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

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Re: 10CFR50.73(a)(2)(ii)
June 25, 1992
MP-92-684

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Reference: Facility Operating License No. DPR-65
Docket No. 50-336
Licensee Event Report 92-003-01

Gentlemen:

This letter forwards update Licensee Event Report 92-003-01.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace
Director, Millstone Station

SES/RAB:ljs

Attachment: LER 92-003-01

cc: T. T. Martin, Region I Administrator
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2 and 3
G. S. Vissing, NRC Project Manager, Millstone Unit No. 2

NRC Form 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92

Estimated burden per response to comply with this information collection request: 50.0 hrs. Forward comments regarding burden estimate to the Records and Reports Management Branch (P-630), U.S. Nuclear Regulatory Commission, Washington, DC 20555, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Millstone Nuclear Power Station Unit 2	0 5 0 0 0 3 3 6	1 OF 0 4

TITLE (4)
Spent Fuel Pool Criticality Analysis Error

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		MONTH	DAY	YEAR	FACILITY NAMES	
0 2	1 4	9 2	9 2	- 0 0 3	- 0 1		0 6	2 5	9 2		0 5 0 0 0
											0 5 0 0 0

OPERATING MODE (9)	POWER LEVEL (10)	THIS REPORT IS BEING SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
1	0 3 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Robert A. Borchert, Unit 2 Reactor Engineer, Ext. 4418	AREA CODE 2 0 3 4 4 7 - 1 7 9 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	D B	I R K	C 4 9 C	N							

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On February 14, 1992, at 1415 hours, with the plant in Mode 1 at 30% power, Northeast Nuclear Energy Company (NNECO) was notified by ABB-Combustion Engineering (ABB-CE) that a calculational error existed in the criticality analysis for the Region 1 spent fuel storage racks. NNECO determined that this condition was reportable as a condition outside of the design basis of the plant. An immediate report was made to the NRC, and the existing reactivity condition of the spent fuel pool was verified to be in compliance with the plant Technical Specifications.

The original effective multiplication factor (K_{eff}) calculated by ABB-CE for the Region 1 fuel storage racks for nominal dimensions, nominal spent fuel pool temperature and 4.5 weight percent enriched fuel assemblies was 0.9224 (without uncertainties). The discovered error results in an underprediction of approximately 0.04 delta K_{eff}. Revised calculations by ABB-CE indicate that K_{eff} is actually 0.963 for the same conditions. An investigation by ABB-CE has traced the error to two approximations used in their calculation.

Criticality analyses to support spent fuel storage rack design changes are complete, and proposed changes to the plant Technical Specifications were submitted to the NRC on April 16, 1992. These changes were approved by the NRC on June 4, 1992.

I. Description of Event

On February 10, 1992, at approximately 1130 hours, Northeast Utilities (NU) was notified by an independent contractor that a higher than expected effective multiplication factor (K_{eff}) was calculated for the Region 1 fuel storage racks. On February 11, 1992, NU notified ABB-Combustion Engineering (ABB-CE) of the potential error in the spent fuel pool criticality analysis. On February 14, 1992, at 1415 hours, with the plant in Mode 1 at 30% power, Northeast Nuclear Energy Company (NNECO) was notified by ABB-CE that a calculational error existed in the criticality analysis for the Region 1 spent fuel storage racks.

The Millstone 2 spent fuel storage racks were modified in May 1986, and consist of two regions:

(a) Region 1 is designed to store up to 384 fuel assemblies with an initial enrichment of up to 4.5 weight percent U-235. Region 1 was designed to allow fuel assembly storage in every location. The Region 1 storage racks contain a neutron poison material (Boroflex), and have a nominal center-to-center pitch of 9.8 inches.

(b) Region 2 is designed to store up to 728 fuel assemblies which have sustained at least 55% of their design burnup. Fuel assemblies are stored in a three-out-of-four array, with blocking devices installed to prevent inadvertent placement of a fuel assembly in the fourth location. The Region 2 storage racks have a nominal center-to-center pitch of 9 inches.

