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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD

OFFICE OF THE SECRETARY
RULEMAKING AND
ADJUDICATIONS STAFF

Before Administrative Judges:
Charles Bechhoefer, Chairman
Dr. Richard F. Cole
Dr. Charles N. Kelber

In the Matter of : Docket No. 50-423-LA-3

DOMINION NUCLEAR : ASLBP No. 00-771-01-LA-R
CONNECTICUT, INC. :

(Millstone Nuclear Power Station, Unit No. 3 :
Facility Operating License NPF-49 : March 18, 2002

CONNECTICUT COALITION AGAINST MILLSTONE AND
LONG ISLAND COALITION AGAINST MILLSTONE DETAILED WRITTEN
SUMMARY PURSUANT TO 10 CFR Section 2.1113

In accordance with the provisions of 10 CFR Section 2.1113, the Connecticut Coalition Against Millstone and Long Island Coalition Against Millstone (collectively, the "Intervenors") submit herewith their Detailed Written Summary of all the facts, data and arguments which are known to them at this time and on which they propose to rely at oral argument to support the existence of a genuine and substantial dispute of fact in the reopened proceeding. This Summary is supported by the sworn written submission of Joseph H. Besade.

FACTUAL BACKGROUND

This proceeding involves an application to increase the capacity of the spent fuel pool ("SFP") of the Millstone Nuclear Power Station, Unit No. 3. Three contentions were previously admitted into controversy in this proceeding, one of which (Contention 4) concerned whether the licensee was able or willing to carry out administrative controls

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for the SFP adequately. On October 26, 2000, the Atomic Safety and Licensing Board ("Licensing Board") issued a Memorandum and Order that, with respect to Contention 4, ruled that "NNECO"¹ has demonstrated that it can adhere to administrative controls, with adequate safety margin and defense in depth, without posing an undue or unnecessary risk to plant workers or the public." LBP-00-26, 52 NRC at 200.

One month later, the licensee disclosed to the U.S. Nuclear Regulatory Commission ("NRC") that it "could not confirm the location of two fuel pins" at the Millstone Unit 1 SFP. Such disclosure was made public by the NRC in the NRC Weekly Information Report For the Week Ending November 24, 2000. In addition, the disclosure was made public in the NRC Daily Events Report as Event Number 37596 dated December 14, 2000.

On December 18, 2000, the Intervenors moved to reopen these proceedings for further development of the record based on the newly disclosed evidence of the licensee's "discovery" that it could not account for two missing fuel rods, which information is did not reveal during the peroceedings before the Licensing Board.

By Memorandum and Order issued on May 10, 2001, the Licensing Board granted the Intervenors' Motion for Reconsideration of LBP-01-1 and it reopened the record on Contention 4 "to the extent that it bears upon both the adequacy of administrative controls at the Millstone Unit 3 SFP and DNC's ability or willingness to implement such controls successfully." The Licensing Board limited the scope of its reconsideration to

¹ Effective March 31, 2001, Dominion Nuclear Connecticut, Inc. ("DNC") became the operating licensee for the Millstone Nuclear Power Station in place of Northeast Nuclear Energy Company ("NNECO").

the procedures or controls for management of the SFPs and their modes of execution that may be common to Millstone-1 and Millstone-3.LBP-01-17.

In the intervening time, the Licensee created a Root Cause Assessment Team "to analyze the root cause and factors contributing to the loss of the two fuel rods."² That team characterized its conclusion that the "root cause" as being an 'unrecognized over-reliance on Millstone 1 reactor engineers to compensate for organizational and process weaknesses in implementing the special nuclear material inventory and control procedures."³

In addition, these proceedings were ordered suspended upon the motion of the NRC Staff when the NRC Office of Investigations ("OI") commenced an investigation on February 13, 2001. OI released a report on October 31, 2001.⁴

ARGUMENT

The phenomenon of the Unit 1 missing fuel rods – a phenomenon which includes the complete loss of accountability of special nuclear material containing deadly plutonium and Uranium-235, the continuing failure to recover the rods, the untimely disclosure of the fact of lost accountability to the NRC in violation of law and the complete failure to disclose the fact of lost accountability to the Licensing Board - does directly bear upon both the adequacy of administrative controls at the Millstone Unit 3 SFP and DNC's

² NRC Special Inspection 05000245/2001013, Executive Summary at 3. The report is attached as Exhibit 1.

³ Id.

⁴ The OI Report is attached as Exhibit 2.

ability or willingness to implement such controls successfully. Therefore, there is a genuine and substantial dispute of fact which can only be resolved through further adjudicatory proceedings.

I. The phenomenon of missing spent fuel rods from Millstone Unit 1 is not an historically-bound event.

The Inspection Report⁵ and OI Report⁶ do not differ in their finding that NNECO lost accountability over the Millstone Unit 1 spent fuel pool decades ago.

However, NNECO's failure to recover control and, ultimately, find the unaccounted for spent fuel rods is a continuing phenomenon which has been complicated by NNECO's acknowledged failure to comply with federal reporting requirements timely.⁷

At the same time, NNECO improperly withheld disclosure of the missing rods from these proceedings when such information was compelled by operation of 10 CFR 2.740(e)(2).⁸

It is clear from the OI report and the voluminous materials submitted by DNC in discovery that personnel associated with unlawful untimely disclosure of the missing rods to the NRC and withholding of the fact of lost accountability from these proceedings, while formerly personnel employed by NNECO, are now personnel employed by DNC in the same or similar positions.

Millstone's operations have been historically clouded by years of persistent falsification of operating conditions at the three reactors, a related phenomenon which

⁵ Exhibit 1

⁶ Exhibit 2

⁷ See 10 CFR Part 74, Subpart A.

⁸ See Declaration of Joseph H. Besade, paragraphs 9-13.

brought about the unprecedented shutdown of the entire facility in 1996 after TIME magazine featured Millstone whistleblowers on its cover.

The ongoing controversy concerning the continuing failure to locate and gain accountability over the missing spent fuel rods clearly shows that there is a distinct inability and unwillingness on the part of the owner/operators of the Millstone Nuclear Power Station – whoever at the moment they might be – to act appropriately in the area of spent fuel operations in times demanding of unquestioned adherence to administrative controls.⁹

II. LER 2001-007-00 has direct bearing on the issue of Millstone's ability and willingness to adhere to administrative controls in its spent fuel pools.

LER 2001-007-00¹⁰ states as follows:

"On October 22, 2001, with the plant in mode one at 100 per cent power, it was discovered that heavy loads have been historically moved at Millstone Unit 2 without appropriate procedural guidance. In order to support plant operation and refueling activities, various items need to be lifted and transported to locations within the power block and yard. These lifts and movements are controlled by procedures which take into consideration safety related structures, systems, components, and fuel which may be adversely affected by a load drop. Historically this issue has been addressed via the guidance provided in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." Commitments were established for procedural controls, conduct of operations for cranes, and safe load paths.

⁹ See, e.g., "Data Show World Awash in Stolen Nuclear Material" (Reuters March 6, 2002), Exhibit 3.

¹⁰ See LER 2001-007-00, Exhibit 4.

"The Millstone Unit No. 2 Spent Fuel Pool Area, 38'-6" elevation of the Auxiliary Building [NF], as well as the cask washdown pit, is addressed by procedure MP 2712B1, "Control of heavy Loads." The procedure shows the Spent Fuel Pool as a restricted area for lifts, with a safe load path adjacent to the pool. Historically, loads such as new fuel, spent resin casks, and other items have been lifted from the railroad access bay at the 14'-6" elevation, to and from the 38'-6" elevation, over a safety related pipe trench. Most recently, a spare reactor coolant pump [P] motor [M] was lifted into the cask washdown pit. However, these loads have been lifted over the safety related pipe trench using a crane [CRN] that is not 'single failure proof' as described in NUREG-0612.

"The safety related pipe trench lies below the cask washdown pit and the railroad access bat floor. The trench contains conduit [CND], cable raceways [TRLY] and safety related piping, including redundant refueling water storage tank [TK] (RWST) suction headers and redundant emergency diesel Service Water [LB] headers. The drop of a heavy load in the area of the cask washdown pit could cause failure of the floorslab resulting in damage to the safety related pipe trench. In addition, the end wall of the railroad access bay supports various safety related items that could be damages while performing heavy loads in the area.

"The cask crane is not 'single failure proof' as described in NUREG-0612. The crane is a conventional 100 ton beam crane. The factor of safety requirements for rigging, presented in NUREG-0612 can be extended to the hook and other load bearing components where the stress distributions do not change s the load is being either lifted or transported horizontally; however, it cannot be extended to the other parts such as

the cable, sheaves, etc., where the stress distribution does change while the load is being lifted/transported. Thus a failure of one of these parts must be considered even though the probability of such a failure is very low. If one of these parts does fail, the load will not necessarily fall straight down. If a sheave were to fail, or if the cable somehow rides up over the edge of a sheave, and then fails, the block will tilt prior to releasing the load. The center of gravity of the load will move to remain directly beneath the location of the support force. This support force location will be constantly changing as the cable unloads. Hence, an initial angle and/or slight tendency to tumble cannot be precluded.

"Should a load drop have occurred, the floor of the cask pit could have failed and the resulting impact to the safety related structures below the floor may have resulted in a loss of safety function for the RWST and service water system. **The ability to safely shut down the plant under these circumstances would have been a significant challenge and is not an analyzed condition for the facility.**

"On the basis of the above, this condition is considered to be reportable under 10 CFR 50.73(a)(2)(ii) as an unanalyzed condition which could significantly degrade plant safety, and 50.73(a)(2)(v) as a condition that could have prevented the fulfillment of the safety function.

"2. Cause

"The root cause for the failure to identify heavy load paths is inadequate engineering work practices in the Millstone engineering department in the area of programs."

Thus, the root cause of the missing Unit 1 spent fuel rods remains just the same as the root cause for the unanalyzed condition which could significantly degrade safety at Unit 2, namely, "inadequate engineering work practices in the Millstone engineering department in the area of programs."

The departments responsible for evaluating pathways for heavy loads on Millstone Unit 2 are the same departments which will be responsible for conforming with the multitude of new administrative controls planned to prevent problems at Millstone Unit 3.

Unit 2's longstanding problem was not discovered until October 22, 2001 by DNC, NNECO's successor.

Millstone's history with Unit 1 spent fuel pool problems and its Millstone Unit 3 fuel pool expansion plans and controversies leave one wondering how the problem at Unit 2 could have been unanalyzed for so long, with such a significant safety risk.

Conclusion

A genuine and substantial dispute of fact exists as to the ability and willingness of the Millstone owner/operator to adhere to administrative controls and such dispute can only be resolved through an adjudicative hearing.

THE INTERVENORS

By:

Nancy Burton
Nancy Burton, Esq.
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Redding Ridge CT 06876
Tel. 203-938-3952

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Charles Bechhoefer, Chairman

Dr. Richard F. Cole

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In the Matter of : **Docket No. 50-423-LA-3**

DOMINION NUCLEAR : **ASLBP No. 00-771-01-LA-R**

CONNECTICUT, INC. :

(Millstone Nuclear Power Station, Unit No. 3 :
Facility Operating License NPF-49 : **March 18, 2002**

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing "Connecticut Coalition Against Millstone and Long Island Coalition Against Millstone Detailed Written Summary Pursuant to 10 CFR 2.1113" was mailed on March 18, 2002 to the following via U.S. Mail, postage pre-paid, and emailed as indicated hereinbelow:

Charles Bechhoefer, Chairman
Administrative Judge
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Dr. Charles N. Kelber
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Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
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Office of Commission Appellate
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Washington DC 20555

Dr. Richard F. Cole
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
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Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington DC 20555
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(email: HEARINGDOCKET@nrc.gov)

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A handwritten signature in black ink, appearing to read "Nancy H. Brink". The signature is written in a cursive style and is positioned above a horizontal line.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

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DOMINION NUCLEAR : **ASLBP No. 00-771-01-LA-R**
CONNECTICUT, INC. :

(Millstone Nuclear Power Station :
Unit No. 3) :
Facility Operating License NPF-49 : **MARCH 18, 2002**

DECLARATION OF JOSEPH H. BESADE IN SUPPORT OF
INTERVENORS' SUMMARY AND SWORN SUBMISSION

I, Joseph H. Besade, declare as follows:

1. I am above the age of eighteen (18) years and I believe in the obligation of an oath.
2. I reside at 22 Fifth Avenue in Waterford, Connecticut.
3. My home is within two (2) miles of the Millstone Nuclear Power Station.
4. I am a member of the Intervenor, Connecticut Coalition Against Millstone, and serve as its secretary.
5. I have attended virtually all public meetings and proceedings of the U.S. Nuclear Regulatory Commission ("NRC") and Dominion Nuclear Connecticut, Inc. ("DNC") in the Town of Waterford which have been addressed to the issue of the failure of the owners and operators of the Millstone Nuclear Power Station to

account for two high-level radioactive spent fuel rods since the issue was brought to public attention on or about the week of November 24, 2000.

6. Upon information and belief, to date, neither DNC, nor its predecessor, Northeast Nuclear Energy Company ("NNECO") nor the NRC has been able to account for the lost spent fuel rods in the intervening time.

7. I am familiar with the publicly released reports of investigations carried out by NNECO, DNC and the NRC concerning the lost rods.

8. From such reports I am familiar with the fact that on September 12, 2000, if not sooner, NNECO knew that it did not know the location of the two rods.

9. NNECO did not disclose such fact during these proceedings prior to October 26, 2000, the date the Licensing Board issued its Memorandum and Order dismissing Contention 4.

10. In these proceedings, the Intervenors submitted the following Interrogatory, *inter alia*, to NNECO on March 21, 2000:

"Interrogatory No. F-1: Please identify all instances of error (at Millstone or other nuclear plants) in managing, moving, placing or tracking fresh or spent fuel and all documents pertinent thereto."

11. In its response dated April 4, 2000, NNECO provided the following response:

"With regard to Millstone, the following events have been identified as responsive to this request . . ." together with information regarding eleven events at Millstone.

12. None of the events identified disclosed the fact that the Licensee could not

account for the location of two spent fuel rods at Unit 1.

13.Upon information and belief, NNECO never amended its response to Interrogatory No. F-1 in these proceedings to reflect its "discovery" on or before September 12, 2000 that it could not account for the two spent fuel rods.

14.I am familiar with the Root Cause Assessment Team and its characterization of the root cause of the loss of the two fuel rods as an "unrecognized over-reliance on Millstone 1 reactor engineers to compensate for organizational and process weaknesses in implementing the special nuclear material inventory and control procedures."

