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The Northeast Utilities System

January 11, 2001  
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U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

Subject: Millstone Nuclear Power Station, Unit No. 1, Docket No. 50-245  
Licensee Event Report (LER) 2000-02-00

This letter forwards Licensee Event Report 2000-02-00 (Attachment 1) and is submitted pursuant to 10CFR20.2201(b).

If you have any questions regarding this letter, please contact Mr. Bryan S. Ford at (860) 437-5895.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

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Bryan S. Ford  
Director Decommissioning

cc: H. J. Miller, Region I Administrator  
J. B. Hickman, NRC Senior Project Manager, Millstone Unit No. 1  
T. J. Jackson, NRC Region 1

Director  
Bureau of Air Management  
Monitoring and Radiation Division  
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79 Elm Street  
Hartford, CT 06106-5127

IE22

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1) <b>Millstone Nuclear Power Station Unit 1</b>		DOCKET NUMBER (2) <b>05000245</b>	PAGE (3) <b>1 OF 6</b>
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TITLE (4)  
**Fuel Rod Accountability**

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 NAME	DOCKET NUMBER	
11	16	2000	2000	-- 002	-- 00	01	15	2001	FACILITY NAME	DOCKET NUMBER	
OPERATING MODE (9)		N/A	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)								
POWER LEVEL (10)			0	<input checked="" type="checkbox"/> 20.2201(b)			20.2203(a)(2)(v)			50.73(a)(2)(i)	50.73(a)(2)(viii)
				20.2203(a)(1)			20.2203(a)(3)(i)			50.73(a)(2)(ii)	50.73(a)(2)(x)
				20.2203(a)(2)(i)			20.2203(a)(3)(ii)			50.73(a)(2)(iii)	73.71
				20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)	OTHER
			20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A	
			20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME <b>Bryan Ford, Decommissioning Director</b>	TELEPHONE NUMBER (Include Area Code) <b>(860) 437-5895</b>
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE).	<input type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15)	MONTH <b>4</b>	DAY <b>01</b>	YEAR <b>01</b>
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

During a reconciliation and verification of the Millstone Unit 1 spent nuclear fuel records, Unit 1 personnel concluded that the location of two full-length irradiated fuel rods could not be determined, and was not properly tracked in the Special Nuclear Material (SNM) records. The records reconciliation and verification effort is part of ongoing decommissioning activities at Millstone Unit 1.

The two irradiated fuel rods are from fuel assembly MS 557, which was disassembled in 1972 for inspection. The two rods were displaced during the re-assembly of assembly MS 557 in 1974. Records indicate that in 1979 and 1980, the displaced rods were physically verified to be stored in a canister in the Spent Fuel Pool (SFP). The rods and canister are no longer in the SFP location documented in 1979 and 1980. Records retrieved to date do not document their relocation or disposition.

Due to the radiation levels associated with the fuel rods, it is only considered credible that they either remain stored in the SFP or they were shipped in a shielded cask to a facility licensed to accept radioactive material. Due to the controls in place at both Millstone and the facilities licensed to accept radioactive material, there is no undue risk to the health and safety of the public or plant and licensed facility workers.

The investigation into the location of the two fuel rods is ongoing.

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

I. Description of Event

During a reconciliation and verification of the Millstone Unit 1 spent nuclear fuel records, it was concluded that the location of two full-length irradiated fuel rods was not properly tracked in the Special Nuclear Material (SNM) records. The records reconciliation and verification effort is part of ongoing decommissioning activities at Millstone Unit 1. A condition report (CR) M1-00-0548 was written on November 16, 2000, documenting the issue. Table 1 provides a description of the fuel rods.

The two irradiated fuel rods are from fuel assembly MS 557, which was disassembled in 1972 for inspection. The two rods were displaced during the re-assembly of assembly MS 557 in 1974. Records indicate that in 1979 and 1980, the displaced rods were physically verified to be stored in a canister in the Spent Fuel Pool (SFP). The rods and canister are no longer in the SFP location documented in 1979 and 1980. Records retrieved to date do not document their relocation or disposition.

On December 14, 2000, Northeast Nuclear Energy Company (NNECO) notified the Nuclear Regulatory Commission (NRC) of the fuel rod accountability issue via telephone pursuant to the requirements of 10CFR20.2201(a)(ii) and 10CFR50.72(b)(2)(vi). Concurrently, NNECO notified the State of Connecticut.