The original effective multiplication factor (K_{eff}) calculated by ABB-CE for the Region 1 fuel storage racks for nominal dimensions, nominal spent fuel pool temperature and 4.5 w/o enriched fuel assemblies is 0.9224 (without uncertainties). The discovered error results in an underprediction of approximately 0.04 delta K_{eff}. Revised calculations by ABB-CE indicate that K_{eff} is actually 0.963 for the same conditions. Evaluations by ABB-CE have confirmed that the Region 2 fuel storage racks are not affected by the error.

NNECO determined that this condition was reportable as a condition outside of the design basis of the plant. An immediate report was made to the NRC, and the existing reactivity condition of the spent fuel pool was verified to be in compliance with the plant Technical Specifications. All fuel movement in the spent fuel pool had previously been restricted due to the observed degradation of the neutron poison material in the Region 1 fuel storage racks. No automatic or manual safety systems were required to respond to this event.

II. Cause of Event

An investigation by ABB-CE has traced the error to two approximations used in their calculation.

First, ABB-CE used an incorrect treatment of the self-shielding effect in Boraflex for the epithermal energy group. This resulted in an overestimation of the neutron absorption in Region 1 and thus a lower calculated K_{eff}.

Second, ABB-CE used a geometric buckling term corresponding to a sparsely populated and unpoisoned array. An approximation of buckling in the poisoned configuration. This approximation also contributed to a lower calculated K_{eff} in Region 1.

III Analysis of Event

This event is being reported in accordance with 10CFR50.73(a)(2)(ii)(B), which requires the reporting of any event or condition that results in the nuclear power plant being in a condition outside the design basis of the plant.

The safety consequence of this event is a potential uncontrolled criticality event in the spent fuel pool. Upon consideration of the following factors, a significant margin to a critical condition was always maintained and, therefore, the safety consequences of this event were minimal:

(a) The boron concentration of the spent fuel pool is procedurally controlled at greater than 1720 ppm, and is typically maintained at greater than 2000 ppm.

(b) All new fuel assemblies previously stored in the Region 1 fuel storage racks had been arranged in a 2 out of 4 checkerboard array.

(c) The maximum initial enrichment of any fuel assemblies previously stored in the Region 1 fuel storage racks was less than 4 weight percent U-235, which is less than the design enrichment of 4.5 weight percent U-235.

(d) All discharged fuel assemblies previously stored in the Region 1 fuel storage racks have sustained at least one cycle of burnup.

IV. Corrective Action

Criticality analyses to support spent fuel storage rack design changes are complete, and proposed changes to the plant Technical Specifications were submitted to the NRC on April 16, 1992. These changes were approved by the NRC on June 4, 1992. These changes split Region 1 into 2 regions, Region A and Region B. Region A can store up to 224 fuel assemblies, which will be qualified for storage by verification of adequate average assembly burnup versus fuel assembly initial enrichment (reactivity credit for burnup). Region B can store up to 120 fuel assemblies with an initial enrichment of up to 4.5 weight percent U-235 and other assemblies which do not satisfy the burnup versus initial enrichment requirements of either Region A or Region C (formerly Region 2). Fuel assemblies will be stored in a 3 out of 4 array in Region B, with blocking devices installed to prevent inadvertent placement or storage of a fuel assembly in the fourth location. Region C is the new designation for the existing Region 2 storage racks. This alphabetic storage rack designation is a human factors consideration, designed to minimize the probability of a fuel assembly movement error and to provide a historical distinction between the various fuel pool configuration records. The attached figure shows the new arrangement of the spent fuel pool.

V. Additional Information

There were no failed components during this event.

Similar LERs: 77-23, 80-05, 83-07, 85-01, 86-10 and 91-10

Spent Fuel Storage Racks

Manufacturer: Combustion Engineering

Model: Hi-Cap Spent Fuel Storage Module

EIIS Code: DB-RK-C490

NRC form 366A
(6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Millstone Nuclear Power Station Unit 2	0 5 0 0 0 3 3 6	9 2	— 0 0 3	— 0 1	0 4 OF 0 4

TEXT (If more space is required, use additional NRC Form 366A's) (17)