15.I am aware that 10 CFR 20.2201(a)(ii) requires that a nuclear licensee such as the owner/operator of the Millstone Nuclear Power Station must notify the NRC by telephone within thirty (30) days after the occurrence of any lost, stolen or missing licensed material, if it contains above a certain quantity of radionuclides, becomes known to the licensee.

16.I am aware that the NRC has reported that the missing fuel rods contain 40 grams of plutonium and 100 grams of Uranium-235.

17. I am familiar with the Reuters news service article entitled "Data Show World Awash in Stolen Nuclear Material" dated March 6, 2002.

18.I am familiar with Licensee Event Report 2001-007-00, which involves a "discovery" by DNA on October 22, 2001 "that heavy loads have been historically moved at Millstone Unit No. 2 without appropriate procedural guidance" and which identifies as the root cause of such phenomenon as "inadequate

FROM : JOE BESADE, WTFD, CT, 06385

PHONE NO. : 860 442 7016

Mar. 18 2002 06:46PM P4

FROM : NANCYBURTONESQFAX2039383168XXX FAX NO. :

Mar. 18 2002 05:58PM P4

engineering work practices in the Millstone engineering department in the area of programs."

19. I am familiar with the August 8, 2001 application of DNC to amend its license to eliminate the word "Nuclear" from the official name of the Millstone Nuclear Power Station such that, should such application be granted, the facility would henceforth be known as the "Millstone Power Station."

Joseph H. Besade
Joseph H. Besade

STATE OF CONNECTICUT

ss: MANTIC

COUNTY OF NEW LONDON

Sworn to and subscribed before me this 18th day of March, 2002.

Beth A. Chapman
Commissioner of Superior Court

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

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DOMINION NUCLEAR : **ASLBP No. 00-771-01-LA-R**
CONNECTICUT, INC.

(Millstone Nuclear Power Station,
Unit No. 3) :
Facility Operating License NPF-49 : **March 18, 2002**

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing "Declaration of Joseph H. Besade In Support of Intervenors' Summary" was mailed on March 18, 2002 to the following via U.S. Mail, postage pre-paid, and emailed as indicated hereinbelow:

Charles Bechhoefer, Chairman
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Washington DC 20555
Attn: Rulemakings and Adjudication

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Adjudicatory File

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EXHIBIT 1

UNITED STATES
February 27, 2002

Docket No. 05000245
EA No. 02-014

License No. DPR-21

Mr. J. Alan Price, Vice President
Nuclear Technical Services
c/o David A. Smith, Manager-Regulatory Affairs
Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

SUBJECT: SPECIAL INSPECTION 05000245/2001013, DOMINION NUCLEAR
CONNECTICUT, INC., MILLSTONE POWER STATION UNIT 1, WATERFORD,
CONNECTICUT

Dear Mr. Price:

On October 9 - 18, 2001, Todd Jackson, John Hickman, and Martha Williams of the NRC conducted a special inspection at the above address of activities authorized by your NRC license. The inspection focused on your investigation into the loss of two spent fuel rods from Millstone Unit 1. Within this area, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel. The inspection was continued in the Region I office until December 21, 2001, to review licensee records, and also records pertaining to General Electric Company's Vallecitos, California, nuclear fuel research facility. The findings of the site visit portion of the inspection were discussed with you and others of your staff on October 18, 2001, and all of the findings were also presented at a public exit meeting on January 15, 2002.

The NRC special inspection team determined that your investigation was thorough and complete, and the conclusions were reasonable and supportable. The NRC team concurred in your conclusion that the missing fuel rods are most likely located in a licensed low-level radioactive waste facility. The NRC team also concluded that it is highly unlikely the fuel rods, in their entirety, remain in the Millstone 1 spent fuel pool. Because of the radiological controls in place at any of the possible locations of the missing fuel rods, realistically, there is no current threat to public health. The NRC team agreed with your conclusion that there is no evidence to support the possibility of theft or diversion of the missing fuel rods, and this is not a plausible scenario. The NRC staff concluded that there are presently adequate controls to account for all special nuclear material at the Millstone Station, except for the missing fuel rods.

Acknowledging realistically that the missing fuel rods are not in a location that poses immediate threat to public safety, nonetheless the loss of control of this material is of significant concern. An important part of your investigation of the missing fuel rods was assessment of root cause. The NRC team concluded, similarly to your root cause assessment, that management controls and supervision of activities related to handling of special nuclear material and irradiated fuel were insufficient at various periods over the past 20 years. We identified two specific, apparent

J. Alan Price
Dominion Nuclear Connecticut, Inc.

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violations. The apparent violations, which are described in the enclosed inspection report and executive summary, involve the failure to: (1) keep adequate records, establish adequate procedures for control and accounting, and conduct physical inventories of special nuclear material; and (2) report missing radioactive material in a timely manner. These apparent violations are being considered for escalated enforcement in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG 1600. Such action may involve issuance of a civil penalty.

Before the NRC makes its enforcement decision, we are providing you an opportunity to either (1) respond to the apparent violations addressed in this inspection report within 30 days of the date of this letter, or (2) request a predecisional enforcement conference. Please contact Ronald R. Bellamy at (610) 337-5200 within seven days of the date of this letter, to inform us as to which of the above two options you choose. If a predecisional enforcement conference is held, it will be open for public observation and will be announced to the public via a press release.

If you choose to respond in writing, rather than at a predecisional enforcement conference, your response should be clearly marked as a "Response to Apparent Violations in Inspection Report No. 05000245/2001013" and should include for each apparent violation: (1) the reason for the apparent violation, or, if contested, the basis for disputing the apparent violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. In describing your corrective action, you should be aware that the promptness and comprehensiveness of your actions will be considered in assessing any civil penalty for the apparent violations. Your response should be submitted under oath or affirmation and may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision.

In addition, please be advised that the number and characterization of apparent violations described in the enclosed inspection report may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with 10 CFR 2.790, a copy of this letter, its enclosure, and your response (if you choose to provide one) will be placed in the NRC Public Document Room (PDR) and will be accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction.

Sincerely,

/RA/

George Pangburn, Director
Division of Nuclear Materials Safety

Enclosure: Inspection Report No. 05000245/2001013

cc:

D. A. Christian, Senior Vice President - Nuclear Operations and Chief Nuclear Officer
W. R. Matthews, Vice President and Senior Nuclear Executive
P. J. Parulis, Manager, Nuclear Oversight
D. A. Smith, Manager, Regulatory Affairs
L. M. Cuoco, Senior Nuclear Counsel
C. J. Schwarz, Director, Nuclear Operations and Maintenance
State of Connecticut SLO Designee
First Selectmen, Town of Waterford
D. Katz, Citizens Awareness Network (CAN)
R. Bassilakis, CAN
J. M. Block, Attorney, CAN
G. Winslow, Citizens Regulatory Commission (CRC)
E. Woollacott, Co-Chair, NEAC
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J. Alan Price
Dominion Nuclear Connecticut, Inc.

4

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DATE	2/21/02		2/21/02		2/26/02		2/19/02	

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NAME								
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**U.S. NUCLEAR REGULATORY COMMISSION
REGION I**

INSPECTION REPORT

Inspection No. 05000245/2001013
Docket No. 05000245
License No. DPR-21
Licensee: Dominion Nuclear Connecticut, Inc.
Location: Millstone Power Station, Unit One
Rope Ferry Road
Waterford, CT 06385
Inspection Dates: October 9-December 21, 2001

Inspectors: Todd Jackson, CHP, Team Leader, Health Physicist, Region I
John Hickman, Project Manager, NRR
Martha Williams, Material Control & Accounting Inspector, NMSS

Approved By: /RA/ February 26, 2002
Ronald Bellamy, Chief _____ date
Decommissioning and Laboratory Branch

EXECUTIVE SUMMARY

Dominion Nuclear Connecticut, Inc.
NRC Inspection Report No. 05000245/2001013

Millstone Unit 1 is currently in decommissioning status. The Unit received a full power operating license on October 7, 1970, and was shut down on November 4, 1995, in response to significant site-wide regulatory concerns. The licensee subsequently removed all fuel from the reactor vessel and placed it into the spent fuel pool. The licensee decided on July 17, 1998, to permanently cease any further operation of the plant and informed the NRC of the decision by letter dated July 21, 1998. Millstone Unit 1 is in a cold and dark SAFSTOR condition with an independently functioning spent fuel pool island being maintained for the safe storage of the spent nuclear fuel in the pool.

During records reconciliation and verification of the Millstone 1 spent fuel pool inventory in June 2000, the licensee identified that two full-length fuel rods were not in the locations reflected in special nuclear material records. Inventory cards indicated that the rods should be located in the spent fuel pool, however, the licensee determined the rods were not in the specified locations. Initially, the licensee considered the discrepancy to be a problem of failure to update records to reflect the actual location of the two spent fuel rods, and searched for the rods in the Unit 1 spent fuel pool. Not finding the missing rods, the licensee wrote a condition report in November 2000 to document that the rods could not be located.

The licensee determined that the two fuel rods had originally been part of fuel assembly MS-557, which was received at Millstone in 1969 and was part of the first core loading at the plant. In 1972, following a seawater intrusion event and exposure of all fuel assemblies in the core to an excessive chloride concentration in reactor water, fuel assembly MS-557 was disassembled for inspection. When MS-557 was reassembled in 1974, center spacer capture rod BK0136 and tie rod BP0406 (which had been damaged during disassembly/reassembly) were not included in the reconstructed assembly. The two rods were placed in a container for individual fuel rods and stored in the spent fuel pool. From 1974 to 1979 there was no documentation of the location of the two fuel rods. Records dated 1979 and 1980 show the fuel rods in the container stored in the spent fuel pool. Records prepared after 1980 do not mention the fuel rods or the container. Significant work, including two re-racks and shipments of miscellaneous irradiated components from the spent fuel pool, occurred between 1980 and 1992.

The licensee made a telephone report to the NRC Operations Center on December 14, 2000 and submitted a written Licensee Event Report on January 11, 2001. The licensee formed a dedicated investigative review team, as well as an independent management review team to concurrently review the overall investigation effort. The licensee's investigation expanded through January 2001 to a peak of about 25 full time personnel and continued until October 2001. Although the current licensee for Millstone Unit 1 is Dominion Nuclear Connecticut, the Fuel Rod Accountability Project (FRAP) was directed, staffed, and funded by Northeast Utilities, the former licensee for the Millstone Station. The continued involvement of Northeast Utilities was a condition of the purchase of the Millstone Station by Dominion, which occurred on March 31, 2001.

The licensee's investigation included identification and evaluation of possible scenarios for disposition of the two fuel rods, interviews of personnel who might have worked with the rods or been aware of activities involving the rods, searches of the spent fuel pool to determine if the two rods were still somewhere in the pool, and searches of records to determine if documentation existed describing the disposition of the rods. The licensee identified a total of 75 scenarios for evaluation. Of the 75 scenarios, 12 were considered implausible and not evaluated further. Twelve scenarios were investigated fully, through use of detailed action plans. Ten scenarios were addressed through one or more specific confirmatory investigative actions, and 41 scenarios were addressed through physical searches conducted in the Millstone 1 spent fuel pool or elsewhere on the Millstone Station. Personnel interviews and records reviews were the methods used in the action plans for detailed scenario investigation.

Dominion Nuclear Connecticut submitted the final report of the FRAP to the NRC on October 5, 2001. The licensee concluded that the fuel rods were safely located in a facility that is licensed to either store or dispose of radioactive material. Specifically, the investigation determined that the rods are: (a) in an undetermined location in the Unit 1 spent fuel pool; (b) at General Electric's Vallecitos, California nuclear fuel research facility; or (c) at one or both of the low-level radioactive waste disposal facilities in Barnwell, South Carolina (Barnwell) or the Hanford reservation in Richland, Washington (Hanford). Further, the FRAP concluded that the likelihood that the rods remain in the Unit 1 spent fuel pool or are at GE's Vallecitos nuclear facility was low, and that the low-level radioactive waste facility at Barnwell had the most significant opportunity to receive the rods.

Routine NRC inspections reviewed activities of the licensee's investigation throughout 2001. NRC Region I led a special inspection with staff from the Offices of Nuclear Reactor Regulation and Nuclear Material Safety and Safeguards, onsite in October of 2001, and continuing through December 2001. The focus of the special inspection was to perform a thorough and systematic review to determine the adequacy of the licensee's investigation. The special inspection team was also chartered to assess the licensee's root cause analysis, and to determine if the licensee was in compliance with NRC regulations.

The NRC special inspection team determined that the FRAP investigation was thorough and complete, and the conclusions were reasonable and supportable. As a result of the special inspection, the NRC team concurred in the licensee's conclusion that the low level radioactive waste facility at Barnwell had the most significant opportunity to receive the rods, with an opportunity also existing to some small degree for the inadvertent shipment of the fuel rods to Hanford. The NRC team also concluded that, while it is highly unlikely the rods in their entirety remain in the Millstone 1 spent fuel pool, it is possible that fuel pellets or fragments remain on the spent fuel pool floor as a result of the cutting methods used to process waste hardware. A layer of sediment exists over portions of the spent fuel pool floor. Inspection methods were sufficient to assure intact fuel rods or large segments would not be in the sediment. The inspection team did not concur with the licensee that GE Vallecitos was a potential location for the fuel rods, and determined that GE Vallecitos was not a plausible location.

The licensee commissioned a Root Cause Assessment Team to analyze the root cause and factors contributing to the loss of the two fuel rods. The team characterized the root cause as being an "unrecognized over-reliance on Millstone 1 reactor engineers to compensate for organizational and process weaknesses in implementing the special nuclear material inventory and control procedures." Contributing elements identified by the licensee's team described weaknesses in special nuclear material inventory and radwaste characterization, weaknesses in coordination of spent fuel pool activities and in procedure compliance, and inconsistent supervision and oversight of spent fuel pool activities. Sixteen corrective and preventive actions were recommended by the root cause assessment team, and the licensee incorporated them into the Millstone Station corrective action program. The inspectors found the root cause analysis to be comprehensive and concurred with the conclusions. The inspectors also concluded that management controls and supervision of activities related to handling of special nuclear material and irradiated fuel were insufficient at the time to prevent the loss of the two fuel rods.

