



Entergy Nuclear Northeast
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June 17, 2004
BVY 04-056

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

Subject: Vermont Yankee Nuclear Power Station
License No. DPR-28, Docket No. 50-271
Reportable Occurrence No. LER 2004-002-00

As defined by 10 CFR 20.2201(b), we are submitting the attached reportable occurrence as LER 2004-002-00. This LER provides an update on the progress of the event investigation. Additional information will be provided in accordance with the requirements of 10 CFR 20.2201(d).

Sincerely,

ENERGY NUCLEAR OPERATIONS, INC.
VERMONT YANKEE

A handwritten signature in black ink, appearing to read "Kevin A. Bronson".

Kevin Bronson
General Manager

cc: USNRC Region I Administrator
USNRC Resident Inspector - VYNPS
USNRC Project Manager - VYNPS
Vermont Department of Public Service

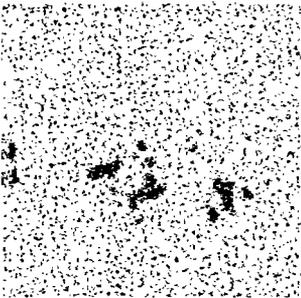
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LICENSEE EVENT REPORT (LER)
(See reverse for required number of digits/characters for each block)

1. FACILITY NAME VERMONT YANKEE NUCLEAR POWER STATION (VY)	2. DOCKET NUMBER 05000271	3. PAGE 1 of 9
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4. TITLE
Special Nuclear Material not Accounted for at Vermont Yankee

5. EVENT DATE	6. LER NUMBER	7. REPORT DATE	8. OTHER FACILITIES INVOLVED
MO DAY YEAR 04 20 2004	YEAR SEQUENTIAL NUMBER REV NO 2004 - 002 - 00	MO DAY YEAR 06 17 2004	FACILITY NAME DOCKET NUMBER N/A 05000 - FACILITY NAME DOCKET NUMBER N/A 05000 -

9. OPERATING MODE N	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
	<input checked="" type="checkbox"/>	20.2201(b)	<input type="checkbox"/>	20.2203(a)(3)(ii)	<input type="checkbox"/>	50.73(a)(2)(ii)(B)	<input type="checkbox"/>	50.73(a)(2)(ix)(A)
10. POWER LEVEL 0	<input type="checkbox"/>	20.2201(d)	<input type="checkbox"/>	20.2203(a)(4)	<input type="checkbox"/>	50.73(a)(2)(iii)	<input type="checkbox"/>	50.73(a)(2)(x)
	<input type="checkbox"/>	20.2203(a)(1)	<input type="checkbox"/>	50.36(c)(1)(i)(A)	<input type="checkbox"/>	50.73(a)(2)(iv)(A)	<input type="checkbox"/>	73.71(a)(4)
	<input type="checkbox"/>	20.2203(a)(2)(i)	<input type="checkbox"/>	50.36(c)(1)(ii)(A)	<input type="checkbox"/>	50.73(a)(2)(v)(A)	<input type="checkbox"/>	73.71(a)(5)
	<input type="checkbox"/>	20.2203(a)(2)(ii)	<input type="checkbox"/>	50.36(c)(2)	<input type="checkbox"/>	50.73(a)(2)(v)(B)	<input type="checkbox"/>	OTHER Specify in Abstract below or in NRC Form 366A
	<input type="checkbox"/>	20.2203(a)(2)(iii)	<input type="checkbox"/>	50.46(a)(3)(ii)	<input type="checkbox"/>	50.73(a)(2)(v)(C)	<input type="checkbox"/>	
	<input type="checkbox"/>	20.2203(a)(2)(iv)	<input type="checkbox"/>	50.73(a)(2)(i)(A)	<input type="checkbox"/>	50.73(a)(2)(v)(D)	<input type="checkbox"/>	
	<input type="checkbox"/>	20.2203(a)(2)(v)	<input type="checkbox"/>	50.73(a)(2)(i)(B)	<input type="checkbox"/>	50.73(a)(2)(vii)	<input type="checkbox"/>	
	<input type="checkbox"/>	20.2203(a)(2)(vi)	<input type="checkbox"/>	50.73(a)(2)(i)(C)	<input type="checkbox"/>	50.73(a)(2)(viii)(A)	<input type="checkbox"/>	
	<input type="checkbox"/>	20.2203(a)(3)(i)	<input type="checkbox"/>	50.73(a)(2)(ii)(A)	<input type="checkbox"/>	50.73(a)(2)(viii)(B)	<input type="checkbox"/>	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		

