North Atlantic

North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, NH 03874
(603) 474-9521

The Northeast Utilities System

January 28, 1997

Docket No. 50-443
NYN-97010

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
Response to NRC Generic Letter 96-06

North Atlantic Energy Service Corporation (North Atlantic) has enclosed a summary report identifying the actions that have been taken and conclusions reached in response to NRC Generic Letter 96-06[1]. Generic Letter 96-06 requested that licensees determine the following:

(1) if containment air cooler cooling water systems are susceptible to either waterhammer or two-phase flow conditions during postulated accident conditions;

(2) if piping systems that penetrate the containment are susceptible to thermal expansion so that overpressurization of piping could occur.

The Seabrook Station Primary Component Cooling Water (PCCW) System was reviewed for the susceptibility to two-phase flow or waterhammer during postulated design basis accident conditions, particularly with regard to the containment air coolers. The enclosed summary report concludes that the PCCW system is not susceptible to two-phase flow or waterhammer during design basis accident conditions.

The Seabrook Station containment penetrations and the adjacent piping (piping inboard of the inner containment isolation valve) were reviewed for susceptibility to thermally induced overpressurization. The Seabrook Station containment penetrations were determined to not be susceptible to thermally induced overpressure conditions. The enclosed summary report identifies that several containment isolation valves were found to have the potential for overpressurization due to heatup of trapped fluid adjacent to the inner containment isolation valve. Corrective actions were initiated to ensure that the affected containment isolation valves are not challenged by overpressure conditions and would remain capable of performing their intended safety function. North Atlantic initiated non-emergency one hour reports on January 13, 17 and 24, 1997, due to the potential for containment bypass during a scenario in which the inner containment isolation valve is challenged as a result of the overpressure condition and the outer containment isolation valve does not close upon receipt of an automatic closure signal (single failure condition).

---

[1] NRC Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions" September 30, 1996

A072 1/1

Should you have any further questions regarding this letter please contact Mr. Anthony M. Callendrello, Licensing Manager, at (603) 773-7751.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

William A. DiProfio
Station Director

cc: H. J. Miller, Region I Administrator
A.W. De Agazio, NRC Project Manager, Seabrook Station
J.B. Macdonald, Senior Resident Inspector, Seabrook Station

Subscribed and sworn to before me
this 28 day of January, 1997

Susan J. Messer
My Commission Expires December 22, 1998

**NORTH ATLANTIC ENERGY SERVICE CORPORATION
CLOSURE SUMMARY FOR NRC GENERIC LETTER 96-06,
ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT
INTEGRITY DURING DESIGN BASIS ACCIDENT CONDITIONS**

1.0 PURPOSE

The purpose of this closure summary is to provide the results of the reviews conducted for Seabrook Station for NRC Generic Letter 96-06, "Assurance Of Equipment Operability And Containment Integrity During Design Basis Accident Conditions." North Atlantic Engineering Evaluation 96-023, "Generic Letter 96-06 Response," documents the complete evaluation for NRC Generic Letter 96-06.

2.0 BACKGROUND

NRC Generic Letter 96-06 identified the following areas of concern:

1) Cooling water systems serving the containment air coolers may be exposed to the hydrodynamic effects of waterhammer during either a loss of coolant accident (LOCA) or a main steam line break (MSLB). These cooling water systems were not designed to withstand the hydrodynamic effects of waterhammer and corrective actions may be needed to satisfy system design and operability requirements.

2) Cooling water systems serving the containment air coolers may experience two phase flow conditions during postulated LOCA and MSLB scenarios. The heat removal assumptions for design basis accident scenarios were based on single-phase flow conditions. Corrective actions may be needed to satisfy system design and operability requirements.

3) Thermally induced overpressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident mitigating systems to perform their safety functions and could also lead to a breach of containment integrity via bypass leakage. Corrective actions may be necessary to satisfy system operability requirements.

3.0 DISCUSSION

The areas of concern were reviewed for the Seabrook Station containment air coolers and containment penetrations to ensure that the systems were capable of performing their safety functions.

3.1 Waterhammer and Two-Phase Flow

There are six containment air coolers at Seabrook Station, three cooled by Primary Component Cooling Water Loop A and three by Loop B. The containment air coolers are described in the Seabrook Station UFSAR Section 9.4.5. The cooling water to the containment air coolers is described in the Seabrook Station UFSAR Section 9.2.2. The containment air coolers do not perform a safety function at Seabrook Station. Post accident containment cooling is accomplished using the RHR and containment spray heat exchangers.

Following a design basis LOCA or MSLB the containment air coolers are isolated from the PCCW system on a Phase B containment isolation signal (containment pressure greater than 18 psig) or a low-low level in the PCCW head tank. Once the coolers are isolated, the piping system becomes pressurized up to the relief valve set pressures. The piping system inside containment is protected by several relief valves that limit the maximum internal pressure to the piping design pressure.

Following a LOCA or a MSLB that results in a containment peak pressure of less than 18 psig, the PCCW system flow will remain as single phase. The PCCW system elevation head from the PCCW head tank to the top elevation of the containment air coolers is greater than the containment pressure of 18 psig. Thus, the saturation temperature of the water in the PCCW system containment air coolers inside containment is greater than saturation temperature of the containment at 18 psig, resulting in single phase fluid in the containment air coolers and precluding the potential for waterhammer.