The current risk to human health from the missing fuel rods is negligible. If the rods were in and are still in any of the possible locations identified by the licensee, they would have been and still are subject to all of the controls for protecting workers and the public that are in place for handling and safeguarding radioactive material. If the rods were mistaken for some other non-fuel waste object, such as a local power range monitor, and were inadvertently shipped offsite, they would have been packaged in shielded shipping containers due to their high radiation levels, and would therefore have satisfied the shipping requirements for external exposure limits. Furthermore, the radiation detection instruments at the potential offsite locations would also have detected unshielded irradiated fuel. Although the burial sites at Barnwell and Hanford are not licensed to accept irradiated reactor fuel, the amount of radioactivity in the two spent fuel rods is a small part of the total inventory of several million curies at either disposal site. The long term risk presented at the burial sites by the presence of the two missing spent fuel rods, as well as whether there is a need for potential remedial actions, is currently being evaluated by the states of South Carolina and Washington in coordination with the NRC.

The licensee also analyzed the scenarios of theft or diversion and determined there was no evidence to support such a possibility. The inspectors reviewed the licensee's analysis of this scenario and agreed with the conclusion. The very high radiation level of the material (contact radiation level of approximately 1600 R/hr in 1980) would have made theft difficult, dangerous, and highly unlikely. The licensee concluded that, whether shipped offsite or remaining in the spent fuel pool, the missing spent fuel rods were always properly controlled as radioactive material. This is true even if, as is most likely, the rods were incorrectly identified as waste. Since the two spent fuel rods contain 40 grams of plutonium and 100 grams of U-235, the missing material is defined by NRC regulations in 10 CFR 73.2 as special nuclear material of low strategic significance.

As a result of the NRC special inspection, apparent violations of NRC regulations were identified. These violations, which are being considered for escalated enforcement action, are summarized below:

Failure to adequately account for special nuclear material

Beginning in 1980 and continuing through November 2000, the licensee failed to keep adequate records of the special nuclear material in irradiated fuel rods BK0136 and BP0406; failed to establish adequate written material control and accounting procedures sufficient to account for all special nuclear material in his possession; and failed to identify through physical inventory that the two fuel rods were no longer in the location stated in the book inventory (the previous inventory updated by receipts and shipments). (VIO 50-245/2001-013/001)

As a result of the loss of control of the special nuclear material in the two spent fuel rods, there may have been several consequences resulting if the special nuclear material had been transferred to an unauthorized recipient. Specifically, during the period from March 1985 to December 1992, the licensee may have:

- transferred special nuclear material contained in two irradiated reactor fuel rods in an unauthorized manner to a low level waste burial site not licensed to receive the material (Barnwell and/or Hanford);
- shipped special nuclear material contained in irradiated reactor fuel to low level waste burial sites in Barnwell and/or Hanford. The irradiated reactor fuel exceeded the limit for Class C waste and is therefore not suitable for a low level waste burial site;
- incorrectly identified and characterized the special nuclear material in irradiated reactor fuel as other waste, and incorrectly certified in shipping manifests the composition of the waste as suitable for a low level waste burial site;
- transferred special nuclear material to one or more other locations (Barnwell and/or Hanford burial sites) without completing and submitting a Nuclear Material Transaction Report, DOE/NRC Form 741; and
- shipped irradiated reactor fuel without establishing and maintaining, or making arrangements for, and assuring the proper implementation of a physical protection system for the shipment(s).

Failure to report missing radioactive material in a timely manner

Lost or missing material is defined in 10 CFR 20.1003 as licensed material whose location is unknown. On September 12, 2000, with the examination of assembly MS-557 and physical verification of the northwest corner of the spent fuel pool completed, the licensee could not identify the location of the two fuel rods. Although the licensee did eventually report the missing licensed material to the NRC Operations Center on December 14, 2000, the licensee did not know the location of the two spent fuel rods as of September 12, 2000. As a result, the licensee failed to notify the NRC in a timely manner according to the requirements of 10 CFR 20.2201(a)(ii), which requires that

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NRC be notified within 30 days after the occurrence of any lost, stolen, or missing licensed material exceeding specified quantities becomes known to the licensee. (VIO 50-245/2001-013/002)

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REPORT DETAILS

Introduction

Millstone Unit 1 is currently in decommissioning status. The Unit received a full power operating license on October 7, 1970, and was shut down on November 4, 1995, in response to significant site-wide regulatory concerns. The licensee subsequently removed all fuel from the reactor vessel and placed it into the spent fuel pool. The licensee decided on July 17, 1998, to permanently cease any further operation of the plant and informed the NRC of the decision by letter dated July 21, 1998. Millstone Unit 1 is in a cold and dark SAFSTOR condition with an independently functioning spent fuel pool island being maintained for the safe storage of the spent nuclear fuel in the pool.

According to Licensee Event Report 2001-002-00, during a records reconciliation and verification effort by the licensee in November 2000, it was identified that the location of two full-length fuel rods was not properly reflected in special nuclear material records. Inventory cards indicated that the rods should be located in the spent fuel pool; however, the licensee determined the rods were not in the specified locations. Initially the licensee considered the discrepancy to be a problem of failure to update records to reflect the actual location of the two spent fuel rods and searched for the rods in the Unit 1 spent fuel pool. Not finding the missing rods, the licensee wrote a condition report in November 2000 to document that the rods could not be located.

The licensee determined that the two fuel rods had originally been part of fuel assembly MS-557, which was received at Millstone in 1969 and was part of the first core loading at the plant. In 1972, all fuel assemblies in the core were exposed to an excessive chloride concentration in reactor water caused by seawater entering the reactor coolant system through condenser tube leaks. Fuel assembly MS-557 was disassembled for inspection following this chloride intrusion, and the fuel rods from the assembly stored in the spent fuel pool until replacement non-fuel components were received in 1974. When MS-557 was reassembled in 1974, center spacer capture rod BK0136 and tie rod BP0406 (which had been damaged during disassembly/reassembly) were not included in the reconstructed assembly. The two fuel rods were placed in a container for individual fuel rods and stored in the spent fuel pool. From 1974 to 1979 there was no documentation of the location of the two fuel rods. Records dated 1979 and 1980 show the fuel rods in the container stored in the spent fuel pool. Records prepared after 1980 do not mention the fuel rods or the container. Significant work, including two re-racks and shipments of miscellaneous irradiated components from the spent fuel pool, occurred between 1980 and 1992.

The licensee made a telephone report to the NRC Operations Center on December 14, 2000, and submitted a written Licensee Event Report on January 11, 2001. The licensee formed a dedicated investigative review team, as well as an independent management review team to concurrently review the overall investigation effort. The licensee's investigation expanded through January 2001 to a peak of about 25 full time personnel and continued until October 2001. Although the current licensee for Millstone

Unit 1 is Dominion Nuclear Connecticut, the Fuel Rod Accountability Project (FRAP) was directed, staffed, and funded by Northeast Utilities, the former licensee for the Millstone Station. The continued involvement of Northeast Utilities was a condition of the purchase of the Millstone Station by Dominion, which occurred on March 31, 2001.

The licensee's investigation included identification and evaluation of possible scenarios for disposition of the two fuel rods, interviews of personnel who might have worked with the rods or been aware of activities involving the rods, searches of the spent fuel pool to determine if the two rods were still somewhere in the pool, and searches of records to determine if documentation existed describing the disposition of the rods. Personnel interviews and records reviews were the methods used in the action plans for detailed scenario investigation onsite at Millstone.

Dominion Nuclear Connecticut submitted the final report of the Millstone Unit 1 FRAP to the NRC on October 5, 2001. The licensee concluded that the fuel rods were safely located in a facility that is licensed to either store or dispose of radioactive material. Specifically, the investigation determined that the rods are: (a) in an undetermined location in the Unit 1 spent fuel pool; (b) at General Electric Company's Vallecitos, California nuclear fuel research facility; or (c) at one or both of the low-level radioactive waste disposal facilities in Barnwell, South Carolina (Barnwell) or the Hanford reservation in Richland, Washington (Hanford). Further, the FRAP concluded that the likelihood that the rods remain in the Unit 1 spent fuel pool or are at GE's Vallecitos nuclear facility was low, and that the low-level radioactive waste facility at Barnwell had the most significant opportunity to receive the rods.

NRC Region I led a special inspection with staff from the Offices of Nuclear Reactor Regulation and Nuclear Material Safety and Safeguards, onsite in October of 2001, and continuing through December 2001. The focus of the special inspection was to perform a thorough and systematic review of the licensee's investigation to determine adequacy. The special inspection team was also chartered to assess the licensee's root cause analysis, and to determine if the licensee was in compliance with NRC regulations. As a result of the special inspection, the NRC team concurred in the licensee's conclusion that the low level radioactive waste facility at Barnwell had the most significant opportunity to receive the rods, with an opportunity also existing to some small degree for the inadvertent shipment of the fuel rods to Hanford. The NRC team also concluded that, while it is highly unlikely the rods in their entirety remain in the Millstone 1 spent fuel pool, it is possible that fuel pellets or fragments remain on the spent fuel pool floor as a result of the cutting methods used to process waste hardware. The inspection team did not concur with the licensee that GE Vallecitos was a potential location for the fuel rods, and determined that GE Vallecitos was not a plausible location.

The State of Connecticut has been involved in the monitoring of the licensee's activities since November 2000. The States of South Carolina and Washington were contacted when the licensee identified the transport of the fuel rods to the low-level waste sites at Barnwell and Hanford as potential scenarios. California was contacted when Vallecitos was identified as a potential scenario. Weekly conference calls involving these

stakeholders began in January 2001 and continued through December 2001. Routine NRC inspections were conducted by Region 1 inspectors during January, February, May, June, and August, including oversight of the licensee's spent fuel investigation. Dominion Nuclear Connecticut, Inc. (DNC) representatives visited Region I on April 23, 2001, to present a report on the status of their investigation.

Section 1. Review of Licensee's Fuel Rod Accountability Project (FRAP) Investigation Process
Section 1. Review of Licensee's Fuel Rod Accountability Project (FRAP) Investigation Process

1.1 FRAP Project Management

a. Inspection Scope

The inspectors reviewed the method and approach of the licensee's FRAP, evaluated the process and procedures developed for the project, assessed the qualification and experience of the personnel selected to staff the project, and evaluated the effectiveness of management involvement and oversight.

b. Observations and Findings

The inspectors reviewed procedures M10063, "Project Plan;" M10063-1, "Guideline for Administrative Controls", and M10063-6, "Guideline for Project Training." The guidance documents provided sufficient controls for the overall project plan and process guidance, documentation criteria and documentation control, and training expectations and documentation.

The inspectors interviewed the FRAP Executive Sponsor (Vice-President, Northeast Utilities) and the Project Manager, who reported that the search for the missing fuel rods originally started as an effort under the supervision of the Unit 1 Operations Manager. As it became apparent that the goal of finding the two missing fuel rods would not be resolved expeditiously, the decision was made to form the FRAP, as well as an Independent Management Review Team. The Independent Management Review Team was composed of senior-level industry experts whose role was to provide oversight to the growing search effort and assure that all possibilities were addressed by the FRAP to explain what happened to the missing fuel.

The inspectors reviewed records documenting the qualifications of selected FRAP personnel for appropriate background, experience and training. Personnel had extensive background and experience in the nuclear power industry and experience in task force investigations such as the FRAP. All personnel files reviewed contained documentation indicating completion of the expected training.

c. Conclusions

The inspectors concluded the project was well managed. As the program expanded from the initial investigation to a dedicated project, the licensee developed appropriate and satisfactory project plans, descriptions, and guidelines. Personnel with appropriate qualification and experience were selected to staff the Project, and the training required by licensee procedures was conducted. The Independent Review Team provided sufficient oversight and contributed to the completeness and thoroughness of the final investigation.

1.2 Licensee Physical Inspections 1.2 Licensee Physical Inspections

a. Inspection Scope

The inspectors reviewed the planning, execution and documentation of the physical inspections performed to locate the spent fuel rods.

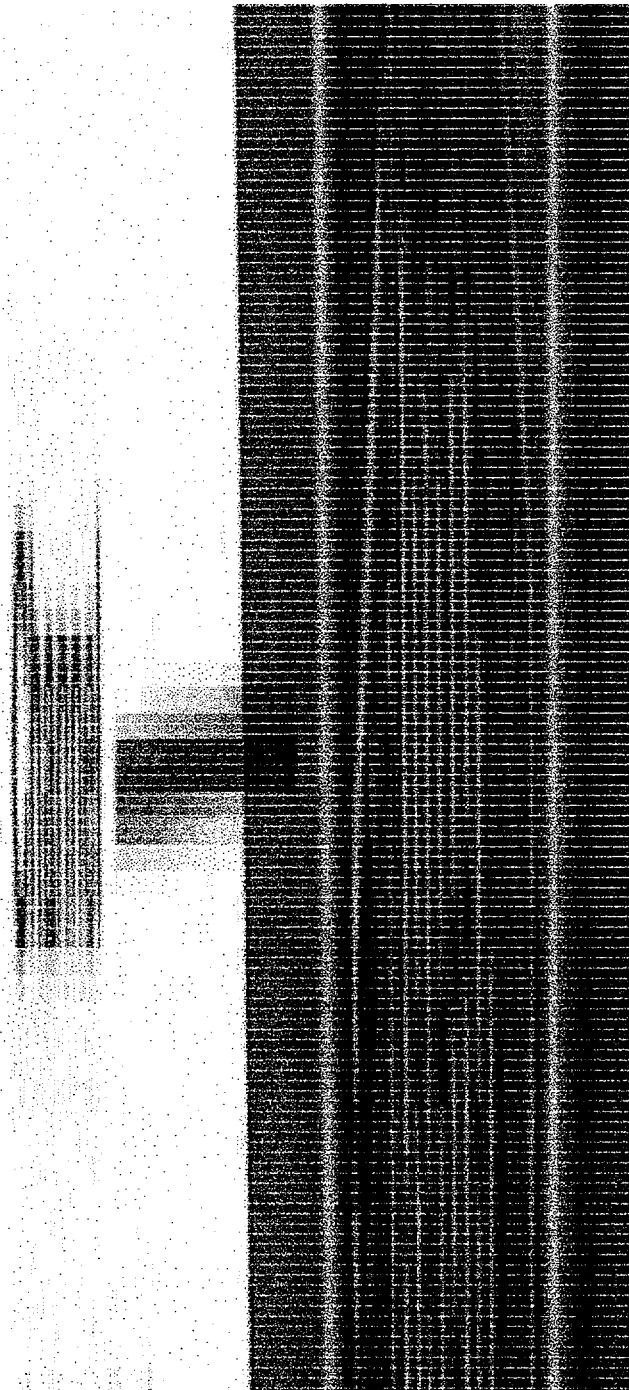
b. Observations and Findings

The inspectors reviewed FRAP Procedure 10063-2, "Guidelines for Physical Inspection." The document was found to provide appropriate and complete guidance for the conduct and documentation of the physical inspection of the spent fuel pool. The document provided guidance on the review of prior inspections, identification of search areas, development of inspection techniques, and establishment of acceptance criteria. Incorporation of the inspection results into the scenario dispositions was also addressed.

