February 1, 2001

The Honorable Edward J. Markey
United States House of Representatives
Washington, D.C. 20515

Dear Congressman Markey:

I am responding to your letter of December 20, 2000, in which you asked several questions concerning the accountability for two irradiated fuel rods presumed missing from the Millstone Nuclear Power Station, Unit 1 (Millstone 1). Our responses to your specific questions are enclosed. Please recognize that we are early in our review of this event and are still pursuing clarification of a number of issues. The answers we are providing are based on our current knowledge. The licensee is continuing its investigation and we will continue to monitor its actions. As you requested, a copy of the Licensee Event Report, dated January 11, 2001, is provided, including a time-line of the licensee's actions leading to the discovery of the condition.

The licensee's initial investigation consisted of visual inspection of the spent fuel pool, review of vendor and licensee fuel and fuel shipping records, and personnel interviews. Since then, the licensee has retrieved records and reviewed potentially relevant documentation, such as vendor fuel reconstitution records, spent fuel pool maps, control room logs, radiation work permits, material transfer forms, and waste shipment records. The licensee intends to conduct additional spent fuel pool visual inspections and personnel interviews and have further communications with representatives from the licensed radioactive waste facilities in Barnwell, South Carolina, and Hanford, Washington.

The U.S. Nuclear Regulatory Commission (NRC) staff has closely monitored the licensee's investigation since the licensee formally reported to the staff by telephone on December 14, 2000, that it could not locate the two fuel rods. In addition, the NRC staff has discussed the event with individuals representing the States of South Carolina and Washington, which have possible involvement as Agreement States, and will continue to engage them in the event follow up.

In closing, let me emphasize that I share your concerns regarding this issue. Because of the potential health and safety implications, the NRC views the control of spent nuclear fuel to be of great importance. At this point, it is highly likely that the two missing fuel rods are either still located in the Millstone 1 spent fuel pool, or are buried at a licensed radioactive waste disposal site, thereby posing little or no threat to public health and safety. However, the NRC will closely monitor and evaluate the licensee's response to this event to assess actions to be taken to preclude future similar events. If the missing fuel rods are buried at a low-level waste disposal site, we will assess what corrective actions may be required.

If you have further comments or questions, please contact me.

Sincerely,

/RA/

Richard A. Meserve

Enclosure: Questions and Answers

Questions and Answers

Q. "What Commission requirements govern the storage of spent fuel at nuclear power plants?"

A. NRC requirements governing the monitoring, inventory and record keeping for storage of spent fuel at nuclear power plants are provided in Title 10 of the Code of Federal Regulations (10 CFR), Part 70, "Domestic Licensing of Special Nuclear Material," and in particular Section 70.51, "Material balance, inventory, and records requirements." The requirements that address the manner in which the fuel is stored are provided in 10 CFR Part 50 Appendix A, 10 CFR 50.68, 10 CFR Part 72, and the specific license for the facility.

Q. "What procedures and policies are licensees required to follow to verify that no material is lost, stolen, or diverted?"

A. In accordance with 10 CFR 70.51(c), a power reactor licensee is required to establish, maintain, and follow written material control and accounting procedures that are sufficient to enable the licensee to account for the special nuclear material (SNM) in its possession.

In addition, in accordance with 10 CFR 70.51(d), a power reactor licensee is required to conduct a physical inventory of all SNM in its possession at intervals not to exceed 12 months.

The licensee is also required to maintain records on the inventory (including location), disposal, and transfer of all SNM, which includes plutonium, uranium-233 (U-233), and uranium enriched in the isotopes U-233 or U-235. According to the requirements of 10 CFR 70.51(b)(5), the licensee must retain records of transfer from the facility for the life of the license, but may dispose of material acquisition and physical inventory records three years after the transfer is made.

Further, pursuant to the requirements of 10 CFR 70.54(a) and 74.15(a), the licensee must submit a Nuclear Material Transaction Report to the Nuclear Material Management and Safeguards System (NMMSS), operated for both NRC and the Department of Energy, every time its facility transfers (or receives) SNM.

Finally, in accordance with 10 CFR 70.53(a)(1) and 74.13(a)(1), at least twice a year, the licensee must submit material balance reports concerning SNM received, produced, possessed, transferred, consumed, disposed of, or lost, and an inventory composition report to NMMSS. NMMSS reconciles each licensee's report with a report generated from NMMSS and requests investigation of any differences. NRC participates in reconciliations when a reconciliation cannot be accomplished by NMMSS and the reactor licensee. The NMMSS is discussed further in a subsequent response.

Q. “What fines or other penalties can the Commission impose if a licensee fails to adhere to such requirements?”

A. Violations of NRC regulations are subject to civil enforcement action and may also be subject to criminal prosecution. After identifying an apparent violation, the NRC makes an assessment in accordance with its Enforcement Policy.

Three primary enforcement sanctions are available: a Notice of Violation (NOV), a civil penalty, or an order. An NOV identifies a requirement and how it was violated, and formally cites the violation pursuant to 10 CFR 2.201, "Notice of violation;" it normally requires a written response. A civil penalty is a monetary fine imposed under the authority of Section 234 of the Atomic Energy Act of 1954, as amended (AEA). The AEA allows for penalties of up to $100,000 per violation per day. The Debt Collection Improvement Act of 1996 raised the amount to $110,000. An order modifies, suspends, or revokes a license or requires specific actions be taken by a licensee or a person. The Commission's authority to issue orders under Section 161 of the AEA is broad and covers any area of licensed activity that affects the public health and safety. NOVs and civil penalties may be issued for violations. Orders may be issued for violations or because of public health or safety issues.

Q. “Does the Commission intend to impose any such fines or penalties in this case?”

A. The NRC staff’s inquiry into the circumstances leading to the loss of accountability is still ongoing. When complete, we will apply the Enforcement Policy to determine the appropriate enforcement action. The NRC staff notes, however, that any civil sanction may be limited by the statute of limitations, 28 U.S.C. § 2462, “Time for commencing proceedings,” which is applicable to the NRC as well as other government agencies.

Q. “According to the aforementioned article in *The Day*, Leon J. Olivier, a senior vice president and chief nuclear officer at Millstone [1], and Bruce Kenyon, president of generation for Northeast Utilities, indicated that they had no knowledge of any other commercial nuclear plant that had misplaced spent nuclear fuel. Is the Commission aware of any other instances of lost or misplaced spent fuel?”

A. The other instances the Commission is aware of are as follows:

In 1990, a nuclear power plant shipped one more irradiated fuel rod than planned. The licensee discovered the discrepancy in 1991 and notified the NRC and the NMMSS, and corrected its records. The extra rod was protected along with the rest of the shipment.

On several occasions, licensees have reported “lost” or “missing” spent fuel, but in each case the spent fuel was known to be contained in the reactor coolant system, the spent fuel pool, or a refueling pathway, and thus was secure within the facility.

Q. “Will the Commission require its licensees to review the inventories of all other nuclear power facilities in the U.S. to determine if other discrepancies exist?”

A. NRC is closely monitoring the licensee’s investigation to determine exactly what happened to the two Millstone 1 fuel rods. Following the completion of the NRC’s inquiry, we will consider whether industry-wide generic action is warranted.

Q. “Are utilities required to periodically review their inventories to find whether these types of discrepancies exist?”

A. A power reactor licensee is required to conduct a physical inventory of all SNM in its possession at intervals not to exceed 12 months in accordance with 10 CFR 70.51(a)(8) and 10 CFR 70.51(d) .

Q. “How can we know whether the missing rods at Northeast Utilities are an isolated incident or evidence of a more widespread phenomenon?”

A. Licensee SNM inventory and transaction data are required to be reported to the National Nuclear Material Accounting Database via the NMMSS. The NMMSS maintains information on facility inventories, shipper-receiver differences, and inventory differences. The transaction information is used to match reported shipments with corresponding receipts. Twice a year, licensees reconcile facility records with the NMMSS information to identify anomalies in facility records. The NRC staff is still investigating why the Millstone 1 anomaly was not identified in 1980 or in later years by the licensee or NMMSS. Based on the results of our investigation, we may elect to require additional actions at other facilities.

Q. “According to the article in *The Day*, radioactive waste at the facilities in South Carolina and Washington ‘is not buried in a precise location.’ Why not?”

A. Regulations provided in 10 CFR 61.80, "Maintenance of records, reports, and transfers," require that the licensee record and document, among other things, the quantity of radioactive wastes in a shipment and the location of disposal in the site. Since South Carolina and Washington are Agreement States, the low-level waste disposal facilities in these States are regulated by State agencies. Both States have adopted regulations compatible with 10 CFR Part 61, including provisions for recording the location of disposals.

The regulations at 10 CFR Part 61 became effective in January 1983 and the State regulations were adopted subsequent to 1983. If the Millstone 1 fuel rods were shipped to either of these sites before 1983, the specific requirements of those regulations would not have been applicable. However, according to officials from South Carolina and Washington, the locations of disposed wastes were being recorded during the early 1980s. Thus, both facilities could retrieve waste, if necessary, because of the existence of records for the location of specific disposals.

Q. "Do these sites record at least the quantity of the materials that are buried? Why wouldn't these sites require a knowledge of the inventories on their premises?"

A. The quantities of radioactive materials are and must be recorded. Thus, the inventories are required to be known. The records for disposal are based in part on the shipping manifest provided to the waste storage facility by the licensee shipping the material.

Q. "What are the potential public health consequences of storing high-level waste like the spent fuel rods at low-level radioactive waste facilities?"

A. Currently there is no evidence that the Millstone 1 spent fuel rods were disposed of at a low-level waste site. The Commission's regulations in 10 CFR Part 61 (and the compatible regulations in the States of Washington and South Carolina) rely on a combination of 100 years of active institutional controls (to control land use at the facility), government ownership of land, and engineered barriers or depth of burial to isolate highly radioactive wastes from people. However, because the fuel rods remain highly radioactive longer than low-level waste, there is a potential for higher doses to possible intruders after the Part 61 controls are no longer in effect. There is no present hazard from the disposal of the two fuel rods from Millstone 1 at a low-level waste facility.