The presence of two-phase flow resulting from operation of heat exchange equipment through transients resulting from design basis accidents was reviewed. This condition was described in NRC Information Notice 96-60, Potential Common-Mode Post-Accident Failure of Residual Heat Removal Heat Exchangers. The results showed that the two-phase flow conditions were not a concern for the Seabrook Station Primary Component Cooling Water System.

3.2 Thermally Induced Overpressurization of Containment Penetrations

Thermally induced overpressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident mitigating systems to perform their safety functions and could lead to a breach of containment integrity via bypass leakage.

Overpressurization of piping systems may occur when liquid is trapped in an isolated piping system. When the liquid is heated, it expands, potentially producing high pressure within the piping section. At a high enough pressure, the piping may rupture. The heat source may be hot system fluid, conduction of heat through piping in proximity to hot system fluid, or an ambient temperature rise.

Generic Letter 96-06 requested that licensees determine if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that overpressurization of piping could occur.

The methodology used to determine this included examining each penetration in the containment. All containment piping penetrations described in the Seabrook Station UFSAR Figure 6.2-91 were reviewed. The general configurations are as follows:

> Relief Valves: Relief valves are located on the piping between the containment isolation valves. If pressure is raised high enough from thermal expansion, the relief valve will lift to relieve the pressure and protect the isolated piping and components. Relief valve settings are determined, in part, to protect the most limiting component. Therefore, should the relief valve lift, no piping or components will be degraded.
>
> Check Valves: Check valves are used as containment isolation valves inside the containment. Should thermal expansion relief be necessary, the check valves will allow flow out of the isolated piping and away from the containment penetration.

Air/Gas/Atmosphere: The systems that contain air, gas, or containment atmosphere are not required to have thermal relief protection, as these systems do not experience the same rapidly increasing pressures as do water-filled systems.

Seal Filled Systems: For containment pressure transmitters, isolation from the containment atmosphere is provided by a sealed bellows arrangement located immediately inside the containment wall and is connected to the pressure transmitter outside containment by a sealed fluid tube. Isolation outside containment is provided by a diaphragm in the pressure transmitter. The sealed sensing lines have no isolation valves, but because of the nature of the sealed fluid system, a postulated severing of the line during either normal operation or accident conditions will not result in any radioactive release from the containment.

High Temperature Process Fluid: For some containment piping penetrations, the normal process fluid temperature is higher than the containment ambient temperature during heatup, normal operations, and postulated LOCA conditions. Therefore, when these lines are isolated, the process fluid cools and contracts. Should ambient containment temperatures rise, the process fluid has sufficient room for thermal expansion. Therefore, thermal relief protection is not necessary for these penetrations.

Each containment penetration is adequately protected from thermally induced overpressurization from trapped fluid between the containment isolation valves.

Piping systems that are on the containment side of the inside containment isolation valves and connected to the containment isolation valves were reviewed to determine if a trapped volume of water could heat up and overpressurize the inside containment isolation valve.

Several containment isolation valves were found to have the potential for overpressurization due to heat up of trapped fluid adjacent to the inside containment isolation valve. The affected containment penetrations and immediate and future corrective actions were:

1) Those bounded by the SIS test line / accumulator fill line, valves SI-V70, SI-V131, SI-V134, SI-V158, SI-V160, RH-V27, RH-V28 and RH-V49. See UFSAR Figures 6.3-2, 6.3-3, 6.3-4 and 6.3-5. The immediate corrective action was to open a drain line in the SIS test line and then to implement a design change that provides a continuous drain path through an orifice. In the future, a relief valve will be added to the SIS test line and the continuous vent path through an orifice removed.

2) The refueling cavity drain line to the spent fuel pool cleanup loop, valve SF-V86. See UFSAR Figure 9.1-2. The immediate corrective action was to open a drain valve in the affected piping system to eliminate the possibility of an overpressure condition. In the future, a valve alignment change will be implemented to provide a pressure relief path.

3) The waste liquid drain line from the reactor coolant drain tank to the primary drain tank, valve WLD-V81. See UFSAR Figure 9.3-17. The immediate corrective action was to provide a relief path to the reactor coolant drain tank by opening a valve in the flow path and later implementing a design change to add a relief valve to a test connection line. In the future, a relief valve will be added to the process piping.

In each case the appropriate Technical Specification action statements were entered prior to implementing the corrective action. Corrective actions were initiated to ensure that the affected containment isolation valves are not challenged by overpressure conditions and would remain capable of performing their safety function.

North Atlantic initiated non-emergency one hour reports on January 13, 17 and 24, 1997, due to the potential for containment bypass during a scenario in which the inner containment isolation valve is challenged as a result of the overpressure condition and the outer containment isolation valve does not close upon receipt of an automatic closure signal (single failure condition).

4.0 CONCLUSION

The Seabrook Station Primary Component Cooling Water System was reviewed for the presence of two-phase flow and the potential for waterhammer due to system responses to design basis accidents, particularly with regard to the containment air coolers. The PCCW system is not susceptible to two-phase flow or waterhammer due to system responses to design basis accidents.

The Seabrook Station containment penetrations and the adjacent piping were reviewed for thermally induced overpressurization. Corrective actions were initiated to ensure that the affected containment isolation valves are not challenged by overpressure conditions and would remain capable of performing their safety function. The Seabrook Station containment penetrations are not subject to thermally induced overpressure conditions.