The inspectors reviewed the FRAP document titled "Scenario Dispositions 5.1.1-5.1.38, Physical Inspections, Rev. 1." The document reflected an extensive review of all proposed scenarios involving the missing fuel rods still being located in the spent fuel pool. By FRAP management decision, all scenarios involving the rods being located in the spent fuel pool were investigated by physical inspection regardless of assessed likelihood.

The inspectors reviewed documentation related to the spent fuel pool free space inspection, "Memo FRAP-01-52", which included extensive documentation of the debris under the fuel racks. The inspection of spaces and gaps in the spent fuel pool utilized a combination of visual and radiation monitoring.

The inspectors interviewed FRAP staff concerning the conduct of spent fuel pool inspections. Licensee staff said that pool inspections addressed the possibility that the two missing fuel rods had been placed within another assembly in the storage racks and



therefore were not readily visible in the racks. No record was found indicating such an action had occurred, and it could only have been accomplished by removing the tie plate from the top of the assembly. Figure 1 is a cutaway illustration of a fuel rod, and Figure 2 illustrates the components of a fuel assembly. Removal of the tie plate would have disturbed the corrosion film covering the tie plate and fasteners, markedly changing the appearance of the assembly hardware and enabling clear identification of assemblies that had been altered. The licensee concluded that only those assemblies on which these components were shiny and without a corrosion film could have been candidate assemblies within which to place an individual rod. Assemblies not showing evidence of disassembly were presumed to be intact and unchanged since discharge from the reactor. These inspections included observation of the tops of all 2884 assemblies in the pool for indication of prior disassembly. Twenty-nine assemblies showing evidence of disassembly were inspected by the FRAP to confirm that records for all fuel rods were as expected, including recorded high resolution video examination to view and count each rod in these assemblies. The licensee did have records indicating disassembly of some fuel in the spent fuel pool for a variety of reasons since the plant began operation. In all cases, assemblies identified by inspection that showed evidence of disassembly confirmed the records indicating that these assemblies had been altered, and additionally the number of fuel rods in each assembly was verified.

The inspectors reviewed selected videotape records of spent fuel pool and fuel assembly inspections. The videos documented a methodical search of all the fuel assemblies for indications of disassembly. Video documentation of the inspection of non-fuel areas was complete except for inaccessible areas (e.g., the spent fuel pool sump was covered by a plate with small openings, and was located under the fuel racks). Areas with loose sediment or silt were visible on the videotapes of the searches, in some places to a depth greater than the diameter of a fuel rod. The licensee had reached areas under the fuel racks using a crawler robot with a camera mounted on it, and had used a probe, also mounted on the crawler, to push through the silt layer while observing with the video camera. A plow-like attachment was also used to displace the sediment in some areas, to enable viewing through the camera for objects within or under the sediment. The probing instruments were designed to detect objects one foot or longer in length. The licensee concluded in the memo identified as "FRAP-01-0157" that the only remaining potential location in the spent fuel pool involves the rods having been cut into many small segments which would allow them to be in several locations in the spent fuel pool and not visually identifiable.

As noted in the FRAP report, the Project chose not to disassemble and inspect the rods in each assembly in the spent fuel pool due to radiation exposure considerations, the risk of a fuel handling accident, and difficulties associated with reading the serial numbers on the individual fuel rods. Project staff also stated that GE personnel were not able to retrieve serial number data for all the individual spent fuel rods at Millstone 1 because some records no longer existed. Based on the completeness of the inspection conducted on the fuel assemblies that showed evidence of disassembly and the very limited potential information to be gained, the licensee decided not to conduct an examination of all the individual fuel rods in the spent fuel pool.

c. Conclusions

The physical inspection process was thorough and comprehensive. The documentation of the spent fuel pool physical inspections was complete. The FRAP augmented and/or repeated earlier inspections where it was not clear that the earlier inspection had been sufficiently thorough or rigorous. Video documentation was complete except where circumstances or accessibility made that impossible. The inspectors agree with the licensee's conclusion that the possibility of the missing fuel, either as intact rods or large segments, remaining in the spent fuel pool is limited and unlikely.

1.3 Licensee Scenario Investigation and Disposition 1.3 Licensee Scenario Investigation and Disposition

a. Inspection Scope

The inspectors reviewed the general approach to defining the possible scenarios for fuel pin disposition, evaluated the FRAP assessment of the scenarios for plausibility and for investigation, evaluated the process used to resolve uncertainties and differing opinions, and reviewed conclusions for reasonableness.

b. Observations and Findings

The inspectors reviewed Procedure M10063-5, "Guideline for Scenario Development and Investigation," which provided general guidance on the process to be followed for identifying the scenarios which could explain the loss of the fuel rods and the process for investigating those scenarios for plausibility. The document provided adequate guidelines to define the process, while allowing adequate flexibility to enable all potential scenarios to be identified.

The inspectors interviewed FRAP staff regarding the initial scenario development process. Following the initial development of the scenario population by a team brainstorm process, each scenario was further developed by a formula write-up of the basic questions: who, what, when, where, why, and how. Group meetings were held to review the write-ups. Two members were assigned to develop an initial assessment of each scenario. Group meetings were again conducted to review likelihood, plausibility, and required investigative actions for each scenario. Following appropriate investigative actions, which included inspections, interviews, and document reviews, the group reviewed the results. Documentation of the investigation into each scenario was prepared.

The inspectors reviewed summaries documenting meetings held to discuss FRAP scenarios. Review of these summaries indicated that detailed discussions were conducted for the scenario development process, with exhaustive and methodical consideration of possibilities. The licensee identified a total of 75 scenarios for evaluation. Of the 75 scenarios, 12 were considered implausible and not evaluated.

further. Twelve scenarios were investigated fully, through use of detailed action plans. Ten scenarios were addressed through one or more specific confirmatory investigative actions, and 41 scenarios were addressed through physical searches conducted in the Millstone 1 spent fuel pool or elsewhere at the Millstone Station.

The inspectors reviewed selected scenario documentation including: Scenarios 5.1.1 through 5.1.38, "Physical Inspections," which documented all the spent fuel pool scenarios, 5.2.1 a & b, "Transfer and Storage at Low Level Waste Storage (Bunker)", 5.4.1, 2 & 3, "Barnwell 1988, 1989 & 1990, & 1992", 5.7.1, 2 & 3, "Theft or Diversion", and 5.8.1 a & b, "Shipped Offsite but not GE, Barnwell, or Hanford."

c. Conclusions

The scenario development and investigation process was good. Initial development was comprehensive and the investigative process was thorough and meticulous. The documentation and analysis of the scenarios were also thorough and complete.

1.4 Licensee Interviews.4 Licensee Interviews

a. Inspection Scope

The inspectors reviewed the methodology and results of the interview process used by the licensee, and assessed the effectiveness of the methodology and the completeness and comprehensiveness of the results.

b. Observations and Findings

The inspectors reviewed Procedure M10063-4, "Guideline for Interviewing." Extensive guidance was provided on the conduct and subject areas for the in-person interviews. Detailed and structured guidance was provided for the phone interviews, including a list of specific questions to be asked. The guidance provided was thorough and appropriate.

The inspectors discussed with FRAP staff the development process for selecting the personnel to be interviewed. Interviews were important elements in each of the detailed action plans developed for the scenarios designated by the FRAP as requiring full investigation. Candidates were classified as primary or secondary, with primary classification indicating a greater possibility for the individual to provide significant information. The initial selection of the primary and secondary interviewees was based on documented past work and likelihood of direct involvement of individuals with the missing fuel rods. This selection process was done as part of a group review by the FRAP team. Over 200 people were interviewed by the FRAP, with about 100 primary and 100 secondary interviews. The primary interviews were typically held face-to-face, with the interviewee and two interviewers from the project team. The number of two-person FRAP interview teams was limited to only two in order to maximize consistency in the interview process. Secondary interviews were typically conducted via telephone by a FRAP team member who used a scripted list of questions. Group meetings were

conducted weekly to review interview results in order to maximize the dissemination of information and lessons learned among all members of the FRAP. Where the telephone interviews indicated a potential of an individual's greater involvement than previously anticipated, these individuals were included in subsequent in-person interviews. The formalized interview process developed for the FRAP was effective and provided for consistent results and effective dissemination of the information obtained.

The inspectors reviewed documentation of selected interviews and spoke with several interviewees, one of whom had extensive involvement in packaging and shipping radioactive material from the spent fuel pool offsite. In discussions with the inspectors, this person provided additional information concerning the shipments to Barnwell in 2000. Based on this information, which was not recovered by the licensee's interview process, the inspectors concluded the shipments in 2000 did not contain the missing fuel rods (discussed in section 3.4 of this report).

c. Conclusions

The licensee's interview process was well planned and rigorously conducted. Documentation was extensive and indicated that the interviews were complete and thorough. Appropriate reviews of the results were conducted for lessons learned and potential new investigative directions, and information was effectively used to improve subsequent interviews. A question was raised regarding the completeness of information obtained from one interviewee. The inspectors concluded that the additional information obtained by the inspectors did not alter but supported the conclusion of the FRAP that Barnwell had the most significant opportunity to receive the fuel rods, and also that this example did not indicate a broader concern regarding the effectiveness of the FRAP interview process.

Section 2. Loss of Accountability

2.1 Investigation of Past Processing of Irradiated Hardware.1 Investigation of Past Processing of Irradiated Hardware

a. Inspection Scope

The inspectors reviewed the licensee's investigation of past activities in the spent fuel pool to process various irradiated hardware components for shipment as waste. In particular, the review focused on the processing of items that appeared similar to fuel rods, which the licensee identified as including local power range monitors (LPRMs), source holders, and dry tubes.

b. Observations and Findings

The licensee described various items of irradiated hardware that do not contain fuel but do appear similar to fuel rods, that had been removed from the reactor core and placed in the spent fuel pool as waste during operations at Millstone 1. The missing fuel rods are 0.57 inches in diameter and 158 inches (13 feet, 2 inches) long. Portions of LPRMs are 0.7 inches in diameter, and full length LPRMs are 42.6 feet long. LPRMs include a "hot end" and a "cold end" (identified in these terms based on their radiation levels at the end of their useful service life). The "hot end" is located in the reactor core region during service, becoming activated by the neutron flux in the core and therefore significantly radioactive. LPRM hot end contact radiation exposure rates at Millstone have ranged from 10,000 to 25,000 R/h, which is substantially greater than the contact exposure rates of 1,600 R/hr in 1980 estimated by the licensee for each of the missing spent fuel rods. The "cold end" of the LPRM was never exposed to the core neutron flux and therefore did not become activated, but is contaminated on its surface. At the end of its useful life, the LPRM is removed from the core and taken into the spent fuel pool for storage. Typical LPRM processing at Millstone 1 has included separating the hot end from the cold end, initially producing a hot segment just under 13 feet in length.

The licensee also identified source holders and dry tubes as other items in the spent fuel pool resembling the missing fuel rods. Source holders are 0.7 inches in diameter and 13 feet, 2 inches long, and dry tubes are similar. Licensee procedures for source holder removal did not specify where in the spent fuel pool source holders removed from the core were to be stored. Three source holders cannot be accounted for by the licensee, leading the licensee to conclude that they have been disposed of as waste. Source holders and dry tubes do not contain special nuclear material and there is no NRC requirement to account for these objects, only that they be controlled as radioactive material.

The FRAP investigators examined in depth the possibility that the two missing spent fuel rods were mistakenly processed as irradiated hardware, cut into segments along with LPRM hot ends or source holders or dry tubes, and shipped to a low level waste burial site for disposal along with other similar looking materials. The licensee identified three separate campaigns during which irradiated waste hardware in the spent fuel pool was processed, including the planned cutting of LPRMs into segments for disposal. These campaigns were conducted during September-October 1979, August 1984, and January-February 1985.

September-October 1979 Processing Campaign

A contractor company (Crouse) performed processing activities on irradiated hardware, including cutting of LPRMs, in the spent fuel pool during this period of time. The FRAP investigators characterized the contractor as having limited experience in identifying reactor components. Additionally, interviewees told the licensee that supervision of the contract workers by licensee personnel was not very rigorous, and the licensee's supervisors were not experienced in refueling floor activities.

As noted previously, LPRM hot ends appear similar to the missing fuel rods. Personnel who are unfamiliar with the various hardware objects found in the spent fuel pool may not have distinguished between fuel rods and LPRM hot ends. The licensee also noted that contractor personnel did not have available visual aid equipment, such as a borescope or underwater video camera, to examine items in the pool more closely. Contractor personnel interviewed by the licensee also indicated that they expected that fuel would only be stored in the racks, and that they were told not to touch anything in the racks. Since the missing rods were apparently stored along the spent fuel pool wall in the northwest corner, outside the racks and tied to the railing, it seems plausible that the contractor workers could have mistaken the two fuel rods for other irradiated hardware. The licensee provided the inspectors with photographs from 1985 showing very crowded conditions, with numerous ropes or cables tied to the railing and leading down into the spent fuel pool. The licensee stated that such a condition, with many items tied to the railing, was also common in the 1979-1980 time frame. The licensee has recognized the possibility for errors presented by such crowded storage and by mixing spent fuel/special nuclear material in with other items. While not specifically prohibited by procedure, the licensee stated that it has been standard practice at Unit 2 and Unit 3 not to store fuel anywhere in the spent fuel pool except in the fuel storage racks, and this is also current practice at Unit 1. The inspectors confirmed the licensee's current practice of restricting fuel storage to the racks.

The inspectors requested that the licensee obtain records for spent fuel pool water chemistry samples in 1979 and 1980 to determine if there was any information regarding radioactive material in spent fuel pool water during these years. The licensee was able to retrieve only one record (dated March 21, 1980) for the two year period, which provided gamma spectroscopy analysis results for a 500 ml sample of spent fuel pool water. The licensee was not required by the NRC to retain these records, and this single set of data provided little perspective on trends in spent fuel pool water radionuclide concentrations.