12. LICENSEE CONTACT FOR THIS LER

NAME Kevin Bronson, General Manager	TELEPHONE NUMBER (Include Area Code) (802) 257-7711
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
N/A					N/A				

14. SUPPLEMENTAL REPORT EXPECTED

<input checked="" type="checkbox"/>	YES (If yes, complete EXPECTED SUBMISSION DATE)	<input type="checkbox"/>	NO	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
					08	19	2004

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On 04/20/2004, with the reactor shutdown for a refuel outage, an inventory of Special Nuclear Material (SNM) located in the Spent Fuel Pool (SFP) revealed that two fuel rod pieces, approximately one half inch in diameter by approximately 9 and 17.75 inches in length were not in the designated storage location. This event was initially reported as NRC Event Number 40694 pursuant to 10 CFR 50.72 (b)(2)(xi) on 04/21/04, with an update notification on 05/19/04 to address additional reporting regulations. The partial length fuel rod pieces were the result of a fuel inspection, sipping, and reconstitution campaign that was performed in 1979 due to Crud Induced Localized Corrosion (CILC) fuel rod failures identified at Vermont Yankee and elsewhere within the nuclear industry. The two fuel rod pieces were believed to have been placed in narrow pipes that are an integral part of a larger stainless steel container and stored at the bottom of the SFP. This container was only designed for storage of the fuel rod pieces in the SFP and did not have the necessary shielding to allow for safe transport outside of the underwater environment. The portion of the investigation that involves the visual inspection of the SFP is complete. Continuing efforts include, but are not limited to, document reviews and interviews with pertinent present and former employees and contractors who have been associated with SFP and radioactive waste operations at Vermont Yankee.

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

DESCRIPTION:

On 04/20/2004, with the reactor shutdown for a refuel outage, an inventory of Special Nuclear Material (SNM) located in the Spent Fuel Pool (SFP) revealed that two fuel rod pieces, approximately one half inch in diameter by approximately 9 and 17.75 inches in length were not in the designated storage location. This event was initially reported as NRC Event Number 40694 pursuant to 10 CFR 50.72 (b)(2)(xi) on 04/21/04 in connection with a planned press release. An update to this notification was completed on 05/19/04 pursuant to 10 CFR 20.2201(a)(1)(ii), for "missing radioactive material" and under 10CFR74.11 for "lost SNM" as it became apparent to the SNM investigation team that a high probability existed the missing fuel rod pieces would not be found in the SFP.

The partial length fuel rod pieces were the result of a fuel inspection, sipping, and reconstitution campaign that was performed in 1979 due to Crud Induced Localized Corrosion (CILC) fuel rod failures identified at Vermont Yankee and elsewhere within the nuclear industry. The two fuel rod pieces were believed to have been placed in narrow pipes that are an integral part of a larger stainless steel container and stored at the bottom of the SFP that is approximately 40 feet in depth. This container was only designed for storage of the fuel rod pieces in the SFP and did not have the necessary shielding to allow for safe transport outside of the underwater environment. The portion of the investigation that involves the visual inspection of the SFP is complete. Continuing efforts include, but are not limited to, document reviews and interviews with pertinent present and former employees and contractors who have been associated with SFP and radioactive waste operations at Vermont Yankee.

10 CFR 20.2201(b) requires a written report within 30 days after the initial notification for the occurrence of any lost, stolen, or missing licensed material that was reported under 10 CFR 2201(a)(1)(ii) for licensed material in a quantity greater than 10 times the quantity specified in Appendix C to Part 20. The following topics are required to be addressed within the report.

