NORTHEAST UTILITIES
NU
THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

P.O. BOX 270
HARTFORD, CONNECTICUT 06101
(203) 666-6911

August 21, 1980

Docket Nos. 50-213
50-245
50-386
A00705

Office of Nuclear Reactor Regulation
Attn: Mr. H. R. Denton, Director
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) TMI-2 Lessons Learned Task Force Report (Short Term), NUREG-0578.
(2) H. R. Denton letter to All Operating Nuclear Power Plants dated October 30, 1979.
(3) W. G. Counsil letter to H. R. Denton dated December 31, 1979.
(4) W. G. Counsil letter to B. H. Grier dated September 9, 1979.
(5) Cordell Reed letter to D. F. Ross, Jr. dated October 30, 1979.
(6) W. G. Counsil letter to H. R. Denton dated January 31, 1980.
(7) W. G. Counsil letter to H. R. Denton dated April 11, 1980.
(8) D. M. Crutchfield letter to W. G. Counsil dated May 7, 1980
(9) R. Reid letter to W. G. Counsil dated February 25, 1980

Gentlemen:

Haddam Neck Plant
Millstone Nuclear Power Station, Units Nos. 1 and 2
TMI-2.1.3.b - Additional Instrumentation for Detection of Inadequate Core Cooling

Reference (1) as supplemented by Reference (2), provided the NRC staff position for Additional Instrumentation for Detection of Inadequate Core Cooling. The Connecticut Yankee Atomic Power Company (CYAPCO), for the Haddam Neck Plant, and Northeast Nuclear Energy Company (NNECO), for Millstone Units 1 and 2 hereby provide this submittal to further elaborate on CYAPCO's and NNECO's position regarding a reactor vessel water level detector, as originally stated in References (3), (6) and (7).

In Reference (1), CYAPCO and NNECO were required to, "Describe further measures and provide supporting analyses that will yield more direct indication of low reactor coolant level and inadequate core cooling such as reactor vessel water level instrumentation". The clarification provided in Reference (2) committed CYAPCO and NNECO "to provide the necessary analysis and to study advantages of various instruments to monitor water level and core cooling...". Reference (2) also requires that this evaluation include reactor water level indication, and that "the indication of inadequate core cooling must be unambiguous..."

In the case of Millstone Unit No. 1, NNECO reiterates the position of Reference (3) that existing instrumentation is capable of detecting inadequate core cooling and, therefore, no additional instrumentation is needed.

NRC requirements per Section 2.1.3.b References (1) and (2) recommend a two-phase program for analysis and development of instrumentation for detection of inadequate core cooling. The first phase dealt with detection of reduced cooling level or existence of core voiding with installed plant instrumentation. As documented by Reference (3), the currently available and installed instrumentation is adequate to detect the existence of inadequate core cooling, as additional procedural guidance has been developed by Combustion Engineering, Westinghouse, and General Electric owners groups. NNECO and CYAPCO have updated emergency procedures and associated operator training based upon these guidelines at the Haddam Neck Plant and at Millstone Units 1 and 2.

There is presently installed at either or both the Haddam Neck Plant and Millstone Unit 2 the following equipment which singly or in combination provides indication of inadequate core cooling.

(1) Reactor Vessel Head Thermocouples
(2) Hot Leg and Cold Leg Resistance Temperature Detectors
(3) Subcooled Margin Monitor
(4) Primary Coolant Pressure and Flow Instruments
(5) Pressurizer Level and Pressure Instruments
(6) Reactor Coolant Pump Ammeters
(7) Steam Generator Level and Pressure Instruments
(8) Incore Thermocouples
(9) Self Powered Neutron Detectors

CYAPCO and NNECO have determined that the existing instrumentation is adequate for the detection of inadequate core cooling. Specifically, the incore thermocouples measure the approach to inadequate core cooling (i.e. increasing core temperature) directly. Both the Westinthouse and Combustion Engineering studies of inadequate core cooling scenarios, References (4) and (5), concluded that core exit thermocouples provide satisfactory information to alert operators of the approach to inadequate core cooling. Also, Combustion Engineering's inadequate core cooling effort, Reference (4), showed that Reactor Coolant Pump current is directly proportional to the loss of primary system inventory and thus is an excellent measure of approach to core uncovery. This instrumentation, in conjunction with the revised operating procedures by CYAPCO and NNECO provides adequate indication of the approach of inadequate core cooling.

In support of the second phase of the program, CYAPCO and NNECO are closely monitoring the progress of the reactor vessel water level instruments being developed by Westinghouse and Combustion Engineering.

The Westinghouse system (Reference (5)) utilizes a differential pressure measuring device to measure water level and relative void content of the circulating primary coolant system fluid. This system, as proposed by Westinghouse, would provide level indication from the bottom of the reactor vessel to the top of the vessel and from the hot legs to the top of the vessel. Based upon an evaluation of this system, CYAPCO and NNECO conclude that substantial analyses/testing remain to be completed to establish an unambiguous reactor vessel water level from differential pressure readings. This system provides full density (single phase) water level based on the hot leg temperature. For transients resulting in essentially a two-phase mixture, the water level predicted is expected to be much lower than what actually exists, thereby providing information which may result in unwarranted and possibly unsafe operator action. CYAPCO and NNECO conclude that the current design of this system will not necessarily provide an unambiguous water level reading.

The Combustion Engineering system (Reference (4)) utilizes a heated junction thermocouple for establishing the reactor vessel water level. The heated junction thermocouple sensor measures the change in thermocouple output voltage as a result of the difference in the thermal conductive properties between steam and water. A series of heated junction thermocouples located axially above the core would provide indication of the development and status of void fractions above the core. This system range does not extend below the top of the core. Combustion Engineering, however, contends that the existing instruments (excore detectors, core exit thermocouples) would provide adequate indication of void fractions within the core. This system is judged to be in its developmental phase and its capability to provide an unambiguous reactor vessel water level indication has yet to be demonstrated.

Pursuant to the requirements of References (1) and (2), CYAPCO and NNECO have examined a variety of reactor vessel water level monitoring systems as documented by Reference (6). CYAPCO and NNECO have concluded that none of the proposed systems, including the Westinghouse and Combustion Engineering systems described above, have demonstrated their ability to provide the operator with an unambiguous reactor vessel water level indication.

A reactor vessel water level monitoring device that provides an unambiguous indication of reactor vessel fluid level during all transients would be a useful tool for the operator in detection of inadequate core cooling. CYAPCO and NNECO have determined, however, that development of such a device has not been satisfactorily demonstrated. CYAPCO and NNECO continue to support and monitor the progress of both the Westinghouse and Combustion Engineering programs and urge the NRC to ensure that such devices are adequately tested over the wide range of design transients and that their potential for misleading the operator is extremely low before mandating their installation. Failure to verify the accuracy of a RVLM device may result in installations that could conceivably degrade plant safety.

CYAPCO and NNECO concur with the current draft Regulatory Guide 1.97, Revision 2, which states "Direct indication of coolant level in the reactor vessel is not currently available in pressurized water reactors." Installed costs of such a system would be in excess of two million dollars and without reasonable assurance of increased plant safety. Hence, CYAPCO and NNECO have deferred plans to install additional instrumentation to monitor reactor vessel fluid level until it can be shown that such a system will provide the operator with a reliable and unambiguous indication of reactor vessel water level.

Based upon the above information, it is concluded that the Haddam Neck Plant, Millstone Unit No.1, and Millstone Unit No. 2 have fulfilled the written staff requirements for item 2.1.3.b of Reference (1) in their entirety. No action beyond the commitment to follow and support the development of a reactor vessel water level device is planned to fulfill the requirements due by January 1, 1981. Further support for this determination is derived from References (8) and (9), wherein the Staff stated that CYAPCO and NNECO had met the requirements of NUREG 0578 item 2.1.3.b, even though the Staff had been made aware of CYAPCO's and NNECO's intent not to install a reactor vessel water level monitoring device.

CYAPCO also notes that the Reference (5) material is applicable to the Haddam Neck Plant and that material is hereby placed on Docket No. 50-213.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
Senior Vice President

By: W. F. Fee
W. F. Fee
Executive Vice President