir:

Enclosed please find our response to Mechanical Engineering Branch RAI 210.89, which was inadvertently omitted from our Reference (c) response to your Requests for Additional Information forwarded in Reference (b).

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

John DeVincentis

J. DeVincentis
Project Manager

RAM/fsf

B001

cc: Atomic Safety and Licensing Board

ASLB SERVICE LIST

Philip Ahrens, Esquire
Assistant Attorney General
Department of the Attorney
General
Augusta, ME 04333

Representative Beverly Hollingworth
Coastal Chamber of Commerce
209 Winnacunnet Road
Hampton, NH 03842

William S. Jordan, III, Esquire
Harmon & Weiss
1725 I Street, N.W.
Suite 506
Washington, DC 20006

E. Tupper Kinder, Esquire
Assistant Attorney General
Office of the Attorney General
208 State House Annex
Concord, NH 03301

Robert A. Backus, Esquire
116 Lowell Street
P.O. Box 516
Manchester, NH 03105

Edward J. McDermott, Esquire
Sanders and McDermott
Professional Association
408 Lafayette Road
Hampton, NH 03842

Jo Ann Shotwell, Esquire
Assistant Attorney General
Environmental Protection Bureau
Department of the Attorney General
One Ashburton Place, 19th Floor
Boston, MA 02108

210.89 Evaluation of Tees or Branch Connections in Class 1 Piping

The analysis of tees or branch connections as required by NB-3650 of the Code is a relatively complex process; the documents received to date do not give sufficient detail to enable us to say that Code requirements have been or will be met. Please furnish a detailed description of how this analysis has been (or will be) performed, along with examples involving:

(a) An ANSI B16.9 tee

(b) A Branch Connection per NB-3643

RESPONSE: NSSS

(a) A thermal transient heat transfer analysis was performed for each ANSI B16.9 tee on all the Class 1 auxiliary lines. All normal, upset, and test conditions identified in FSAR Section 3.9.1 were considered.

The thermal quantities ΔT_1, ΔT_2, and $|\alpha_a T_a - \alpha_b T_b|$, as defined in NB-3650, were calculated on a time-history basis, using a one-dimensional finite difference method for forced and free convection heat transfer analysis. Stresses due to these quantities were calculated for each time increment using the simplified methods of NB-3650 of the Code.

A minimum of two thermal expansion analyses, corresponding to the maximum and the minimum pipe wall average temperatures or fluid temperatures, were conservatively performed to generate the maximum and minimum moment sets for stress and fatigue evaluations. Thermal anchor movements were included in these analyses. The combination of stresses due to these moments and the associated peak transient stresses with the other required load sets produced conservative stress ranges and fatigue usage factors.

(b) Stress evaluation of sockolet connections (half-couplings used on Class 1 auxiliary piping systems) were performed in accordance with the simplified methods described in the Code (NB-3650). For primary stress evaluation, stress indices for sockolet connections were conservatively considered to be the same as those for a branch connection.

For the fatigue evaluation, finite element heat transfer and stress analyses for various thermal transient loadings were performed with conservative fatigue strength reduction factors. Finite element thermal transient stresses were combined with pressure and external moment stresses to evaluate equations (10) through (14) of the ASME Code for sockolet connections.

BOP

ASME III, Class 1 piping systems comply with NB-3650. The determination of tee and branch moments is performed according to the requirements of Note 5 of Table NB-3683.2-1. For static piping system loadings, run and branch moments, M_{ir} and M_{ib} respectively, are computed in a straightforward manner in which the conditions of equilibrium are satisfied. Thus, the determination of M_r is direct. Furthermore, since all dynamic seismic analyses are performed utilizing response spectra techniques, the determination of M_r is conducted on a modal basis wherein each mode yields a consistent set of moments with the proper signs. The appropriate combination (i.e., grouping method) of the modal M_r values is then used to obtain results for each of the three earthquake directions.

The thermal quantities, ΔT_1, ΔT_2, and $|\alpha_a T_a - \alpha_b T_b|$ for each applicable thermal transient are determined when required by the ADLPIPE program and are included in the appropriate equations of NB-3650.

NOTE: ASME III, Class 1 piping of one inch nominal pipe size or less is qualified according to the requirements of Paragraph NB-3630(d)(1) where Subsection NC is stipulated.