- (i) A description of the licensed material involved, including kind, quantity, and chemical and physical form; and
- (ii) A description of the circumstances under which the loss or theft occurred; and
- (iii) A statement of disposition, or probable disposition, of the licensed material involved; and
- (iv) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas; and
- (v) Actions that have been taken, or will be taken, to recover the material; and
- (vi) Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

Topic (i): A description of the licensed material involved, including kind, quantity, and chemical and physical form.

During the on-going SNM investigation, an accurate measurement was made of the remaining pieces of the two fuel rods from which the two missing pieces originated and it was determined that the fuel rod piece that came from location D-2 in fuel assembly LJ3915 was 17.75 inches in length, and the fuel rod piece that came from location D-2 in fuel assembly LJ3949 was 9 inches in length. Table 1 contains a detailed physical description and Table 2 contains the isotopic inventory of the missing fuel rod pieces.

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Topic (ii): A description of the circumstances under which the loss or theft occurred.

On 03/17/79, the plant was shutdown to begin a refueling outage. The purpose of this outage was to inspect, sip, reconstitute and replace a number of leaking fuel assemblies. The two missing fuel rod pieces originated from two fuel assemblies (LJ3915 and LJ3949) from this batch of fuel rods and were believed to have been placed in a storage container in the SFP.

The two fuel rod pieces were discovered missing on 04/20/04 from their designated storage container in the SFP as part of a SNM verification plan. To date, there is no firm, reliable evidence to support what actually occurred that resulted in the missing fuel rod pieces.

The most likely scenario currently postulated for the lost SNM is that, as a result of a SFP clean-up effort, the pieces were shipped off site in a cask to a licensed low-level radiological waste disposal facility. When complete, the root cause process will produce a series of scenarios that will be evaluated. Each of these scenarios will be investigated through the scenario development and resolution process based on facts generated by data review and interviews.

Topic (iii): A statement of disposition, or probable disposition, of the licensed material involved.

The most likely scenario currently postulated for the lost SNM is that, as a result of a SFP clean-up effort, the pieces were shipped off site in a cask to a licensed low level radioactive waste disposal facility.

Topic (iv): Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas.

No specific exposures to plant personnel or the public have been identified as a result of this event.

Topic (v): Actions that have been taken, or will be taken, to recover the material.

The root cause investigation is currently in progress. A team of investigators completed a detailed physical inspection of the SFP. A second team is collecting and performing document reviews and a third team is conducting interviews with present and former employees and contractors who have been associated with SFP and radioactive waste operations at Vermont Yankee.

The portion of the investigation that involves the visual inspection of the SFP is complete. That work included searches with pole-mounted and robotic crawler-mounted cameras above and below all accessible areas around the spent fuel storage racks as well as in empty fuel racks and other containers and storage areas. The camera search did not find the missing fuel rod pieces. Therefore, it is believed that the two missing fuel rod pieces are not in the SFP.

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The following SFP inspections were completed by the team:

1. The container and integral piping where the two fuel rod pieces were believed to be stored.
2. All open spaces in the SFP.
3. All containers hanging on the wall that could contain the fuel rod pieces.
4. Accessible areas under the racks.
5. Accessible areas in between the fuel storage racks.
6. On top of the fuel assemblies.
7. All open cell locations that have not been used in the past two years.
8. Four fuel assemblies directly associated with the 1979 fuel inspection, sipping, reconstitution and replacement campaign (LJ3915, LJ3912, LJ3949 and LJ3891).
9. One additional fuel assembly (LJ3892) with one fuel rod that had separated into four segments (3 segments shipped to GE Vallecitos; one remains in the fuel assembly).
10. Two fuel storage assemblies were inspected for verification of fuel rods and void spaces.
11. All fuel assembly serial numbers were verified.