The licensee postulated that, if the rods had been processed during the 1979 cutting campaign, this could explain why no personnel interviewed recalled seeing the rods in the pool. According to the radiation work permit records obtained by the FRAP, LPRM cutting was performed for 19 days during September and October 1979. Based on licensee data, 23 LPRMs would have been available in September 1979 in the spent fuel pool for the contractor to cut. The radiation work permits indicate that the contractor cut the LPRMs and placed the segments into storage liners in the spent fuel pool for future shipment. Licensee investigators determined through interviews that cutting was performed during this campaign using a crimping shear, and possibly a saw. The licensee acknowledged that fuel pellets or pellet fragments could have fallen onto the floor of the spent fuel pool during the process of cutting the fuel rods. Use of a saw to cut the fuel rods would have made it more likely that fuel material could have fallen onto the spent fuel pool floor, although licensee personnel did not believe that whole fuel pellets would have easily slipped out of the fuel cladding tube without being noticed. If the crimping shear had been used for cutting, it is more likely fuel pellets and fragments

would have been contained because the design of the shear was intended to crimp the ends of cut tubing to prevent materials from coming out of the tube.

August 1984 Processing Campaign

The August 7-8, 1984, LPRM cutting campaign was performed by Unit 1 Operations Department personnel. An experienced Senior Reactor Operator was responsible for refueling floor operations during this two-day campaign. Personnel interviewed by the licensee stated they were highly trained and intimately familiar with the fuel and fuel handling operations. No personnel interviewed recalled seeing the two fuel rods, or the 8-rod container used to store the two individual rods on the side of the spent fuel pool, during this time period.

January-February 1985 Processing Campaign

GE was the contractor performing LPRM cutting operations during the campaign from January 24 - February 1, 1985. A detailed procedure was written specifically for the work conducted during this campaign, and was approved by the Plant Operations Review Committee. The contractor cut 38 LPRM hot legs, and each one was a 23 foot long section at the start of the work. It is implausible these 23 foot long sections could have been mistaken for 13 feet, 2 inch long fuel rods. In addition, the licensee determined that the GE personnel on the project were experienced workers who would have been expected to recognize the differences between fuel rods and LPRM sections. The licensee also interviewed the Northeast Nuclear Energy Company project manager for the campaign, who recalled that the GE LPRM cutter was positioned 5-10 feet below the water surface of the spent fuel pool, which was close enough to the surface for good visibility of the items being cut. The licensee concluded that the available information for this campaign provides clear and convincing evidence that the fuel rods were not inadvertently cut during this project.

c. Conclusions

The licensee's evaluation of possibilities for inadvertent cutting of the missing spent fuel rods was thorough. The inspectors concluded that the licensee's assessment was reasonable, and the September - October 1979 irradiated hardware processing campaign in the spent fuel pool presented the most likely opportunity for the missing fuel rods to have been cut.

2.2 Control and Accounting of Special Nuclear Material

Control and Accounting of Special Nuclear Material

a. Inspection Scope

The inspectors reviewed the licensee's program and procedures for controlling and accounting for discrete items containing special nuclear material. The examination addressed the adequacy of the licensee's written material control and accounting

procedures and included review of (1) historical procedures, (2) procedures currently in use, (3) general material control and accounting program implementation (including inventory practices and internal transfers), and (4) documentation of external transfers of special nuclear material. The inspectors also reviewed the licensee's reconciliation of various data sources regarding accounting of special nuclear material.

b. Observations and Findings

Historical procedures

The inspectors reviewed Operations Procedure No. 1001, "Fuel Inventory and Control" (dated January 1972), which was in effect when rods BK0136 and BP0406 were removed from assembly MS-557, and Reactor Engineering Procedure No. 1001, "SNM Inventory and Control" (dated September 1978), which was in effect when the rods were identified and recorded in the Unit 1 Kardex® inventory card file. In both procedures, the fuel assembly is defined as the basic unit of special nuclear material. The 1972 procedure designates core instrumentation (source range monitors, intermediate range monitors, local power range monitors and traversing in-core probe monitors) as special nuclear material, and the 1978 procedure specifically defines fission detectors as special nuclear material, although these units contain significantly less special nuclear material than an individual fuel rod. Although individual fuel rods outside of an assembly are not specifically designated as units of special nuclear material in the two versions of Procedure 1001 reviewed, both also include the special nuclear material category "any other material designated by the Reactor Engineer." The Reactor Engineer is assigned responsibility for preparing and maintaining records of transfer and inventory of special nuclear material.

The procedures require periodic physical inventory of all special nuclear material, consisting of a piece count of the spent fuel pool contents and comparison with the most recent spent fuel pool map. This is also the current method of inventory. Performance of the piece count entails counting the number of items located in a specified area (such as a section of the spent fuel pool racks) and comparing the total count with the number of items shown on the map. The inspectors noted that procedures specify performance of a piece count inventory but provide no guidance on how to perform the piece count.

Loss of accountability of the two spent fuel rods from assembly MS-557 occurred because of several instances when personnel failed to follow the material control and accounting procedures in place at the time and due to inadequacies of the procedures themselves. The Reactor Engineer did not identify the two rods as "other special nuclear material bearing items" when the assembly was reconstituted without them (1974), although these were discrete items and clearly fit into the "other" category defined in the procedure. Inventory cards were not generated for the two fuel rods at that time, an error which was corrected in May 1979 when the Reactor Engineer noticed the two fuel rods in the spent fuel pool, positively identified them, and initiated Kardex® inventory cards. However, once Kardex® inventory cards were generated in May 1979, these Kardex® records were not subsequently maintained as required. In fact, when the

FRAP investigators discovered the two cards in June 2000, they had not been updated since 1979.

Physical inventories (as defined in the written procedure) were not sufficient to identify that the two rods were no longer in the location indicated by the spent fuel pool maps. When the rods were omitted from the map after April 30, 1980, it was not recognized that a change from the previous map had occurred. No record was created to cause spent fuel rods BK0136 and BP0406 to be carried as separate items for comparison with subsequent inventory piece counts. Even though the Kardex® cards were generated, the data about these two fuel rods was not brought into the licensee's inventory process. The licensee has concluded that the two rods were misidentified and mistakenly processed as irradiated hardware, an action that would not have required use of a material transfer form, nor generated any special record when it occurred. Therefore, the omission of the two rods from the spent fuel pool map created after April 30, 1980, assured that there would be no future inventory discrepancy.

Comments from licensee personnel indicated that in the 1980 time frame, staff would probably have viewed the two individual rods as part of the reconstructed MS-557 assembly. Once the rods were positively identified in May 1979, there would not have been an inventory discrepancy, since MS-557 was accounted for already and shown on the spent fuel pool map. The method of calculating and tracking the special nuclear material balance for spent fuel assemblies over time may have encouraged the mindset that individual rods remained part of an assembly regardless of the physical location within the spent fuel pool. The computerized tracking method uses a single decay factor, enabling a single calculation for decay correcting an entire assembly. To separately track each fuel rod in an assembly would require 49 individual calculations, a significant increase in number and complexity of calculations. While it is clearly possible to perform the additional calculations, the licensee indicated the inclination to avoid the need to perform calculations for individual rods. The licensee confirmed that, until the two missing fuel rods were determined to be missing in November 2000, the two rods had continued to be shown in the special nuclear material inventory accounting records as if they were still part of assembly MS-557.

Current Millstone Station material control and accounting program implementation
(including current inventory practices and internal transfers)

The inspectors interviewed Reactor Engineering personnel from Units 2 and 3 in order to gain an understanding of the licensee's implementation of the material control and accounting and fuel handling procedures. Licensee personnel interviewed displayed a thorough understanding of the requirements and written procedures.

The inspectors reviewed the current material control and accounting procedures, which included the following improvements compared to earlier versions: provision for recording and tracking items of special nuclear material that are generated during fuel assembly reconstitution and other non-standard special nuclear material movement; an instruction to compare the results of a physical inventory with those of the previous

physical inventory; and designation of fuel rods (in addition to assemblies) as units of special nuclear material.

Procedure MC5, "Special Nuclear Inventory and Control" (dated August 2001), is the overarching material control and accounting procedure. Each of the three Millstone Units has a written procedure that provides specific instructions on special nuclear material inventory and control. Each unit also includes in its fuel handling procedure references to the material control procedures. Additional procedures have been developed to cover the special nuclear material accounting program, preparation of required reports, accounting for sealed sources, and maintaining the master list of special nuclear material.

As described by Millstone personnel, there are three item control areas used to keep track of special nuclear material for special nuclear material accounting purposes: the new fuel storage area, the spent fuel pool, and the core (at Unit 1, the spent fuel pool is currently the sole active item control area). New fuel is received in sealed containers, for which the shipper generates a Form 741 at time of shipment, and submits the form to the Nuclear Materials Management and Safeguards System. (The Nuclear Materials Management and Safeguards System is operated by the U.S. Department of Energy, and is the official government database for tracking transfers of special nuclear material in the United States.) The nuclear material received is confirmed by the receiver, also by report to the Nuclear Materials Management and Safeguards System. At Millstone, a Kardex® file card (record) is then initiated for the item. After the new fuel containers are opened, assembly serial numbers are identified and verified. According to procedure, from this point on movements of fuel are to be identified and recorded on material transfer forms. An "executer" uses the material transfer form as instruction for movements to be performed, and a "verifier" follows the move as it is performed. Fuel movement is documented in accordance with applicable procedures. The material transfer forms for completed moves are later forwarded to the special nuclear material bookkeeper, who updates the Kardex® card file database and ShuffleWorks® computer map of special nuclear material locations.

The current spent fuel pool map is maintained and updated using the computer application ShuffleWorks®, not manually as it was in the past. As described by licensee personnel, physical inventory includes examination of individual cell locations in the storage racks and a count of the number of assemblies in the spent fuel pool. Items that do not contain special nuclear material, such as moveable in-core detectors and local power range monitors, are inventoried along with assemblies and other special nuclear material items. Per procedure MC5, a piece count inventory of the number of items in a discrete portion of the item control area (such as a rack within the spent fuel pool) is compared with the expected number of items shown in that area per the database as reflected on the current spent fuel pool map. The physical inventory does not include visual verification of the identity of all spent fuel pool contents, but compares the total number of items in a rack area with the corresponding number of items shown on the spent fuel pool map.

The inspectors reviewed video taped records of the Millstone Unit 1 spent fuel pool contents inventory, which were prepared by licensee personnel during the most recent survey. The inspectors compared the assembly locations specified in the official record of the September 2001 special nuclear material inventory (map) with the locations shown in the video record for a sample of items. There were no discrepancies.

Past practices at Unit 1, such as hanging fuel rod containers from the spent fuel pool rails, had created the potential for misidentification of individual fuel rods. The licensee stated the practice at Units 2 and 3 has always been to restrict fuel storage only to the racks. Based on interviews of Reactor Engineering personnel, the inspectors noted that current practice is to store all special nuclear material items in distinct and specific locations, defined as the spent fuel pool racks for spent fuel. There are procedural controls for storage of both spent fuel assemblies and individual rods that require approval of Millstone Station management before material could be stored in different spent fuel pool locations (MC-5, Rev. 3 and EN 21001, Rev. 021-01 are examples). This approach has been successful in controlling the location of spent fuel (including individual fuel rods) at Millstone Units 2 and 3.

Documentation of external transfers of special nuclear material (Form 741)

A nuclear transfer report, form NRC/DOE-741, must be completed for each shipment or receipt of special nuclear material. Procedure MP-13-SNM-PRG, "Millstone Special Nuclear Material Control and Accountability Program," assigns responsibility for preparation of 741 reports to the Special Nuclear Material Accountant.

The inspectors examined a sample of 741 forms for shipments and receipts of special nuclear material. Back-up documents were also reviewed and were found to support the information in the 741 forms. No concerns were identified with the special nuclear material transfer forms in this sample.

The national Nuclear Material Management and Safeguards System had prepared a report for Millstone of all shipments and receipts documented using Form 741 for the period February 1969 through March 2000. The report lists individual line items that appear in all Forms 741 for the specified period. Using the report, the licensee confirmed that all known historical shipments of individual fuel rods, including shipments of segmented test rod segments, were documented in 741 forms. NRC independently confirmed that all shipments and receipts in the Nuclear Material Management and Safeguards System records balanced. Rods BK0136 and BP0406 were not listed in the report, indicating they had not knowingly been shipped from Millstone identified as special nuclear material.

Several 741 forms of importance to the investigation were also reviewed, including the 741 form documenting the shipment of four segmented test rod segments to GE-Vallecitos Nuclear Center in April 1980 (FRAP Report Scenario 5.5.1). The inspectors noted that this 741 form listed the address of the receiver (GE-Vallecitos) as Waterford, CT and included the remark, "Material transferred to General Electric FOB Waterford, Connecticut." According to GE representatives, NRC license SNM-1270 authorized

receipt of material by GE of special nuclear material at Millstone (Waterford, CT) for transport. Transported material was then delivered to GE-Vallecitos and accepted by GE under NRC license SNM-960.

Reconciliation of Various Data Sources

The licensee had identified a number of sources of data regarding what special nuclear material was expected to be contained in the Unit 1 spent fuel pool, and had analyzed special nuclear material data for Millstone 1 contained in the following sources:

- Kardex® card file
- Spent fuel pool maps
- Millstone special nuclear material accountability system
- Nuclear Material Transaction Records (Forms 741)
- Millstone material transfer forms
- GE records
- Fuel assembly reconstitution records
- ShuffleWorks® computerized database display output

The licensee had determined there were numerous differences between the various sources of special nuclear material data, and stated that a focus of the spent fuel pool data reconciliation work during 2000 was to resolve these differences. The reconciliation work had first identified that the two spent fuel rods were not accounted for, as well as other record discrepancies which had been resolved. After resolution of data discrepancies, the licensee had visually verified the identity and location of spent fuel in the Unit 1 spent fuel pool and compared the data with the expected location of special nuclear material from the records. This verification confirmed that there was no special nuclear material unaccounted for other than the two missing rods; however, eight fuel assemblies were found to be in different rack locations than indicated in the records. Of these eight discrepancies, some were the result of misplaced Kardex® cards (which were later found), some were due to transcription errors, and some were erroneous database entries. The licensee stated these location discrepancies did not constitute special nuclear material accounting discrepancies because the item control area is defined as the entire spent fuel pool, and there was complete and balanced accounting of special nuclear material within the spent fuel pool item control area.

The licensee conducted a similar physical verification of the database during 2001 for Unit 2 and Unit 3. No discrepancies in spent fuel positions within the spent fuel pools were identified on either Unit 2 or 3 as a result of this review.

Spent fuel pool maps were, and continue to be, the record used during piece count inventories of the spent fuel pool. The inspectors reviewed selected Unit 1 spent fuel pool maps and noted the following regarding the two spent fuel rods:

Date of Spent Fuel Pool Map	Description
March 8, 1978	No notation of separate fuel rods.
March 13, 1979	A block drawn in the lower right corner of page is labeled

Date of Spent Fuel Pool Map	Description
	"fuel rods", although it is shown as outside of the spent fuel pool (near the southwest corner of the pool).
February 26, 1980	A block shown in northwest corner of the spent fuel pool, labeled "2 fuel rods MS-557".
April 30, 1980	Identified as "Rev. 1". Apparent updated photocopy of previous map, showing the fuel rods in the same position in the northwest corner.
September 18, 1980	Identified as "Rev. 2". No notation of separate fuel rods.

The licensee's material control procedures (Procedure 1001, "Fuel Inventory and Control," dated January 1972; Procedure 1001, "Special Nuclear Material Inventory and Control," dated September 1978; and Procedure MC5, "Special Nuclear Material Inventory and Control," dated July 2001) defined when preparation of a material transfer form was required for movement of special nuclear material. The procedural requirements have become more stringent over time. The 1972 procedure required the form to be used for movement "across the boundaries of a material balance area"; the 1978 procedure required the form to be used for movement "within or across the boundaries of an item control area"; and the 2001 procedure required the form to be used for movement "into, out of, or within item control areas."

According to FRAP investigators, no material transfer form could be found describing the disassembly of MS-557 on October 6, 1972. Material transfer forms were expected to have been generated to reflect the movement of all the individual fuel rods from the MS-557 assembly and into a total of seven eight-rod storage containers elsewhere in the spent fuel pool. Investigators concluded that the material transfer forms were not generated for the individual rod moves, nor were spent fuel pool maps updated to show the stored rods. The same conclusion was reached for the subsequent reassembly of MS-557 fuel rods (excepting two rods) on May 4, 1974. No record apparently exists of these two sets of fuel rod movements, therefore not generating any record of the two fuel rods that were not incorporated into the new "scrap" assembly of MS-557 fuel rods. Licensee personnel did not follow the existing procedure requirements in effect at the time for recording and tracking movement of special nuclear material. Other examples of failure to follow procedures were demonstrated by the presence of Kardex® cards in the file indicating positions in the spent fuel pool for items that were actually no longer in the spent fuel pool.

The inspectors requested information regarding those Kardex® cards, if any, remaining after all items physically verified as present in the Unit One spent fuel pool had been accounted for. The licensee identified 32 cards remaining in the card file with outdated and incorrect entries, determined by visual inspection and review of records. The cards indicated the items were in the spent fuel pool, although the licensee verified that the

items were not in the spent fuel pool. The licensee was able to account for all special nuclear material in question. The problem was determined to be record-keeping: the cards had not been properly updated. No additional discrepancies of special nuclear material were identified.

c. Conclusions

The inspectors concluded that accountability of the fuel rods BK0136 and BP0406 was lost sometime after 1979 because Millstone Unit 1 failed to follow procedures, and because the procedures that were in place when the rods were entered into the inventory system were not adequate. A complete physical inventory of special nuclear material, sufficient to account for all special nuclear material in the licensee's possession, was not performed at Millstone Unit 1 between 1980 and 2001. Moreover, Unit 1 failed to properly carry out the limited "physical" inventory called for in the written procedure in that they did not update the book inventory properly.

The inspectors found that the special nuclear material accountability reports appeared complete, except for the material contained in the two missing fuel rods. Accountability personnel rely on the Reactor Engineer to provide the special nuclear material data used to construct the nuclear material transfer (Form 741) and inventory (Form 742) reports. Accountability personnel do not judge the correctness and completeness of data provided by the Reactor Engineer, but accept it as provided.

The licensee's past practice of marking up previous spent fuel pool maps rather than redrawing the entire map also makes it likely that the spent fuel pool map records are unreliable sources of data. The April 30, 1980, map noted the fuel rods in the northwest corner of the pool; however the map notation appeared to be a photocopy of the previous map. This map therefore may not reflect verification of the actual presence of the fuel rods, but rather the practice of marking up map copies to show changes. The map dated September 18, 1980, appears to be a freshly drawn map (not a photocopy of the previous) and has no notation for the two fuel rods. Based on the unresolved discrepancies between the past maps, the inspectors conclude the past spent fuel pool map records are of limited value to resolve discrepancies or prove any conclusion regarding disposition of the two missing spent fuel rods.

10 CFR 70.51 requires that the licensee keep records showing receipt, inventory (including location), disposal, acquisition, and transfer of all special nuclear material in his possession; establish written material control and accounting procedures that are sufficient to enable the licensee to account for all special nuclear material in his possession; conduct annual physical inventories of all special nuclear material in his possession; and complete reports concerning special nuclear material received, produced, possessed and transferred.

Contrary to the requirements, the licensee failed to keep adequate records of the special nuclear material in irradiated fuel rods BK0136 and BP0406; failed to establish adequate written material control and accounting procedures sufficient to account for all special

nuclear material in his possession; and failed to identify through physical inventory that the two rods were no longer in the location stated in the book inventory (the previous inventory updated by receipts and shipments). The inspectors informed the licensee that this was an apparent violation of regulatory requirements (VIO 50-245/2001-013/001)

Section 3. Transfer of Missing Fuel Offsite

3.1 Shipments from Millstone to Vallecitos Nuclear Center during 1980. Shipments from Millstone to Vallecitos Nuclear Center during 1980

Inspection Scope

The inspectors reviewed the licensee's investigation and conclusions concerning the possibility that the rods were shipped to GE-Vallecitos. The inspectors also contacted knowledgeable GE representatives and examined licensee data and records related to shipments of spent fuel from Millstone station to GE-Vallecitos.

Observations and Findings

The inspectors discussed with the licensee the supporting documents for the investigation scenario addressing the possibility that the two missing spent fuel rods had been shipped to GE-Vallecitos. Review of the available records confirmed that no records provide any evidence establishing that the missing rods were shipped to GE-Vallecitos. There were, however, some contemporaneous activities and occurrences at Millstone 1 in the 1979-1980 time frame that are not readily explained by the available records. These activities are described in the FRAP Final Report. For example, four segmented test rods were removed from assembly MSB-125 on May 5, 1979, and on the same day assemblies MS-557 and MS-330 were both moved to the fuel prep machine for the first time since MS-557 had been reconstructed in 1974. The two assemblies remained in the fuel prep machine for about 24 hours, in the midst of a refueling outage. There is no record available describing what activities, if any, occurred involving the assemblies while in the fuel prep machine. One week later, on May 12, 1979, GE personnel read the serial numbers on the two fuel rods contained in the 8-rod storage container located in the northwest corner of the spent fuel pool, and concluded that these were the two rods removed from MS-557 in 1972. The May 15, 1979, memo from the Reactor Engineer concurred in GE's conclusion.

The FRAP also concluded there is basis for uncertainty in the documentation of some items shipped to GE-Vallecitos. The basis for this conclusion described in the FRAP Final Report is the difference between the GE inventory of received reactor hardware (dated May 8, 1980) and the GE inventory of non-fuel hardware packed in the shipment (dated April 10, 1980). While this discrepancy indicates uncertainty in the completeness of the records, it does not indicate that the two rods were cut up and sent in the shipment.

During the records review, the inspectors identified a GE plan dated March 20, 1980, describing the expected uses of the GE 1603 shipping cask, and discussed with the licensee how the plans described had been implemented. The licensee followed up on these discussions and determined that the same shipping cask used for the April 30, 1980, Millstone shipment to GE-Vallecitos had also been used to transport non-fuel materials from another nuclear power plant to GE-Vallecitos. Licensee personnel also determined that at another facility GE had cut spent fuel rods in the spent fuel pool, loaded the segments into the GE 1603 shipping cask, and shipped them to GE-Vallecitos in April 1979. This information showed that GE had previously cut spent fuel rods in spent fuel pools, shipped segments to GE-Vallecitos, and that personnel at

GE-Vallecitos were accustomed to receiving cut segments of spent fuel rods. No additional information was identified, however, indicating that any fuel other than the four test rod segments were included in the shipment from Millstone to GE-Vallecitos, received at GE-Vallecitos on May 7, 1980.

Review of GE procedures showed that the receipt and subsequent processing of shielded cask shipments arriving at GE-Vallecitos were governed by detailed procedures. GE- Vallecitos inventories of special nuclear material have been maintained and periodically reviewed, including inspection by NRC. Inventory discrepancies between the special nuclear material materials received versus the materials anticipated to be received would have been expected to be documented in accordance with GE procedures in effect at the time. No indications of the two missing spent fuel rods from Millstone have been identified in the special nuclear material inventory and logs at GE-Vallecitos.

Three shipments of spent fuel from Millstone to GE-Vallecitos were completed as part of a joint fuel development project using segmented test rods. During the investigation of data regarding the possibility of shipping the missing fuel rods to GE-Vallecitos, the licensee noted that the reported value for the quantity of spent fuel shipped from Millstone to GE-Vallecitos during the period 1979-89 in NRC technical report NUREG-0725, revision 7, dated January 1991, was different than it had been in previous revisions of the report. Total spent fuel shipped from Millstone to GE-Vallecitos in the three shipments was listed as 36 kg in revision 6 to NUREG-0725, and listed as 43 kg in revision 7.

The licensee contacted the NRC office that published the NUREG-0725 data to determine why the value had been changed, and documented their findings in the FRAP Final Report. According to the NRC, the person responsible for originally recording the data had made limited and cryptic notes indicating a telephone call from GE and a value of 8.8 kg on pages related to the shipment that left Millstone on April 30, 1980. The official record of special nuclear material transfer, the DOE/NRC Form 741, for the shipment shows 2.4 kg shipped by Millstone and was confirmed as received by GE. In 1990 a different NRC employee apparently used the handwritten 8.8 kg value as the basis for changing the data reported in NUREG-0725, although no documentation exists explaining this decision. Management of the Spent Fuel Project Office in the NRC Office of Nuclear Material Safety and Safeguards investigated the circumstances for the change of published values and determined that there had been no valid basis for changing the value in 1991, and that the value reported should be 36 kg for the 3 shipments. The Spent Fuel Project Office also indicated that the NUREG-0725 data is not the official record of spent fuel shipped; the official record is based on the Nuclear Material Transaction Report submitted by the shipper and receiver (also known as Form 741) to the Nuclear Materials Management and Safeguards System.

Conclusions

The inspectors did not identify any information showing that the two missing spent fuel rods had been shipped from Millstone to GE-Vallecitos. The NRC Spent Fuel Project Office has concluded that the change to the record of spent fuel shipped, published in NUREG-0725 in 1990, was an error, and the correct value for material shipped from Millstone to GE-Vallecitos in three shipments between 1979 and 1989 is 36 kg as originally published. The inspectors therefore concluded it is implausible that the missing rods were sent to GE-Vallecitos.

3.2 Shipments from Millstone to Hanford during 1985.2 Shipments from Millstone to Hanford during 1985

Inspection Scope

The inspectors reviewed the licensee's investigation and conclusions regarding the possibility that spent fuel from Millstone was shipped to the low level waste burial site in Hanford in packages containing radioactive waste for disposal.

Observations and Findings

FRAP investigators identified three shipments from Millstone to Hanford, occurring during 1985, that could have contained segments of the two missing fuel rods. These shipments were performed by GE as part of a spent fuel pool waste processing contract and occurred on March 20, May 29, and July 31, 1985. Documentation describing LPRM sections included in these shipments indicated that these LPRM sections were positively identified as related to the 1985 GE LPRM cutting campaign, thus making it less likely that unidentified materials would be mixed in with the sections. The March 20 and May 29 shipment contents were described in the FRAP Final Report as being well-characterized; however, in each case the shipping liner was open and available in the spent fuel pool for someone to have added material without recording the addition. The investigators also noted that two older liners (designated as PB-1 and AP-101/ANEFCO) had been stored in the spent fuel pool and contained unidentified hardware items. These two liners were being unloaded and contents examined concurrently with loading of the liner shipped to Hanford on May 29, 1985. While addition of older, unidentified materials may have been feasible, there is no information to indicate that anyone took any action to add materials to these two Hanford shipments.

The shipment made on July 31, 1985 may have been more likely than the other 1985 Hanford shipments to have included materials identified as LPRM sections. The FRAP investigators determined that these containers held LPRM and hardware sections cut by Crouse nuclear workers during the LPRM cutting campaign in September-October 1979. As discussed in Section 2.1, it is plausible that the missing fuel rods were sectioned along with LPRM hot ends during the 1979 cutting campaign, and therefore it is possible that some of the fuel rod sections could have been included in this third waste shipment to Hanford.

Conclusions

The inspectors identified no information that would refute or alter the licensee's conclusion that some of the missing fuel rods could have been sent to the Hanford low level waste burial site along with irradiated hardware.

3.3 Shipments from Millstone to Barnwell during 1988 through 1992.3 Shipments from Millstone to Barnwell during 1988 through 1992

Inspection Scope

The inspectors reviewed the licensee's investigation and conclusions concerning the possible inadvertent shipment of the irradiated fuel rods to the low-level radioactive waste burial site in Barnwell, in packages containing radioactive waste for disposal.

Observations and Findings

1988 Spent Fuel Pool Cleanup and Waste Shipments to Barnwell

The licensee hired a contractor in January 1988 to clean out waste in the spent fuel pool in preparation for a planned 1989 project to install new fuel storage racks. This cleanup work disposed of irradiated hardware, as well as other contaminated materials and filters stored in the spent fuel pool. Uncertainty in the identification and characterization of some of the waste materials was described in the FRAP Final Report.

In the detailed discussion of Scenario 5.4.1, the licensee stated that the November 11, 1987 bid specification for the 1988 spent fuel pool clean up project described, in the scope of work, five containers in the spent fuel pool with hot end segments from 96 LPRMs. The LPRMs that had most recently been discharged from the core typically had contact radiation readings of "tens of thousands of R/h on contact." In the post-project report provided to the licensee, the contractor stated that 12 baskets and inserts were found by the contractor in the spent fuel pool during the project (FRAP Report Reference #66, "1988 Cleanup Final Report"). According to the licensee, prior to the 1988 cleanup there was no accurate list of radwaste contained in the spent fuel pool. Supporting this statement is a 1988 memo from the licensee's cleanup project manager, which indicated that the work specification description of material to be processed was based upon "old memos, notes and recollection of plant personnel" (Northeast Utilities Memo #RAD3-99-49, dated May 31, 1988).

The licensee determined that the contractor accepted Northeast Nuclear Energy Company's description of the material in the containers as LPRMs, and did not try to independently identify or verify identity of LPRM serial numbers or segments. In the 1988 Cleanup Final Report, the contractor described radiation surveys of the baskets and did not individually survey each item within the baskets and liners. The "Liner/basket Radiation Profile" sheets for each of the baskets and liners provide radiation survey measurements made underwater, 6 inches away from the container, and each sheet states in the bottom comments section, "Presumed to be all LPRMs - hot and cold sections." (1988 Cleanup Final Report). This notation also indicates that personnel apparently expected the items in the containers to have various diameters, since hot ends have 0.7 inches maximum diameter and cold ends have 1.4 inches maximum diameter. It therefore seems possible that sections of fuel rods, source holders or dry tubes could have been inadvertently processed and identified as LPRM segments, if they had been cut with LPRMs and placed into the containers before this February 1988 packaging and loading work.

The 1988 project contractor reported shipping a quantity of LPRM segments equivalent to 90 LPRMs, although the licensee's 1987 bid specification for the project had described five containers holding hot ends from 96 LPRMs. The FRAP investigation team independently evaluated the linear feet of LPRMs reported as processed during the 1988 cleanup, and also compared the inventory of LPRMs processed and shipped during various cleanup campaigns (including the 1988 project) versus the total number of LPRMs received at Millstone 1 during the operating life of the plant. The FRAP analysis of the data determined that no more than 83 LPRM hot ends could have been available in the spent fuel pool during February 1988. The licensee estimated for the inspectors that the equivalent of at least 7 LPRM hot ends must have been other objects misidentified as LPRMs, and that the amount of misidentified material could have been as much as the equivalent of 22 LPRM hot ends. Each LPRM hot end section was estimated to be just over 13 feet long. The inspectors therefore noted that between approximately 92 linear feet and 289 linear feet of material incorrectly identified as LPRM sections, with appearance similar to LPRMs and fuel rods, was processed and shipped during this campaign.

1989 and 1990 Waste Shipments to Barnwell

The FRAP Final Report described four shipments from Millstone to Barnwell in late 1989 and 1990, following a spent fuel pool cleanup campaign subsequent to the reracking project. One of these shipments, on May 7, 1990, included a container from the spent fuel pool that the FRAP investigators determined may have contained LPRM segments that were not shipped in 1988. The container, designated FC-1, was identified in the project scope documents as containing 184 LPRM fission detectors, which had been removed from LPRMs and segregated for disposal. A letter from the contractor to the licensee (WasteChem to Northeast Utilities Service Company, dated May 1, 1990) states that some "extra" LPRM segments were removed from FC-1 and processed. As was the case in 1988, each individual item in the container was not examined and packaged for shipment. Characterization was based on item type and in-core exposure time, and therefore precise information on each and every item in the container was not verified and documented through individual visual examination and handling.

1992 Waste Shipments to Barnwell

The licensee used the same contractor to make three shipments in 1992 that it used to perform the 1988 and 1990 shipments. The FRAP investigators noted there were three shipments to Barnwell during this campaign and concluded that only the December 8, 1992, shipment "presented a reasonable opportunity" for inclusion of segments of the missing fuel rods. The basis for the conclusion is that the shipment included a box containing material identified as "miscellaneous trash", the characterization of which included a description of the items as cut-up LPRMs. As with the identified previous shipments, individual items in the container were not surveyed, but the container as a whole was surveyed in preparation for shipment. The individual responsible for characterizing the waste in the shipment described the box contents as including the equivalent of three LPRMs, which would have been older remnants remaining from processing campaigns such as the one conducted in September-October 1979.

The FRAP concluded that the other two shipments in 1992 were sufficiently characterized that they did not contain unidentified or misidentified items. It therefore is possible that the December 8, 1992 shipment could have included pieces of the missing fuel rods, for the same reasons applicable to the 1988 and 1990 shipments.

c. Conclusions

The inspectors agreed with the licensee's conclusion that the scenarios postulating shipment of sections of the spent fuel rods to Barnwell, misidentified as other waste could not be ruled out. The most likely shipments were in 1988, although shipments in 1990 and 1992 could also have contained some or all of the fuel segments.

3.4 Waste Shipments to Barnwell during 2000.4 Waste Shipments to Barnwell during 2000

Inspection Scope

The inspectors reviewed licensee Scenario 5.4.4, describing waste shipments to Barnwell during 2000. The review included records reviews and interviews of licensee personnel involved in the spent fuel pool waste processing and shipping campaign.

Observations and Findings

During 2000, the licensee conducted a campaign to dispose of irradiated waste materials in the spent fuel pool and clean out much of the waste materials in the pool. The project was part of the overall effort to prepare for proposed movement of spent fuel into casks for dry storage.

The FRAP Final Report, Section 4.1.2.3 concluded that two of the 2000 shipments to Barnwell could have included remnants of the two spent fuel rods. The Final Report stated, "...the evidence is not sufficiently clear and convincing..." that the final two shipments in 2000 using TN-RAM casks did not include fuel remnants.

The inspectors interviewed Millstone Station staff responsible for the 2000 Unit 1 spent fuel pool clean-up project and discussed the characterization of materials processed and shipped during this campaign, focusing on the last two shipments which occurred on June 7 and July 17, 2000. Millstone staff referred to logs and project records, focusing on materials placed into a container and referred to in the Final Report as a "bucket of debris". The licensee pointed out that the materials in the bucket were boron tube sections generated during the 2000 project while cutting control rod blades. No other materials were put into the bucket during the project, and project staff had verified that the bucket was empty when they began work. The licensee was certain no unidentified components were put into the bucket, including additional boron tubes found scattered on the spent fuel pool floor from previous control rod blade cutting campaigns. They stated that all such items on the spent fuel pool floor had been moved aside to clear an area to place the shipping casks on the floor of the pool for this project.

The licensee stated that all LPRMs processed for the 2000 shipments were full-length (about 43 feet long) and had been bent into "hairpin" configurations, enabling positive verification of the items as LPRMs and not sections of other tube-like hardware. Licensee staff were able to refer to project records from 2000 as the basis for concluding that no unidentified or unverified materials were included in either of the subject shipments. Additionally, the project engineer's log contained an entry dated June 23, 2000, describing examination of shipping containers in the spent fuel pool and concluding no unidentified debris had been packaged for the shipment. The licensee representative had also been involved in shipping materials to Barnwell in 1988, and noted that the NRC guidance issued in 1995 (Final Branch Technical Position on Concentration Averaging and Encapsulation, Revision in Part to Waste Classification Technical Position, dated January 17, 1995) had resulted in improvements to the characterization methods used at Millstone. As a result, the licensee's efforts to characterize the waste materials shipped in 2000 was more thorough and complete than prior to 1995.

The FRAP Final Report also identified a questionable radiation survey record of the "bucket of debris" as a source of additional uncertainty in characterization of material in the bucket. Millstone staff responsible for the shipment stated to the inspectors that the recorded survey date of July 26, 2000 on the survey form appeared to be an error, with an actual survey date of June 26, 2000. The "bucket of debris" was the only entry on the data sheet, which had a fax date-stamp at the top showing "JUN-28-00 WED" and recorded the material as placed into liner 96813-02¹. Other records in the report, showing transmittal of shipping documentation for liner 96813-02 and listing the "bucket of debris", are dated June 30, 2000, and the shipment was made on July 17, 2000. Consistent with the Millstone staff comments, the vendor's final report of the waste shipping campaign described liner 96813-02 contents as including the "bucket of boron tubes".

¹WMG, Inc. report WMG-20016-9092, "Packaging and Disposal of Irradiated Hardware at Millstone Unit 1 During 2000," dated August 2000.

Conclusions

Based on personal recollections of Millstone personnel, observations and documents reviewed, the inspectors concluded the characterization of waste shipped to Barnwell during 2000 was sufficiently detailed and complete to identify the "bucket of boron tubes" generated during the related waste processing campaign. Therefore the inspectors concluded remnants of the two missing fuel rods could not have been included in the shipments made during 2000, a conclusion which is different than is stated in the FRAP Final Report.

3.5 Overall Conclusions Concerning Transfer of Missing Fuel Offsite

The inspectors agree with the licensee's conclusion that the most likely explanation for disposition of the two missing spent fuel rods is they were cut during the September -October 1979 spent fuel pool cleanup campaign and that the low level radioactive waste disposal facility at Barnwell had the most significant opportunity to receive the rods, with some small opportunity to ship the fuel rods to Hanford. The most likely shipments were the 1988 shipments to Barnwell, although shipments to Barnwell in 1990 and 1992 could also have contained some or all of the fuel segments. The lesser quantity of candidate waste materials sent to Hanford, the timing of shipments, and the type of casks used, all make Hanford a less likely recipient of the rods than Barnwell; however, the possibility of the rods being shipped as waste to Hanford in 1985 cannot be ruled out.

If the licensee shipped the two spent fuel rods to Barnwell and/or Hanford, then the fuel rods were not identified as either special nuclear material or irradiated reactor fuel. Therefore, as a result of the loss of accountability and control of the two fuel rods, the licensee could have, on one or more occasions during the period from March 1985 to December 1992:

- transferred special nuclear material contained in two irradiated reactor fuel rods in an unauthorized manner to a low level waste burial site not licensed to receive the material (Barnwell and/or Hanford);
- shipped special nuclear material contained in irradiated reactor fuel to low level waste burial sites in Barnwell and/or Hanford. The irradiated reactor fuel exceeded the limits for Class C waste and is therefore not generally acceptable for a low level waste burial site;
- incorrectly identified and characterized the special nuclear material in irradiated reactor fuel as other waste, and incorrectly certified in shipping manifests the composition of the waste as suitable for burial at a low level waste site;
- transferred special nuclear material to one or more locations (Barnwell and/or Hanford burial sites) without completing and submitting a Nuclear Material Transaction Report, DOE/NRC Form 741; and
- shipped irradiated reactor fuel without establishing and maintaining, or making arrangements for, and assuring the proper implementation of a physical protection system for the shipment(s).

Section 4. Review of Root Cause Analysis Report

4.1 Root Cause Analysis.1 Root Cause Analysis

1. Inspection Scope

The inspectors reviewed activities of the licensee's Root Cause Assessment Team, including methods and staffing, and the licensee's Root Cause Analysis Report, which was submitted to the NRC on October 29, 2001.

2. Observations and Findings

In addition to the FRAP team and the Independent Management Review Team, the licensee contracted with expert personnel to analyze the root cause behind the loss of the two fuel rods. Two individuals comprised the Root Cause Assessment Team, and they performed a root cause analysis of the missing fuel rods to determine why they had become lost and what actions were necessary to prevent a similar occurrence in the future. The Team members performed their activities independently of the FRAP team.

The Root Cause Assessment Team concluded that:

“...the root cause of the event was an unrecognized over-reliance on Millstone Unit 1 Reactor Engineers to compensate for organizational and process weaknesses in implementing the special nuclear material inventory and control procedures.”

The Root Cause Assessment Team report further described the elements of the root cause contributing to the event as:

- Process weaknesses associated with special nuclear material inventory and control and radwaste characterization;
- Weaknesses in coordination of spent fuel pool activities and procedural adherence; and
- Inconsistent supervision and inconsistently applied oversight of spent fuel pool activities by knowledgeable individuals.

The authors of the Root Cause Analysis Report also concluded that the licensee had maintained physical control of the missing fuel rods as radioactive material. In other words, the Root Cause Analysis Report states (and the FRAP Final Report concludes) that Millstone may have misidentified the missing fuel rods as something other than spent fuel rods, but maintained controls appropriate for the radiation hazard presented by the fuel rods.

Finally, the Root Cause Analysis Report contained a description of lessons learned, as well as recommended corrective and preventive actions. The identified lessons learned are:

- Important material that is stored near waste might inadvertently be considered just that (i.e. waste).
- Without clear line management ownership and involvement, station programs might take their own potentially undesirable course.

- An effective special nuclear material control and accountability program is needed to ensure physical accountability of all special nuclear material entities.
- Periodic special nuclear material inventory records reconciliation is essential to demonstrate that accountability has been maintained.
- Performance areas not covered by 10 CFR 50, Appendix B may still warrant oversight commensurate with their importance to the organization.

Sixteen recommended corrective and preventive actions were presented to the licensee in the Root Cause Analysis Report. The licensee reviewed the Root Cause Analysis Report provided by its contractor and stated that corrective actions had been entered into the Millstone Station Corrective Action Program. Although the Root Cause Analysis Report was not completed during the onsite NRC inspection, the inspectors observed that some corrective action recommendations made by the Root Cause Analysis Report authors were already being implemented by the licensee at the time of the onsite inspection.

3. Conclusions

The licensee used experienced and knowledgeable personnel to analyze the root cause and contributing factors which allowed the events resulting in the loss of two spent fuel rods to occur. The inspectors concurred that the practices and procedures in use through at least 1979 (when the missing fuel rods were last referenced, in a memorandum from the Reactor Engineer) were implemented in a manner that required sustained high quality performance by Millstone personnel, and when personnel errors or lapses occurred, the procedures and programs were inadequate to prevent the loss of the two fuel rods. The Root Cause Analysis Report was comprehensive, and provided extensive corrective action recommendations, which the licensee entered into the Millstone Corrective Action Program.

Although the licensee's Root Cause Analysis Report was not complete at the time of the NRC onsite inspection, the inspectors independently reached many of the same conclusions as the Root Cause Assessment Team. The inspectors noted that licensee personnel did not always follow procedures during the 1970s; procedures defined fuel as assemblies, not individual rods; the licensee relied too heavily on individual performance, with success dependent on people consistently doing more than the procedures required; and the licensee's failure to segregate fuel from non-fuel items in the spent fuel pool created confusion. The inspectors concluded that management controls and supervision of activities related to handling of special nuclear material and irradiated fuel were insufficient at the time to prevent the loss of the two fuel rods.

The inspectors noted that the recommendations of the Root Cause Assessment Team had been incorporated into the licensee's corrective action program as they were identified.

Section 5. Event Reporting

5.1 Licensee Reporting to NRC

Licensee Reporting to NRC

a. Inspection Scope

The inspectors reviewed the licensee's reporting of the two missing spent fuel rods to NRC. Included in the review was the content of the reports filed and the timeliness of those reports.

b. Observations and Findings

The inspectors reviewed a number of reports concerning the inability to account for the two spent fuel rods missing from the Millstone 1 spent fuel pool. A Condition Report (CR M1-00-0548) was initiated internally at Millstone by the licensee on November 16, 2000. The licensee first informed NRC via telephone on November 16, 2000, and followed up on December 14, 2000, with a 30 day call to the NRC Operations Center in accordance with 10 CFR 20.2201(a)(ii). The licensee submitted Licensee Event Report 05000245/2000-002-00 on January 11, within 30 days of calling the Operations Center as required by 10 CFR 20.2201(b) and 10 CFR 50.72(b)(2)(vi). Subsequent revisions to the Licensee Event Report were submitted, dated on March 30, 2001 (2000-002-01) and November 2, 2001 (2000-002-02).

