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

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 665-5000

November 30, 1990

Docket No. 50-213
B13685
Re: Zircaloy Clad Conversion
ISAP Topic 2.17

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

Haddam Neck Plant
Large-Break Loss-of-Coolant Accident Analysis
Zircaloy Cladding Conversion (TAC No. 66958)

In a letter dated August 1, 1989,(1) Northeast Utilities Service Company (NUSCO), on behalf of Connecticut Yankee Atomic Power Company (CYAPCO), informed the NRC Staff of our intent to have Westinghouse perform the large-break loss-of-coolant accident (LOCA) analysis for the Haddam Neck Plant using the NRC-approved, Westinghouse WCOBRA/TRAC methodology for upper plenum injection (UPI) plants. This analysis is in support of the conversion of the Haddam Neck Plant to zircaloy fuel cladding. The scope and schedule for this analysis were presented at a meeting with the NRC Staff on August 10, 1989.

In a letter dated September 26, 1990,(2) CYAPCO submitted a request for exemption from the requirements of 10CFR Part 50, Appendix K, Sections I.D.3, I.D.4, and I.D.5 for the Haddam Neck Plant. This request for exemption and the report provided herein provide the revised large-break LOCA design basis to support the Cycle 17 conversion to zircaloy-clad fuel for four-loop operation.

In a letter dated May 22, 1990,(3) CYAPCO provided the NRC Staff with a revised schedule of planned submittals related to zircaloy cladding

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(1) E. J. Mroczka letter to the U.S. Nuclear Regulatory Commission, "Large Break LOCA Topical Report--Zircaloy-Clad Fuel Conversion (TAC No. 66958)," dated August 1, 1989.

(2) E. J. Mroczka letter to the U.S. Nuclear Regulatory Commission, "10CFR50, Appendix K--Request for Exemption," dated September 26, 1990.

(3) E. J. Mroczka letter to the U.S. Nuclear Regulatory Commission, "Revised Schedule, Zircaloy Cladding Conversion (TAC No. 66958)," dated May 22, 1990.

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conversion. In accordance with that schedule, CYAPCO is hereby providing the report, "Application of the WCOBRA/TRAC Best Estimate UPI Model to the Haddam Neck PWR" (WCAP-12766), describing the Haddam Neck specific application of the NRC-approved Westinghouse WCOBRA/TRAC methodology for the analysis of the large-break LOCA. Two copies of WCAP-12766 are being forwarded directly to the NRC Project Manager, Haddam Neck Plant. This information is proprietary to Westinghouse Electric Corporation. Accordingly, we request that this information be withheld from public disclosure. We will comply with the requirements of 10CFR2.790 to provide a nonproprietary version together with an affidavit as soon as the nonproprietary version has been prepared. We will submit the total required numbered copies of the proprietary and nonproprietary versions of the information and the required affidavit at that time. In the meantime, we have provided sufficient copies for you to initiate your review. We expect to be able to fully comply with the requirements to provide the nonproprietary version of the information and an accompanying affidavit within 4 weeks.

WCAP-12766 describes the methodology used to perform a large-break LOCA analysis of the Haddam Neck Plant, a Westinghouse-designed pressurized water reactor (PWR) with UPI. This methodology conforms to the SECY-83-472 LOCA analysis approach. The analysis tool used for these calculations is the Westinghouse version of the COBRA/TRAC code (WCOBRA/TRAC) which was originally developed at Battelle Northwest Laboratory. Westinghouse has modified and verified the WCOBRA/TRAC code against separate effects and system effects thermal-hydraulic test data which cover the range of thermal-hydraulic conditions expected for a postulated LOCA.

The application of the WCOBRA/TRAC code for the Westinghouse two-loop plants with UPI has been approved by the NRC. The Haddam Neck Plant, while of a four-loop design, has a similar safety injection being introduced through the reactor vessel upper head into the upper plenum. Similar thermal-hydraulic behavior exists between Haddam Neck and the two-loop Westinghouse PWRs with UPI.

This report describes the model used for the Haddam Neck Plant, the sensitivity studies performed to identify the effect of various parameters deemed to be important during the accident, the results of a "superbounded" calculation, which conservatively estimates the 95th percentile peak cladding temperature (PCT), and calculations which include the required features of Appendix K. These results account for the removal of the thermal shield during the 1989-1990 refueling outage and the final fuel assembly design that includes a debris-resistant fuel rod design.

