December 12, 1985

Docket No.: 50-213

Mr. John F. Opeka, Senior Vice President
Nuclear Engineering and Operations
Connecticut Yankee Atomic Power Company
Post Office Box 270
Hartford, Connecticut 06141

Dear Mr. Opeka:

SUBJECT: TMI ACTION PLAN ITEM II.F.2-INADEQUATE CORE COOLING INSTRUMENTATION

RE: Haddam Neck Plant

By letter dated March 11, 1983, Connecticut Yankee Atomic Power Company provided information on the proposed inadequate core cooling instrumentation (ICCI) system for the Haddam Neck Plant. By letter dated August 6, 1984, the staff requested additional information concerning the proposed design and operation of the ICCI system. In response to the August, 1984 letter, CYAPCo provided the required information and associated implementation milestones in a letter dated February 1, 1985.

The staff in conjunction with staff consultants at the Oak Ridge National Laboratory has reviewed your submittals dated March 11, 1983 and February 1, 1985 and concludes that the ICC system design is acceptable and is consistent with the requirements of NUREG-0737 Item II.F.2. A copy of the Safety Evaluation is enclosed. In order that we can complete our implementation review and final approval of the ICCI system, the staff will require that CYAPCo submit the implementation letter report in accordance with its commitment in Enclosure 3 of the February 1, 1985 submittal.

Original signed by: F. Akstulewicz

Francis M. Akstulewicz, Jr.
Haddam Neck Project Manager
Integrated Safety Assessment
Project Directorate
Division of PWR Licensing-B

Enclosure:
As Stated

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Mr. John F. Opeka
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SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
CONCERNING THE INADEQUATE CORE COOLING INSTRUMENTATION
HADDAM NECK PLANT
DOCKET NO. 50-213

Background

In response to Generic Letter 82-28, Connecticut Yankee Atomic Power Company provided information on the proposed inadequate core cooling instrumentation (ICCI) system for the Haddam Neck Plant by letter dated March 11, 1983. By letter dated August 6, 1984, the staff requested additional information concerning the proposed design and operation of the ICCI system. In response to the August, 1984 letter, CYAPCo provided the required information and associated implementation milestones in a letter dated February 1, 1985.

Discussion

The Haddam Neck Inadequate Core Cooling (ICC) monitoring system consists of three instrumentation subsystems: (1) the subcooling margin monitor (SMM), (2) the core exit thermocouples (CET), and (3) the reactor coolant inventory monitoring system. The Haddam Neck plant ICC system is designed as Category I (Class 1E) with redundant trains. Each train contains stand alone processing electronics and displays, which monitor, alarm and trend the ICC. The primary means of displaying the ICC information is provided via the Safety Parameter Display System (SPDS). The SPDS will receive the ICC transmitted data with optical isolation provided by the ICC monitor system. A Category I (Class 1E) back up display is provided for the CETs on the ICC panel located in the control room. Each cabinet will display subcooling/superheat, core exit temperatures and percent coolant level in the vessel above the core.

The installation, functional testing and calibration of the ICCI system, except for the SPDS display, is scheduled for completion by the end of 1986 refueling outage. Temporary display capability will be provided for CETs, core map saturation/superheat in °F/Psat and the heated junction thermocouples.

A. Subcooling Margin Monitor (SMM)

The SMM system uses reactor coolant system (RCS) temperatures and pressures to calculate subcooling (to 300°F) and superheat (to 45°F) either in terms of temperature or pressure. The calculation is based upon the most conservative values of the temperature and pressure input. Signal validation techniques are utilized to ensure the quality of the input variables. Saturation/superheat trouble alarms are provided on the main control board from the ICC cabinet. In summary, the SMM system has been upgraded to meet the requirements of NUREG-0737 Item II.F.2.

B. Core Exit Thermocouples (CET)

The CET monitoring system consists of two redundant independent trains that monitor the 45 chromel-alumel CETs. All CETs are provided with the required cold junction temperature compensation. The CET temperature range is from 200°F to 2,300°F.

As proposed, the 4th quadrant in the core does not meet the NUREG-0737 minimum requirement of 4 CETs. However, Haddam Neck does not have a large core; the core consists of only 157 fuel assemblies. The maximum number of fuel assemblies per thermocouple in a quadrant is 12.1. For large cores, i.e., with 193 fuel assemblies, the minimum of 4 thermocouples per core quadrant corresponds to 12.1 fuel assemblies, which is equivalent to the maximum assemblies per thermocouple at Haddam Neck. The proposed number of CETs in the 4th quadrant is, therefore, acceptable. A CET alarm is provided on the main control board from the ICC cabinet.

C. Reactor Vessel Level Instrumentation System

Following the January, 1986 outage, the Haddam Neck plant will be equipped with a Heated Junction Thermocouple system to monitor coolant inventory in the region above the core. Redundant strings of heated junction thermocouples are arranged in the reactor vessel head area to provide an indication of conditions at eight discrete levels. The system indicates percent of level in the plenum and the head areas. The ICC information display is provided through the SPDS system, which will indicate the HJTC temperatures and in addition will show subcooling/superheat, CET temperatures and RCS pressure. An ICC back up display is provided in a Class 1E cabinet which is located in the control room. The plant specific ICC back up display is provided in a Class 1E cabinet which is located in the control room. The plant specific ICC procedures will be based on CEN-152, CE-NPSD-232 and will be incorporated into the Westinghouse emergency response guidelines.

The generic Combustion Engineering topical report on inadequate core cooling instrumentation using heated junction thermocouples for reactor vessel level measurement has been reviewed by the staff and was found acceptable. The evaluation was published in NUREG/CR-2627, March 1982. However, we will require that CYAPCo provide the implementation letter report which they committed to in Enclosure 3 of the February 1, 1985 letter in order that we can complete our review for approval of the reactor coolant inventory monitoring system implementation.

Conclusions

The staff in conjunction with staff consultants at the Oak Ridge National Laboratory has reviewed the licensee's submittals dated March 11, 1983 and February 1, 1985. Our findings are summarized as follows:

1. The ICC system design was found to be acceptable and to be consistent with the requirements of NUREG-0737 Item II.F.2.

2. The proposed CET temperature range is acceptable.

3. The proposed average of 3 and 3/4 CETs in the 4th quadrant are acceptable because the average number of fuel assemblies monitored per thermocouple is the same as for large reactors with 4 CETs per quadrant.

4. The staff requires the licensee to submit the implementation letter report in accordance with its commitment in Enclosure 3 of the February 1, 1985 submittal in order that we can complete our implementation review and final approval of the ICCI system.

Acknowledgement

Principal Contributor:
L. Lois, Core Performance Branch, NRR
Dated: