

June 8, 2004

The Honorable James M. Jeffords  
United States Senate  
Washington, D.C. 20510

Dear Senator Jeffords:

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am responding to your letter of April 22, 2004, in which you raised specific questions concerning the accountability for two irradiated spent fuel rod segments presumed missing from the Vermont Yankee Nuclear Power Station (Vermont Yankee). Responses to your specific questions are enclosed. The NRC staff is conducting a special inspection to investigate the missing fuel rod segments. More information may become available as the special investigation progresses.

In March 2004, the NRC's Resident Inspector at Vermont Yankee performed an inspection of Entergy's (the licensee's) program for control of special nuclear material. The inspection identified concerns with the method used by Entergy to perform the physical inventory of the two spent fuel rod segments. In response to the Resident Inspector's concerns, Entergy used an underwater video device to determine if the two spent fuel rod segments were in the storage container in the spent fuel pool, but could not locate them. On April 21, 2004, Entergy notified the NRC that the spent fuel rod segments were missing. Entergy initiated an investigation consisting of an additional underwater video inspection of the entire spent fuel pool, a review of Entergy's radioactive material shipment records, personnel interviews, and identification of possible disposal locations. On May 19, 2004, Entergy reported to the NRC that the underwater video inspection of the spent fuel pool was essentially complete. This second underwater video inspection did not find the unaccounted for fuel rod segments.

The NRC staff has closely monitored Entergy's actions and investigation since Entergy reported that it could not locate the two spent fuel rod segments. During the special inspection, the NRC will review the results of Entergy's investigation, assess Entergy's root cause evaluation, determine if Entergy is in compliance with applicable regulations, and identify which findings may have generic implications. The NRC will consider any generic findings in its determination of the need for actions by all licensees. The NRC staff has discussed this issue with individuals representing the States of Vermont, New Hampshire, Massachusetts, Washington, South Carolina, and New York, and will continue to engage them in the NRC's response to the issue. The NRC staff has also briefed members of your staff on this issue.

In your April 22, 2004, letter, you also raised concerns about the steam dryer at Vermont Yankee and requested that the NRC expeditiously release the results of NRC inspections performed in this area. Status information about the steam dryer inspection is included in the enclosed responses.

Additionally, I responded on May 4, 2004, to your letter dated March 31, 2004. As stated in that letter, I responded to the Vermont Public Service Board (PSB) by letter dated May 4, 2004, regarding the PSB's request for an independent engineering assessment of Vermont Yankee. My letter to the PSB discussed an engineering inspection of Vermont Yankee that the Commission believes is appropriate for addressing our oversight responsibilities and is also responsive to the PSB's concerns.

The Commission shares your concerns regarding the two missing spent fuel rod segments. While it is premature to make any conclusions on their location, we believe it is highly unlikely that the material is in the public domain. The NRC views the control of spent nuclear fuel to be of great importance. The NRC will continue to monitor and evaluate the licensee's response to this issue to assess actions to be taken to preclude future similar events.

If you have further comments or questions related to this matter, please contact me.

Sincerely,

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Nils J. Diaz

Enclosure: Questions and Answers

Identical letter sent to:

The Honorable James M. Jeffords  
United States Senate  
Washington, D.C. 20510

The Honorable Patrick Leahy  
United States Senate  
Washington, D.C. 20510

The Honorable Bernard Sanders  
United States House of Representatives  
Washington, D.C. 20515

## Questions and Answers

- Q. “When was the most recent NRC [Nuclear Regulatory Commission] inspection concluding that the missing pieces were in the spent-fuel pool?”
- A. The NRC has never performed an inspection at the Vermont Yankee Nuclear Power Station (Vermont Yankee) specifically to verify that the two missing spent fuel rod segments in question were in the spent fuel pool. However, the NRC has conducted materials control and accounting (MC&A) inspections at Vermont Yankee.

In general, the NRC conducts MC&A inspections to determine whether licensees have limited their possession and use of special nuclear material (SNM) to the locations and purposes authorized by their operating licenses. In addition, during these inspections, the NRC determines whether licensees have implemented adequate and effective programs to account for and control the SNM in their possession. As part of MC&A inspections, NRC inspectors also verify the physical location of a sample of spent fuel assemblies in the spent fuel pool. Findings from MC&A inspections at power reactors prior to 1988 did not indicate that there were major deficiencies in power reactor licensees’ MC&A programs. At that time, the NRC considered there was low risk of improper storage of spent fuel at a power reactor since its physical and radiological characteristics made it highly unlikely that spent fuel could be safely removed from the fuel pool without proper equipment and procedures. Therefore, in 1988, the NRC chose to allocate inspection resources to other more risk-significant issues. In 2001, the NRC staff examined MC&A vulnerabilities as part of the comprehensive review of the NRC’s Safeguards and Security Program that was undertaken in response to the terrorist activities of September 11, 2001, and in response to the issue of two missing fuel rods at the Millstone Nuclear Power Station Unit 1.

In November 2000, the licensee for the Millstone Nuclear Power Station Unit 1 reported to the NRC that two fuel rods were missing from the spent fuel pool. As part of the lessons learned from that event, the NRC staff developed a new Temporary Instruction (TI) 2515/154, “Spent Fuel Material Control and Accounting at Nuclear Plants,” to enhance the NRC’s inspection of licensees’ MC&A programs. The TI provides specific inspection guidance to NRC inspectors and consists of three phases. The first phase determines if a licensee has ever removed irradiated fuel rods from a fuel assembly. If the answer is yes, phase two of the TI is then implemented. Phase two of the TI determines, through detailed questions, if a licensee’s MC&A program is adequate to account for items located in the spent fuel pool. If it is determined that a licensee’s MC&A program has deficiencies, then Phase three of the TI is implemented. Phase three is a much more detailed inspection of the MC&A program, which includes verifying the location in the spent fuel pool of all spent fuel rods that have been separated from their parent fuel assemblies.

In March 2004, the NRC’s Resident Inspectors conducted an inspection at Vermont Yankee using TI 2515/154. Phases one and two of the TI have been completed at Vermont Yankee and documented in NRC Integrated Inspection Report

No. 05000271/2004002, dated May 3, 2004 (ADAMS Accession No. ML041240438)<sup>1</sup>. While performing these inspections, the NRC's Resident Inspectors identified concerns with the method used by Entergy to perform the physical inventory of the two spent fuel rod segments, which are about one-half inch in diameter and about 7 inches and 17 inches in length, respectively. These two fuel rod segments were placed in a container in the spent fuel pool in 1980 after they had broken off from full length fuel rods during repair work on a fuel assembly. In response to the Resident Inspectors' concerns, Entergy used an underwater video device to check if the two spent fuel rod segments were in the storage container in the spent fuel pool, but could not locate them.

Upon identification of the discrepancy in the location of the two spent fuel rod segments, Entergy initiated an investigation. Entergy's investigation consists of an underwater video inspection of the spent fuel pool, a review of Entergy's radioactive material shipment records, personnel interviews, and identification of possible disposal locations. On May 19, 2004, Entergy reported to the NRC that the visual inspection of the spent fuel pool was essentially complete and that the underwater video inspection did not find the fuel rod segments.

The NRC staff has closely monitored Entergy's actions and investigation since Entergy formally made a report to the NRC staff on April 21, 2004, that the two spent fuel rod segments were not in their storage container. The NRC is conducting a special inspection at Vermont Yankee to investigate the missing spent fuel rod segments. During the inspection, the NRC will review the results of Entergy's investigation, assess Entergy's root cause determination, determine if Entergy is in compliance with applicable regulations, and identify which findings may have generic implications.

The NRC will consider the results of the ongoing special inspection at Vermont Yankee and the findings from MC&A inspections at other facilities to determine the need for generic communications, enforcement, inspection, or other regulatory actions.