The basic approach used to establish an estimate of the 95th percentile PCT, as required by SECY-83-472, was to evaluate all sources of uncertainty, including those arising from code development, code assessment, and code application to the PWR. The significant fuel-related inputs to the LOCA analysis (e.g., fuel rod temperature, pressure, etc.) were determined using the NRC-approved, Westinghouse PAD 3.4 fuel performance code. The use of

these data assures consistency in the total analysis package and treatment of uncertainties. To determine the uncertainty associated with the computer code, extensive comparisons were performed with single and integral effects experiments. The WCOBRA/TRAC code uncertainty methodology developed by Westinghouse has also been approved by the NRC. To quantify the uncertainty associated with the Haddam Neck application, a number of PWR sensitivity studies were performed on the accident boundary and initial conditions as well as specific models used in the PWR calculation.

Sensitivity studies were performed using the Haddam Neck model on various parameters which could affect the PCT. The choice of which parameters were to be reconfirmed for Haddam Neck was based on the results of sensitivity studies performed for the Westinghouse two-loop UPI plants. The studies showed that, in general, the effect of parameter variations on the PCT for Haddam Neck was similar in direction to those found for the two-loop UPI plants, although the magnitude of the effect was different in some cases.

To bound all the uncertainties, a "superbounded" calculation was performed. In this calculation, parameters for which sensitivity studies had shown a PCT penalty were included along with the parameters which were originally at their bounded condition. In this fashion, all of the PWR uncertainties which had been derived by comparing the code to test data were also considered.

The SECY-83-472 methodology for LOCA calculations stipulates that best-estimate thermal-hydraulic calculational methods can be used if the uncertainties in the computer code, reactor parameters, and accident boundary and initial conditions are considered such that the 95th percentile PCT can be estimated. This 95th percentile is then compared to the PWR calculation using the required features of Appendix K. The 95th percentile PCT should be less than that obtained from the Appendix K calculation, which indicates that the Appendix K requirements, by themselves, have sufficient conservatism to cover uncertainties at or beyond a 95th percentile. The superbounded calculation thus forms the basis for establishing the validity of the licensing calculation.

The WCOBRA/TRAC calculations for Haddam Neck showed that a conservative estimate of the 95th percentile PCT yielded results which were below the value calculated with the required features of Appendix K. The WCOBRA/TRAC calculation with the Appendix K required features was below the limits of 10CFR50.46. Therefore, the objectives of the SECY-83-472 LOCA calculational approach have been achieved for the Haddam Neck Plant with UPI.

Cycle 17 Implementation

The results provided in the Haddam Neck specific analysis support a peak linear heat generation rate (PLHGR) operating limit of 14.5 kW/ft for the zircaloy-clad fuel. These results also demonstrate the level of conservatism in the current Interim Acceptance Criteria licensing basis for the stainless

steel-clad fuel, where the PLHGR is limited to burnup dependent values of 12.9 and 13.7 kW/ft. The new PLHGR for the zircaloy-clad fuel and the current PLHGRs for the stainless steel-clad fuel will be implemented in the Technical Report Supporting Cycle 17 Operation (TRSCO). Since the large-break LOCA analysis was only performed for four-loop operation, the core operating limits for three-loop operation will be deleted from the Cycle 17 TRSCO.

CYAPCO respectfully requests that the NRC staff review the previously submitted request for exemption and the attached report to support the Cycle 17 conversion to zircaloy-clad fuel. Cycle 17 is currently expected to commence in November 1991.

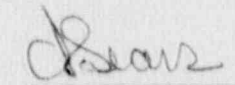
CYAPCO also requests that we meet with you at your earliest convenience in January 1991 at the White Flint office to provide an overview of the results contained herein and to discuss other activities related to the Cycle 17 conversion to zircaloy-clad fuel.

We trust that you will find this information satisfactory, and we remain available to answer any questions you may have during your review of this material.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

FOR: E. J. Mroczka
Senior Vice President

BY: 
C. F. Sears
Vice President

cc: T. T. Martin, Region I Administrator
A. B. Wang, NRC Project Manager, Haddam Neck Plant
J. T. Shedlosky, Senior Resident Inspector, Haddam Neck Plant