An extent of condition assessment is being conducted for this event as part of the event investigation. This review includes the physical search of the SFP as well as a thorough review of SNM, radiological waste and other related documents to ensure accountability of all full and partial length rods.

Topic (vi): Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

An independent assessment of the SNM program has been performed by the Corporate Assessment group to identify areas for improvement to current processes for controlling SNM. The results of this assessment are currently being formalized by the Entergy Nuclear Northeast Corporate Office in White Plains, New York.

Corrective actions will be developed to address the causes identified through the root cause investigation process to prevent recurrence of this event.

CAUSE:

No root cause or contributing causes have been determined at this time. A supplement to this LER will be issued to provide this information when the root cause investigation has been completed.

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CORRECTIVE ACTIONS:

Immediate actions:

1. Contacted the appropriate management personnel, notified the NRC Resident Inspector and notified the NRC Operations Center pursuant to 10 CFR 50.72(b)(2)(xi), recorded as USNRC Event Number 40694.
2. Entered this event into the station's corrective actions process, and established a SNM Investigation Team consisting of plant staff, Entergy shared resources and external consultants.

Interim Actions:

1. Completed an inventory of all SNM located in the SFP. This effort consisted of the following:
 - a. A check of every spent fuel assembly serial number against the documented location in the SFP racks. No discrepancies in the SNM records were noted.
 - b. A verification of the Local Power Range Monitor (LPRM) detectors documented to be stored in the SFP. No discrepancies were noted.
 - c. A verification that the remaining portions of the fuel rods that were the sources of the missing fuel rod pieces were in their documented locations. No discrepancies were noted.
2. Performed SFP inspections as described in the response to Topic (v).
3. Verified that all spent fuel assemblies stored in the SFP are in their correct locations.

Actions in Progress:

1. A methodical review of pertinent documents is being performed to gather information that will be used to analyze potential exit scenarios from the plant and create timelines of significant events to re-create and attempt to follow the movement of the fuel rod pieces.
2. Interviews are being conducted with key personnel that were in a position to be involved with SNM control. Information obtained from the interviews is being input into scenarios under development for the root cause analysis.

Projected Actions:

1. When complete, the root cause process will produce a series of scenarios that will be evaluated. Each of these scenarios will be investigated through the scenario development and resolution process based on facts generated by data review and interviews.
2. Analyze potential exit scenarios from the plant and create timelines of significant events to re-create and attempt to follow the movement of the fuel rod pieces with information obtained through the SNM investigation.

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ASSESSMENT OF SAFETY CONSEQUENCES:

Vermont Yankee has a system of radiation monitors on the refuel floor and throughout the station with alarm set points that are capable of alerting control room operators and plant personnel to the movement of highly radioactive material in the protected area. Due to the radioactive nature of the material, it is unlikely the pieces could have been inadvertently removed from the SFP in anything other than a container specifically designed to contain highly radioactive material. Even after 25 years, the dose rate from either of the two fuel rod pieces would have caused multiple local area radiation monitor alarms while traversing through the protected area. If the pieces were inadvertently removed from the SFP, they would have been placed in a licensed cask and transported to a licensed low level radioactive waste disposal facility. Therefore, there is reasonable assurance that public health and safety is not, nor was ever at risk as a result of this issue.

Table 3 provides the estimated dose rates that would be encountered when handling the fuel rod pieces. The on-going investigation effort will be evaluating this and other possible exit scenarios for the missing fuel rod pieces.

ADDITIONAL INFORMATION:

No similar events were identified to have occurred at Vermont Yankee.

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Table 1: Spent Fuel Rod Description

Type of Special Nuclear Material	Spent Fuel Rods, GE Bundle		
Material	Uranium Dioxide initially enriched to 3.01 percent, encased in Zircalloy 2 cladding		
Physical Form	Solid		
	Fuel Rod 1 (LJ3949)	Fuel Rod 2 (LJ3915)	Total
Length of Spent Fuel Rods	9 inches	17.75 inches	N/A
Spent Fuel Rod Diameter	0.493 inches	0.493 inches	N/A
Effective Full Power Days	855	730	N/A
Exposure MWD/MT	20064	17133	N/A
Weight of Special Nuclear Material	204 grams	405 grams	609 grams

Note: Weights and activities presented in this table have been corrected for the year 2004.