II. Chronology

October 1972	Assembly MS 557 was disassembled by the fuel vendor to provide assembly components for analysis and testing.
May 1974	Assembly MS 557 was reassembled by the fuel vendor. Two rods were not replaced into the assembly.
1974 through 1984	The fuel vendor conducted a Segmented Test Rod (STR) Program that included shipping of irradiated, segmented (partial length) test fuel rods in a shielded cask to the vendor for analysis and evaluation. This program also resulted in the construction of a separate assembly (canister), SRP-2D to hold discharged segmented test rods as needed.
1978 through 1985	Work was performed in the SFP to process, consolidate and store miscellaneous irradiated components and instruments in cask liners.
March 1979	A SFP map dated March 13, 1979 identifies two rods in a canister located in the SFP.
May 1979	A reactor engineer requests that the onsite fuel vendor representative visually inspect the canister in the SFP and identify the two fuel rods utilizing the serial numbers. The vendor responds that their visual inspection of the rods and applicable fuel assembly records indicates that the two fuel rods are from assembly MS 557. The reactor engineer begins tracking these two rods on an inventory card in the Fuel Card Index.
April 1980	The fuel rods are noted on the SFP map of April 30, 1980 as located in a storage canister in the SFP.
September 1980	A SFP map dated September 18, 1980 no longer identifies the location of the fuel rods and canister.
1980 through 1990	Numerous shipments of miscellaneous irradiated components from the SFP occurred.
1990	An inventory list was completed in early 1990 and there was no indication of the canister or the two fuel rods.

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

November 16, 2000	The records reconciliation and verification effort identifies that the location of two full-length irradiated fuel rods was not properly reflected in Special Nuclear Material (SNM) records. Condition Report M1-00-0548 was initiated.
December 14, 2000	NNECO notified the Nuclear Regulatory Commission (NRC) of the fuel rod accountability issue via telephone pursuant to 10CFR20.2201(a)(ii) and 10CFR50.72(b)(2)(vi). Concurrently, NNECO notified the State of Connecticut.
December 20, 2000	The licensed facilities in South Carolina and Washington that receive radioactive waste material shipments from Millstone were contacted and informed about the fuel rod accountability issue.

III. Investigation

A response team was established and later augmented to locate the fuel rods. Due to the radiation levels associated with the fuel rods, the investigation focused on locating the rods either in the pool or at a facility licensed to accept radioactive material. Initial reviews of records and visual inspections of the most likely locations in the SFP have been performed. Selected visual inspections of the SFP were conducted assuming four possible scenarios: (1) the rods are still in their original canister, (2) the rods have been removed from the original canister and have been placed in a different canister, (3) the rods have been placed in a fuel assembly, or (4) the rods are stored in other available locations; e.g., empty fuel storage locations, control rod storage tubes, etc.

The following specific actions have been completed:

1. The visual inspection of assembly MS 557 indicates that it contains a dummy spacer capture rod and an empty hole in one tie rod location.
2. Two specific possible locations for the rods were identified and visually inspected: assembly (canister) SRP-2D and the fuel canister containing fuel assembly MS 508.
3. A visual inspection of accessible spent fuel pool locations was made with special camera equipment.
4. A review of selected vendor and licensee fuel records has been performed.
5. A review of selected vendor and licensee fuel shipment records has been performed. The record of shipments of irradiated fuel describe transfer of test rods to the vendor during the 1974-1984 time period. The vendor location noted on the shipping records was not capable of receiving full-length irradiated fuel rods during the 1974-1984 time period. Therefore, it is considered unlikely that the fuel rods were shipped to this vendor location.
6. Personnel interviews have been performed.
7. A radiological and criticality assessment of the two fuel rods was performed.
8. An independent review team has been established to assess completed actions and provide recommendations as the investigation continues.

The investigation is on-going and the investigation team is being augmented as needed.

IV. Health and Safety

An assessment of the contact radiation levels of the two fuel rods has been performed. Contact radiation levels were initially estimated to have been on the order of 8000R/hr in the early 1980's and approximately 1000R/hr today. Results of the detailed calculations revealed that doses were on the order of 1600R/hr in 1980 and 850R/hr in 2000. With these radiation levels, removal from the SFP, other than in a shielded cask would have triggered multiple plant radiation alarms. The possibility of theft or diversion of the two fuel rods is highly improbable due to the estimated radiation levels.

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Two possible scenarios have been analyzed for health and safety:

1. Fuel rods remain on site.

A criticality calculation has shown that even with the rods inadvertently located next to the most reactive fuel assembly in the spent fuel pool, the geometric configuration is such that the local fuel assembly array, as well as the pool would remain below 0.90  $K_{eff}$  sub-critical. If the rods remain in the SFP, they are stored safely with the other spent fuel and there is no undue threat to the health and safety of the public or plant workers. Further visual inspections of the SFP are planned.

