

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) 666-5000

Re: 10CFR50.73(a)(2)(ii)

March 13, 1992
MP-92-268

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

Reference: Facility Operating License No. DPR-65
No. 50-336
Event Report 92-003-00

Gentler

This letter thirty (30) days after the date of the Event Report 92-003-00 required to be submitted within 60 days of 10CFR50.73(a)(2)(ii).

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace
Stephen E. Scace

Director, Millstone Station

SES/RAB:ljs

Attachment: LER 92-003-00

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

CEH
APR 8 1992
873576

92031200208 920312
PDR ADJCK 05000336
S PDR

JE22, 1

LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this information collection request: 60 0 hrs. Forward comments regarding burden estimate to the Records and Reports Management Branch (2-530), U.S. Nuclear Regulatory Commission, Washington, DC 20541, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503.

FACILITY NAME (1)

Millsone Nuclear Power Station Unit 2

DOCKET NUMBER (2)

0 5 3 0 0 3 3 6 1 OF 0 3

PAGE (3)

TITLE (4)

Spent Fuel Pool Criticality Analysis Error

EVENT DATE (5)

LER NUMBER (6)

REPORT DATE (7)

OTHER FACILITIES INVOLVED (8)

MONTH DAY YEAR

MONTH DAY YEAR

MONTH DAY YEAR

FACILITY NAME

0 2 1 4 9 2 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

0 2 1 4 9 2

0 0 3

0 0 0 5 1 3 9 2

0 5 0 0 0 0 1 1

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.

NNECO is currently evaluating spent fuel storage rack design changes, additional criticality analyses (including the effects of observed boron flux degradation), and changes to the plant Technical Specifications to allow use of the Region 1 fuel storage racks.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

Estimated burden per response to comply with this information collection request: 30.0 hrs. Forward comments regarding burden estimate to the Records and Reports Management Branch (2-530), U.S. Nuclear Regulatory Commission, Washington, DC 20545, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)	
		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 0	0 2	OF 0 3

TEXT (if more space is required, use additional NRC Form 365A-a) (17)

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-Cornubation 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 1955, and consist of two regions:

- 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.
- Region 2 is designed to store up to 728 fuel assemblies which have sustained at least 85% 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 1.9224 (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 0.967 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 the transport cross-sections as an approximation for the total cross-sections. 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 as 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.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

Estimated burden per response to comply with this information collection request: 50.0 hrs. Primary 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.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Millstone Nuclear Power Station Unit 2	0500033692	003	00	03	OF	03

TEXT (if more space is required, use additional NRC Form 366A as 117)

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:

- 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.
- All new fuel assemblies previously stored in the Region 1 fuel storage racks had been arranged in a 2 out of 4 checkerboard array.
- 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.
- All discharged fuel assemblies previously stored in the Region 1 fuel storage racks have sustained at least one cycle of burnup.

IV. Corrective Action

NNECO is currently evaluating spent fuel storage rack design changes, additional criticality analyses (including the effects of observed boron degradation), and changes to the plant Technical Specifications in order to allow use of the Region 1 fuel storage racks. Proposed changes to the Technical Specifications are expected to be submitted to the NRC about April 1, 1992.

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

EHS Code: DP-RK-C490