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Table 2: Spent Fuel Rod Isotopic Inventory

Nuclide	17.75" Fuel Rod Piece		9" Fuel Rod Piece		Total	
	Mass (grams)	Activity (Curies)	Mass (grams)	Activity (Curies)	Mass (grams)	Activity (Curies)
U-235	5.278E+00	1.141E-05	2.676E+00	5.785E-06	7.954E+00	1.720E-05
U-238	3.353E+02	1.128E-04	1.700E+02	5.719E-05	5.230E+02	1.700E-04
Pu-239	1.415E+00	8.798E-02	7.175E-01	4.461E-02	2.133E+00	1.326E-01
Pu-240	3.831E-01	8.734E-02	1.942E-01	4.429E-02	5.773E-01	1.316E-01
Pu-241	7.533E-02	7.764E+00	3.820E-02	3.937E+00	1.135E-01	1.171E+01
Pu-242	4.265E-02	1.629E-04	2.163E-02	8.260E-05	6.428E-02	2.455E-04
Am-241	1.773E-01	6.089E-01	8.990E-02	3.087E-01	2.672E-02	9.176E-01
Cm-242	4.604E-07	1.523E-03	2.334E-07	7.722E-04	6.938E-07	2.292E-03
Sr-90	5.890E-02	8.120E+00	2.986E-02	4.117E+00	8.876E-02	1.224E+01
Cs-137	1.230E-01	1.066E+01	6.237E-02	5.405E+00	1.854E-01	1.607E+01
Co-60	1.880E-05	2.131E-02	9.532E-06	1.081E-02	2.833E-05	3.212E-02
Ni-63	3.370E-04	1.911E-02	1.709E-04	9.690E-03	5.079E-04	2.880E-02
Ni-59	1.780E-03	1.440E-04	9.024E-04	7.301E-05	2.682E-03	2.170E-04
Nb-94	4.650E-05	8.709E-06	2.357E-05	4.414E-06	7.007E-05	1.312E-05
Tc-99	1.500E-01	2.530E-03	7.606E-02	1.283E-03	2.261E-01	3.813E-03
I-129	3.130E-02	5.534E-06	1.587E-02	2.806E-06	4.717E-02	8.340E-06

Notes:

- 1) Weights and activities presented in this table have been corrected for the year 2004.
- 2) The isotopic inventory for the 17.75 inch fuel rod piece was calculated by ORIGEN. Radionuclides and weights for the 9 inch have been derived by linear interpolation.

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**Table 3: Spent Fuel Rod Estimated
Dose Rate Summary - Unshielded**

Years of Decay	17.75" Fuel Rod Piece (rad/hr in air)			9" Fuel Rod Piece (rad/hr in air)		
	Dose Rate On Contact	Dose Rate at 1 ft	Dose Rate at 3 ft	Dose Rate On Contact	Dose Rate at 1 ft	Dose Rate at 3 ft
0	3.52E+06	5.55E+04	7.12E+03	3.40E+06	3.24E+04	3.66E+03
1	1.12E+04	1.84E+02	2.37E+01	1.08E+04	1.07E+02	1.22E+01
2	5.48E+03	9.05E+01	1.17E+01	5.28E+03	5.30E+01	6.03E+00
4	3.25E+03	5.40E+01	6.98E+00	3.12E+03	3.16E+01	3.60E+00
10	1.60E+03	2.69E+01	3.49E+00	1.54E+03	1.59E+01	1.81E+00
15	1.28E+03	2.15E+01	2.79E+00	1.23E+03	1.27E+01	1.43E+00
20	1.10E+03	1.86E+01	2.41E+00	1.06E+03	1.09E+01	1.24E+00
25	9.65E+02	1.63E+01	2.11E+00	9.27E+02	9.59E+00	1.09E+00