Another potential hazard is that radionuclides released from the fuel rods could migrate into the groundwater, eventually exposing members of the public to radiation. The licensee estimates the amount of radioactivity in the fuel rods to be approximately 300 curies. (Although we have not independently verified that estimate, it appears to be reasonable.) This amount of radioactivity is a tiny part of the total inventory of several million curies at each site that must already be isolated to protect the public health and safety. Thus, the incremental effect of the fuel rods on public health and safety from groundwater would be small. The hazard would depend on such factors as the specific radionuclides in the waste and site specific characteristics, such as how fast the groundwater moves.

Q. "What are the consequences for the workers at those facilities?"

A. Radiation exposure of workers at the disposal facilities are governed by radiation protection programs. The doses they receive from radioactive materials are continuously monitored to ensure that the doses are within regulatory limits. Both facilities routinely dispose of some low-level waste with relatively high radiation levels and have procedures in place for ensuring that doses to workers are not only within the regulatory limits but as low as is reasonably achievable. Therefore, we anticipate no significant consequences for the workers.

Q. "What penalties are normally imposed on licensees for sending materials to an improper facility?"

A. The penalties for transporting or disposing of materials improperly are based on the circumstances of each case. The Commission considers the quantity and radioactivity of the materials, the exposure risk to workers or members of the public, and the effect on the environment. The Commission also considers the underlying causes for the violation and the licensee's efforts to identify and correct the problem.

Q. “Does the Commission intend to impose any fines or other penalties in this case?”

A. As noted previously, the NRC staff’s inquiry is still ongoing. If the staff determines that the SNM was transported or disposed of improperly by the licensee, the staff will apply the Enforcement Policy to determine the appropriate enforcement action. The NRC staff notes, however, that any civil sanction may be limited by the statute of limitations, 28 U.S.C. § 2462, “Time for commencing proceedings,” which is applicable to the NRC as well as other government agencies.

Q. “According to the NRC Weekly Report, there is a box in the spent fuel pool at Millstone 1 that workers were not able to examine without assistance from GE [General Electric]. What sort of equipment and expertise was required from GE to do this examination?”

A. The box referred to in the NRC Weekly Report is an in-pool GE storage container, designated SRP-2D, for segmented test fuel rods. Segmented test rods were used at Millstone 1 in the 1970s and early 1980s as part of a joint GE-utility program to evaluate fuel performance. The SRP-2D container is constructed like a fuel bundle, with a lower tie plate, an upper tie plate, and spacers. A bundle channel encases the SRP-2D assembly to provide torsional support, preventing flexing during handling.

Because the channel housing would have to be removed and the upper tie plate may have to be removed to see if the missing fuel rods had been placed in SRP-2D, the licensee contracted with qualified GE personnel experienced in bundle disassembly activities to perform the inspection. Anticipating that special tools might be necessary to disassemble the container, the licensee also contracted with GE to provide those tools.

Q. “Why are those resources and expertise not located at the Millstone [1] facility?”

A. Millstone 1 employs personnel who are qualified to perform fuel handling activities, including dechanneling. However, bundle disassembly activities, such as upper tie plate removal, are not routine operations and are not normally performed by station personnel. GE personnel performed the last bundle disassembly activities at Millstone 1 in the early 1980s. The licensee decided it was safer to use experienced GE personnel for the recent storage container examination. The special tools (which were in fact not required for the examination) are used too infrequently to justify their purchase.

Q. “What assurances can the Commission provide that the spent fuel rods have not been stolen?”

A. The very high radiation level of the material makes theft difficult, dangerous, and very unlikely. The radiation levels also make the material of limited or no economic value. Moreover, the amount and chemical form of the fissile material contained in the two spent fuel rods make it unlikely, in our judgment, that the rods could be used to assist in the manufacture of a weapon. Had a theft occurred for the purpose of terrorism or radiological sabotage, it would be expected that such a threat would have materialized in the 20 years over which the discrepancy is believed to have existed. No such threat has been identified.

Q. “What would be the proliferation consequences of the diversion of this material?”

A. The two fuel rods pose no risk of proliferating nuclear weapons. The uranium (U-235) in the fuel rods is low-enriched uranium (2.44%). The amount of U-235 in each rod is about 50 grams. The plutonium created in each rod during its time in the reactor core is estimated to be approximately 20 grams. In general, the NRC considers proliferation consequences to be small for SNM quantities less than 5000 grams of highly enriched uranium (>20% U-235) or 2000 grams of plutonium, or a combination thereof (10 CFR 73.2, "Special nuclear material of low strategic significance").

Q. “I would like to receive a copy of the written report that the licensee is required to file with the Commission 30 days after making the initial telephone report of the discovery, pursuant to 10 CFR 20.2201.”

A. A copy of the licensee’s report is attached.

Attachment:
Licensee Event Report