2. Fuel rods were shipped off site.

If a shielded cask shipment occurred, it was shipped to a licensed facility, either as:

- (a) Irradiated fuel to the fuel vendor; or

If the fuel rods have been sent to a licensed irradiated fuel vendor, they are being stored in accordance with the vendor's license requirements which are established to ensure that there is no undue risk to the health and safety of the public, environment and the worker. Further records review is ongoing.

- (b) Irradiated waste to a licensed facility.

An initial review of shipping records indicates that the only facilities considered credible for receiving these rods as irradiated waste are the licensed radioactive waste disposal sites in the States of Washington and South Carolina.

During shipment of these rods in a shielded cask, the general radiation profiles for the two fuel rods would have been within the limits established for transportation to these licensed facilities under existing DOT, NRC and States of Washington and South Carolina regulations. Therefore, due to the controls in place during the shipping of radioactive material to these licensed facilities, there is no undue threat to the health and safety of the public, resulting from the possible shipment of these fuel rods.

An initial review of these facilities has indicated that although these facilities are not licensed to accept spent nuclear fuel, they are authorized to receive and possess source material and special nuclear material. This review also indicated that the total activity and volume associated with the rods is a small fraction of the total activity and volume accepted at these sites. In addition, a criticality evaluation of the two fuel rods was performed. In the optimum (or worst case scenario) configuration, the criticality evaluation of the two rods with an enrichment of 2.44 w/o % at zero burn-up, with a water reflector, indicates that the fuel would be substantially sub-critical. Therefore, due to the controls in place at these facilities licensed to accept radioactive material, there is no undue threat to the health and safety of the public, or workers at these facilities, resulting from the possible shipment and receipt of these fuel rods.

Further records review is ongoing.

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### V. Cause of Event

NNECO can not provide the apparent cause for this event at this time. The investigation is on-going.

### VI. Independent Assessment

The Independent Review Team that is augmenting the investigation has performed an initial assessment. They have independently determined that:

- They concur with the information and data reviewed to date that there is no undue risk to the health and safety of the public, plant workers or licensed facility workers.
- Evidence to date does not strongly support one scenario over the other; i.e., that the fuel rods are in the SFP or have been shipped to a licensed facility.

### VII. Ongoing Actions

The investigation and the following actions are ongoing:

1. The establishment of an enhanced project team.
2. The performance of additional SFP visual inspections.
3. The continuation of records retrieval and review of relevant documentation (e.g., SFP maps, control room logs, vendor fuel reconstitution records, radiation work permits, waste shipment records, and material transfer forms).
4. The conduct and documentation of additional personnel interviews.
5. Ongoing communications and notifications to the licensed facility located on the Hanford Reservation in the State of Washington and the licensed facility located at Barnwell in the State of South Carolina.

### VIII. Future Reports

In accordance with 10CFR20.2201(d), subsequent to this written report, additional substantive information will be reported within 30 days of discovery of such information. A Supplemental Report will address the following additional issues:

1. Circumstances under which the rods were lost.
2. Statement of disposition, or probable disposition of the rods.
3. Actions that have been taken and will be taken to recover the rods.
4. Description of procedures or measures that have been, or will be taken to prevent recurrence.

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**Table I – Fuel Rods Description**

<b>Type of Special Nuclear Material:</b>	One GE 7D Tie rod and One GE 7D Spacer Capture Rod
<b>Material:</b>	Uranium dioxide initially enriched to 2.44% in Zircaloy 2 cladding
<b>Length of Fuel Rods:</b>	158 inches
<b>Fuel Rod Diameter:</b>	0.570 inches
<b>Total Uranium in the 2 Fuel Rods:</b>	7732.0 grams (year 2000)
<b>Total Uranium<sub>235</sub> in the 2 Fuel Rods:</b>	101.4 grams (year 2000)
<b>Total Plutonium in the 2 Fuel Rods:</b>	40.2 grams (year 2000)
<b>Total Fissile Plutonium in the 2 Fuel Rods:</b>	32.8 grams (year 2000)
<b>Activity Level:</b>	2.591 X 10 <sup>2</sup> Ci (year 2000)
<b>Average Burnup of Assembly MS 557</b>	9011 MWD/MTU
<b>Effective Full Power Days (EFPD):</b>	508 EFPD