- Q. "We understand that these pieces came from damaged fuel rods and are highly radioactive. Such materials should have set off radiation detectors if moved outside the plant. When was the most recent NRC inspection concluding the detectors were working? Are there circumstances in which could this material have moved off site without alerting the detectors?"
- A. As part of the NRC's Baseline Inspection Program, the NRC staff conducts focused inspections of Vermont Yankee's on-site radiation monitors and Entergy's program for the control of the shipment and disposal of radioactive material. These inspections are performed every 2 years by regional health physics specialists during several on-site visits. The last period for inspection at Vermont Yankee was January 1, 2002, through December 31, 2003. Documentation of the inspections of the on-site radiation monitors performed in 2003 can be found in NRC Inspection Report Nos. 2003-002, 2003-005,

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<sup>1</sup>The inspection report is available for public inspection at the NRC's Public Document Room, located at One White Flint North, File Public Area O1 F21, 11555 Rockville Pike (first floor), Rockville, Maryland. It is also accessible from the Agencywide Documents Access and Management System's (ADAMS) Public Electronic Reading Room on the Internet at the NRC Web site, <http://www.nrc.gov/reading-rm/adams.html>.

and 2003-006<sup>2</sup>. Results of NRC inspections indicate that Vermont Yankee's on-site radiation monitors, as well as the controls for the shipment and disposal of radioactive material, meet regulatory requirements.

The NRC staff is confident that the radiation detectors in the area of the spent fuel pool would have alarmed if the spent fuel rod segments or any other highly radioactive material stored in the pool were inadvertently removed from the spent fuel pool in an unshielded container. Besides the radiation detectors located within the plant, there are additional radiation detectors located at personnel exit points. These detectors monitor each worker exiting the plant's protected area. These are very sensitive detectors designed to alarm at radiation levels slightly above natural background. These detectors help ensure that workers do not leave the site with contaminated clothing, equipment, or radioactive material.

Even if the spent fuel rod segments were inadvertently mixed with other radioactive waste that was stored in the spent fuel pool, and then removed from the site, they would be subject to rigorous controls and oversight. The waste is processed, packaged, and prepared for shipment in a specially shielded container. The shielded container is loaded onto a transport truck and a radiation survey is performed to verify that the radiation levels from the container meet NRC and U.S. Department of Transportation (DOT) regulatory requirements. Once in a shielded container, the two spent fuel rod segments would not be detected by the required radiation survey as long as the radiation levels meet NRC and DOT regulatory requirements.

Results of our inspections indicate that Vermont Yankee's on-site radiation monitors and the controls for the shipment and disposal of radioactive material make it highly unlikely that the spent fuel rod segments are in the public domain.

Q. "If these materials remain in the bottom of the spent fuel pool, do they pose any operational risks at the facility?"

A. If the spent fuel rod segments were located at the bottom of the spent fuel pool, they pose no operational risks to the facility.

With the exception of fuel and water transfer to the reactor vessel during refueling operations, the spent fuel pool is essentially isolated from the remainder of the power plant. The fuel segments are much denser than the cooling water and, therefore, would remain at the bottom of the pool. Spent fuel cooling would be unaffected. Spent fuel assemblies are stored in the spent fuel pool in specially designed racks that hold the assemblies several inches above the bottom of the spent fuel pool. Cooling water enters each assembly through cooling holes which are several inches in diameter and are cut through the bottom plate of the storage rack. Even if the fuel segments did not remain on the pool bottom, the fuel segments are too small to interfere with this cooling flow.

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<sup>2</sup>These inspection reports are available for public inspection at the NRC's Public Document Room and are also accessible from the ADAMS Public Electronic Reading Room using Accession Nos. ML031250446, ML032110574, and ML033140011, respectively.

Q. Status of the Vermont Yankee Steam Dryer

A. For the past year, the NRC staff has been closely following events at certain boiling-water reactor plants involving cracks in welds on the steam dryer inside the reactor pressure vessel. Although the steam dryer does not perform a safety-related function, it must retain its structural integrity under all loading conditions to ensure that loose parts that might be generated from its structural failure do not adversely impact the ability of safety-related components to perform their intended function. During the recent April 2004 refueling outage, Entergy identified some cracks in Vermont Yankee's steam dryer. Entergy repaired the cracks that were in external portions of the dryer. In addition, Entergy analyzed the cracks that were not repaired and determined that the unrepaired cracks could not cause loose parts or impact dryer performance. The NRC staff has inspected Entergy's analysis and did not identify any safety concerns for operation of the plant at the current licensed power level. The results of the inspection will be documented in an inspection report which is scheduled to be issued in August 2004. The inspection report will be publicly available.

The NRC staff is continuing its review of Entergy's request to increase Vermont Yankee's licensed operating power level. The NRC has informed Entergy that Entergy will need to address comprehensively the impact of the proposed increased power level on Vermont Yankee's steam dryer performance.