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

September 24, 1985

Docket No. 50-423
B11720

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
Additional Information Concerning Actuation
of the Hydrogen Recombiners

In an August 28, 1985 telephone conversation among Ms. E. L. Doolittle (NRC Licensing Project Manager), Mr. R. Palla (NRC Containment Systems Branch Reviewer) and representatives of Northeast Nuclear Energy Company (NNECO), Mr. Palla questioned an apparent discrepancy between Section 6.2.5.3 of the FSAR and the Emergency Operating Procedures (EOPs) concerning actuation of the hydrogen recombiners. The FSAR stated that the hydrogen recombiners would be actuated 4 days after DBA, when the hydrogen content of the containment atmosphere reached approximately 3.5 volume percent. The EOPs state that the hydrogen recombiners will be actuated when the hydrogen content of the containment atmosphere reaches 0.5 percent. As discussed with Mr. Palla, the FSAR analysis demonstrated that the hydrogen recombiners could be actuated any time up to 4 days following a DBA and still maintain the containment hydrogen concentration below 4 volume percent.

FSAR Section 6.2.5.3 has been revised to clarify this point. The attached FSAR revision will be included in an upcoming amendment to the FSAR.

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We trust that this information satisfies the Staff's concerns in this matter.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

J. F. Opeka
Senior Vice President

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me J. F. Opeka, who being duly sworn, did state that he is Senior Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public

My Commission Expires March 31, 1988

The energy for this reaction is supplied by the decay of fission products which have escaped from the reactor core and dissolved in the sump water. The fission product distribution and energy absorption used in the analysis are in conformance with Regulatory Guide 1.7. The distribution of fission products and energy assumed in the analysis are given in Table 6.2-68.

4. Radiolytic generation in the reactor core:

   The chemical reaction presented in Item 3 is also applicable to radiolytic decomposition of water in the reactor core. In this case the energy is supplied by the decay of fission products in the fuel.

   Sump and core radiolysis is based on ANS 56.1 ANSI N-275, Draft-6, "Combustible Gas Control."

   The hydrogen generation rate due to core and sump radiolysis and the integrated amounts of hydrogen produced by radiolysis are shown on Figure 6.2-48.

5. Corrosion of metals by solutions used for containment spray:

   Aluminum and zinc bearing and/or coated materials, such as galvanized steel, within the containment may react with the containment spray and produce hydrogen. The inventories of aluminum and zinc inside containment are shown in Table 6.2-69. Note that nearly all the zinc in the containment is in the form of galvanized steel. Zinc-based paint is not used as the primary coating for containment surfaces, so it is only present in limited applications, and is not a significant source of hydrogen. Aluminum and zinc corrosion rates with respect to time are shown on Figures 6.2-49 and 6.2-50, respectively. The same zinc corrosion rate is used for all forms of zinc in the containment: zinc, galvanized steel, and zinc-based paint. The maximum containment temperature transient was used to conservatively maximize corrosion rates. 480.20

   The hydrogen generation rates from zinc and galvanized steel corrosion are presented in Figure 6.2-55. 480.20

   The use of aluminum and zinc inside the containment is minimized. These materials are not utilized in the manufacture of safety related components which are in contact with the core cooling fluid.

The parameters used in calculating the above hydrogen source are given in Tables 6.2-68 and 6.2-69.

The total amount of hydrogen in the containment is calculated by summing the hydrogen produced by each of the five sources above. The partial pressure of the hydrogen is calculated assuming a perfect

gas. The total pressure in the containment (excluding water vapor) is then calculated by summing the partial pressures of the noncondensables. The volume percent of the hydrogen is calculated from the ratio of the partial pressure of the hydrogen to the total containment pressure. The partial pressure of the water vapor in the
8 containment is neglected for conservatism.

The total hydrogen generated for each source is shown on Figure 6.2-48 as a function of time.

The volume control tank in the chemical volume control system (CHS) is automatically isolated from the charging pumps by redundant valves on receipt of an SIS signal. The valves close within 10 seconds after receipt of the signal. The liquid inventory in the tank is sufficient to prevent hydrogen from reaching the charging pump suction before isolation of the tank by virtue of a water seal. Thus, the volume control tank hydrogen is unable to reach the containment after a LOCA and is not considered a source of hydrogen in the analysis.

The containment atmosphere is circulated through the recombiners at a constant flow rate (Table 6.2-67). A separate calculation is performed for both one and two recombiners operating. Each recombiner combines hydrogen and oxygen to form water vapor. All the hydrogen and the appropriate amount of oxygen are removed from the gas passing through the recombiner, and the exhaust is returned to the containment. The hydrogen in the containment is assumed to consist of hydrogen produced by the sources listed above minus the hydrogen previously recombined. The total containment pressure is adjusted to account for the amount of oxygen and hydrogen removed by the recombiner. The volume percent of hydrogen for each time step is then recalculated from the ratio of the hydrogen partial pressure to the containment pressure (neglecting the partial pressure of water vapor).

Figure 6.2-51 gives the post-DBA hydrogen concentration inside the containment structure as a function of time, with no recombiners operating, with one recombiner operating (minimum engineered safety features), and with two recombiners operating. One recombiner in operation is sufficient to maintain the hydrogen content of the containment atmosphere below four volume percent. The recombiners are actuated 4 days after a DBA, when the hydrogen content of the containment atmosphere reaches approximately 3.5 volume percent. There is ample time to initiate the system.

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Figure 6.2-52 shows the hydrogen concentration inside the containment structure with a 50 scfm purge starting 4 days after a DBA. The volume percent of hydrogen in the containment is calculated from the total hydrogen produced minus the amount removed in the purge flow. An inflow of outside air, equal in volume to the purge flow, is assumed. The purge flow is sufficient to maintain the hydrogen concentration below 4 volume percent.

Insert A

The recombiners can be actuated at any time up to a maximum of four days following a DBA. At this time, the hydrogen content of the containment atmosphere is approximately 2.6 volume percent. Four days provide ample time to initiate the system.