The inspectors determined that licensee personnel were aware of the inability to account for the two spent fuel rods significantly sooner than November 16, 2000, the date of the first telephone contact with the NRC on the subject. The NRC Office of Investigations performed an investigation (Case No. 1-2001-007) of whether the licensee willfully failed to report the missing or lost fuel rods to the NRC in a timely manner. Millstone staff told NRC investigators that the May 15, 1979, memo describing the two individual fuel rods that were removed from assembly MS-557 was discovered during June 2000. The licensee began searching for the two fuel rods reflected in the Kardex® file in June 2000. Over the summer licensee personnel reviewed records of material transfer forms, which gave no evidence of activity with bundles that would have explained the missing rods. The licensee staff informed a licensee manager in August 2000 of the discrepancy and apparent recordkeeping problem, and continued to research the records of objects in the spent fuel pool and to search areas of the spent fuel pool in their effort to locate the two fuel rods. From August 29 to September 12, an assembly serial number verification process was undertaken by the licensee. As part of that process, on September 12, 2000 the licensee performed a visual examination of MS-557, which confirmed that two fuel rods were missing from the assembly. Licensee staff who performed the physical searches told the NRC investigator that they did not consider the fuel rods to be missing at that time because a comprehensive search of the spent fuel pool had not been performed, only of the locations indicated in the records. On November 16, 2000, the licensee initiated a condition report, and informed the NRC of the issue.

Lost or missing licensed material is defined in 10 CFR 20.1003 as licensed material whose location is unknown. On September 12, 2000, with the examination of MS-557 and physical verification of the northwest corner of the spent fuel pool completed, the licensee could not identify the location of the two fuel rods. The only documentation of their location, contained in the May 1979 memo from the Reactor Engineer and the two spent fuel pool maps prepared in 1980, were at this time shown to be incorrect. The inspectors concluded that although the licensee did eventually report the missing licensed material to the NRC Operations Center on December 14, 2000, the licensee did not know the location of the rods on September 12, 2000, and, therefore, the timeliness of the report did not satisfy 10 CFR 20.2201(a)(ii).

The NRC Office of Investigations focused on when the licensee became aware that the fuel rods were missing or lost and whether there was any deliberate intent to delay reporting that information to the NRC. The investigation determined that while some licensee personnel/contractors were aware of the possibility that the two fuel rods were missing as early as June 2000, they initially thought the problem was poor recordkeeping, and that the fuel rods were simply misplaced within the spent fuel pool. The investigation did not substantiate that either licensee personnel or contractors deliberately delayed reporting to the NRC that two fuel rods were unaccounted for/missing/lost from the Millstone 1 spent fuel pool.

On October 5, 2001, the licensee, based upon review of the FRAP Final Report provided by the licensee's contractor, determined that the fuel rods could not be located and were considered lost. The licensee notified the NRC Operations Center of this conclusion on October 5, 2001, in accordance with 10 CFR 70.52(a).

c. Conclusions

The inspectors noted that the licensee failed to notify the NRC in a timely manner according to the requirements of 10 CFR 20.2201(a)(ii), which requires that NRC be notified within 30 days after the occurrence of any lost, stolen, or missing licensed material exceeding specified quantities becomes known to the licensee. The two missing spent fuel rods exceed the quantity specified in the regulations. The inspectors informed the licensee that failure to notify the NRC within 30 days of when it became known to the licensee that the fuel rods were missing was an apparent violation of NRC requirements.(VIO 50-245/2001-013/002)

Section 6 Meetings

6.1 Exit Meeting.1 Exit Meeting

The NRC conducted an exit meeting for the inspection on January 15, 2002. The meeting, which was open for observation to the public, was held at the Millstone Station simulator building and was attended by representatives of the licensee, NRC, public and media. An opportunity to ask questions of the NRC and the licensee was available to the public following the close of the exit meeting.

6.2 Other Meetings.2 Other Meetings

The NRC attended several other meetings related to this special team inspection and NRC inspection activities concerning the spent fuel missing from the Millstone 1 spent fuel pool. NRC personnel, including management and inspectors, presented information at public meetings of the Connecticut Nuclear Energy Advisory Committee on May 17 and November 29, 2001, and at public meetings of the Millstone 1 Decommissioning Activities Committee on February 1, and May 17, 2001. A debriefing of the licensee was conducted at Millstone on October 18, 2001 at the conclusion of the special inspection team's onsite inspection activities.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

W. Matthews, Executive Vice President
A. Price, Vice President, Technical Services
F. Rothen, FRAP, Vice President, Northeast Utilities
H. McKenney, Lead Reactor Engineer
B. Borchert, Reactor Engineer
K. Cook, Nuclear Analyst, Reactor Engineering
J. Guerci, Process Owner, Nuclear Fuel
R. Fairbank, Project Manager, Fuel Rod Accountability Project (FRAP)
R. Harnal, Lead Engineer
M. Hills, FRAP
L. Hill, Team Lead, Nuclear Fuel Supply
C. Mandigo, Nuclear Fuel
R. Radasch, FRAP
D. Meekoff, Operations Manager-Unit 1
M. Rutkoske, Engineer
D. Smith, Process Owner, Regulatory Affairs
P. Willoughby, Team Lead, Regulatory Affairs
S. Bazinet, Team Lead, Records Management
J. Laine, Acting Process Owner, Radiation Protection
R. Swanson, Root Cause Team
P. Reagan, Root Cause Team

Others

E. Wilds, Director, Division of Radiation, State of Connecticut, Dept. of Environmental Protection
D. Galloway, Division of Radiation, State of Connecticut, Dept. of Environmental Protection

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

VIO 01-013-01 Failure to adequately account for special nuclear material

VIO 01-013-002 Failure to report missing radioactive material in a timely manner

Closed

None

Discussed

VIO 01-013-01 Failure to adequately account for special nuclear material

VIO 01-013-002 Failure to report missing radioactive material in a timely manner

LIST OF ACRONYMS USED

FRAP	Fuel Rod Accountability Project
DNC	Dominion Nuclear Connecticut, Inc.
GE	General Electric
NRC	Nuclear Regulatory Commission
LPRM	Local Power Range Monitor

APPENDIX APPENDIX

References for Docket Number 50-00245, Millstone Power Station Unit 1

Document Title	Document Date	ADAMS Accession Number
Millstone Nuclear Power Station, Unit No. 1, Docket No. 50-245 Licensee Event Report (LER) 2000-02-00	January 15, 2001 (submitted on January 11, 2001)	ML010170440
Millstone Nuclear Power Station, Unit No. 1, Docket No. 50-245 Licensee Event Report (LER) 2000-02-01	March 30, 2001	ML011010081
Millstone 1: Issuance of Final Report Pertaining to Unaccounted for Spent Fuel Rods	October 5, 2001	ML012850396
Investigation of Millstone Nuclear Power Station, Unit 1: Issuance of Root Cause Investigation Pertaining to Unaccounted for Spent Fuel Rods	October 29, 2001	ML013390308
Millstone Nuclear Power Station, Unit No. 1, Docket No. 50-245 Licensee Event Report (LER) 2000-02-02	November 2, 2001	ML020150002

EXHIBIT 2



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 31, 2001

OFFICE OF THE
GENERAL COUNSEL

Charles Bechhoefer, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Richard F. Cole
Administrative Judge
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Charles N. Kelber
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In the Matter of
DOMINION NUCLEAR CONNECTICUT, INC.
(Millstone Nuclear Power Station, Unit No.3)
Docket No. 50-423-LA-3

Dear Administrative Judges:

Pursuant to LBP-01-29, Memorandum and Order (Staff Motion to Continue to Hold Proceeding in Abeyance), October 5, 2001, at 6, the NRC staff is transmitting by this letter the Office of Investigations report on Case No. 1-2001-007. The report is also being transmitted today to the licensee by a letter from Dr. Ronald R. Bellamy, Chief of the Decommissioning and Laboratory Branch in Region 1.

Sincerely,

Ann P. Hodgdon
Counsel for NRC Staff

Enclosure: As stated

cc w/encls: Service List

Title: MILLSTONE NUCLEAR POWER STATION, UNIT 1:

FAILURE TO REPORT MISSING OR LOST RADIOACTIVE FUEL RODS IN A
TIMELY MANNER

Licensee:

Northeast Nuclear Energy Company
107 Selden Street
Berlin, CT 06037

Docket No.: 50-245

Case No.: 1-2001-007

Report Date: September 28, 2001

Control Office: OI:RI

Status: CLOSED

Reported by:

Mark A. Mullen

Mark A. Mullen, Special Agent
Office of Investigations
Field Office, Region I

Reviewed and Approved by:


Barry R. Letts, Director
Office of Investigations
Field Office, Region I

Participating personnel:

Todd Jackson, Health Physicist, DNMS, Region I

Kristen Monroe, Special Agent

Jeffrey Teator, Special Agent

Robert P. Rzepka, Special Agent

[Redacted]

SYNOPSIS

This investigation was initiated on February 13, 2001, by the Nuclear Regulatory Commission (NRC), Office of Investigations (OI), Region I, to determine when the licensee and licensee personnel/contractors became aware that two fuel rods/pins were unaccounted for/missing/lost from the Millstone Nuclear Power Station (MNPS) Unit 1 spent fuel pool (SFP); and, specifically, whether there was any deliberate effort to delay reporting that information to the NRC.

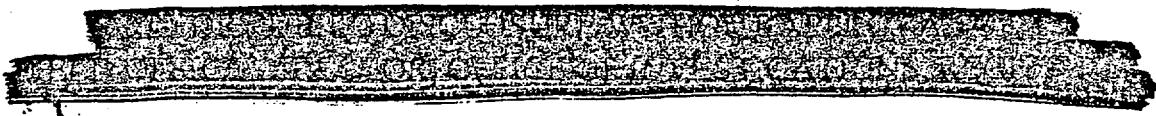
Based on the evidence developed during this investigation, OI did not substantiate that either the licensee or licensee personnel/contractors deliberately delayed properly reporting to the NRC that two fuel rods/pins were unaccounted for/missing/lost from the MNPS Unit 1 SFP.

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LIST OF INTERVIEWEES

Exhibit

BHARDWAJ, Vasant, Manager of Engineering Programs and Components Engineering, James Fitzpatrick Nuclear Power Plant, and former Decommissioning Manager, Millstone Nuclear Power Station (MNPS), Unit 1	39
FORD, Byran S., Entergy Nuclear Generation Company (ENGCO), Pilgrim Nuclear Power Station, and former Decommissioning Director, Entergy, MNPS, Unit 1	36
GUERCI, John, Process Owner of Nuclear Fuel and Safety Analysis, Dominion Nuclear Connecticut, Inc., (DNCT), MNPS	37
HILL, Lee O., Jr., Team Leader, Nuclear Supply Group, DNCT, MNPS	27
HILLS, Michael P., Consultant, Nucon, and former Engineer Decommissioning Organization, Northeast Utilities (NU), MNPS	20 & 21
KUDLA, Christopher S., Engineer/Project Manager, Independent Contractor, MNPS	26
MANDIGO, Carol D., Scientist and Special Nuclear Material Accounting Clerk, DNCT, MNPS	22 & 23
MEEKHOFF, Daniel J., Technical Advisor and Project Manager, DNCT, MNPS	29
McNAMARA, Michael, Vice President, Nuclear Projects, Holtec International, and former Project Manager, MNPS	32
RADASCH, Rockwell L., Maintenance/Support Engineer, Tekton, MNPS, Unit 1	24 & 25
ROTHEN, Frank, Vice-President for Nuclear Services, NU	34
ROTHSTEIN, Harold L., Manager of Spent Fuel Storage Systems and Manager of the Nuclear Department, Washington Power/Washington Group International	31

SPAHN, William E., Shift Manager, DNCT, MNPS, Unit 1	38
TEMPLE, Larry G., Indian Point 2 transition team/becoming future General Manager, and former General Manager Decommissioning, Entergy, MNPS, Unit 1	35
VEGILA, Vicenzo P., Manager of Programs and Components, ENGC, PNPS, and former Engineering Manager, MNPS, Unit 1	28
WHITE, Frostie A., Root Cause Engineer for Fuel Rod Accountability, Excel Services, Inc., MNPS	30

[REDACTED]

DETAILS OF INVESTIGATION

Applicable Regulations

- 10 CFR 50.5: Deliberate misconduct
- 10 CFR 50.9: Completeness and accuracy of information
- 10 CFR 20.2201(a)(1)(ii): Reports of theft or loss of licensed material

Purpose of Investigation

This investigation was initiated on February 13, 2001, by the Nuclear Regulatory Commission (NRC), Office of Investigations (OI), Region I (RI), to determine if the licensee (formerly Northeast Nuclear Energy Company (NNECO)) or licensee personnel/contractors failed to report missing or lost radioactive fuel rods from the Millstone Nuclear Power Station (MNPS) Unit 1 spent fuel pool (SFP) in a timely manner. Specifically, this investigation focused on when the licensee became aware that the two fuel rods were missing/lost and whether there was any deliberate intention to delay reporting that information to the NRC (Exhibit 1).

AGENT'S NOTE: Dominion Nuclear Connecticut, Inc. (DNCT), became the operator of MNPS on April 1, 2001, transferring the license from NNECO.

Background

On February 13 and 15, 2001, Allegation Review Boards (ARB) were convened in Region I to discuss potential wrongdoing discovered by an inspector during an inspection at Millstone Unit 1 from January 29, to February 1, 2001. During the inspection, a licensee special nuclear material (SNM) clerk/scientist indicated that in August 2000 "the guys" mentioned to her a concern that radioactive fuel rods could not be accounted for (Exhibits 2 and 3).

The concern centered on the fact that the NRC inspector had not been notified of the two potentially missing/lost fuel rods until November 16, 2000. Further, the licensee had previously submitted a Semi-Annual Special Nuclear Material Balance Report (SASNMBR/DOE/NRC 742 Forms) for MP1, MP2, and MP3, dated October 25, 2000, in which there was no mention of the two missing/lost fuel rods. The licensee is required by 10 CFR Part 20.2201(a)(1)(ii) to report any lost, stolen, or missing licensed material of a specific quantity within 30 days after it becomes known to the licensee.

Additionally, the Atomic Safety and Licensing Board (ASLB) was holding hearings on whether to grant Northeast Nuclear Energy Company (NNECO), via a licensee amendment application to the NRC, dated March 19, 1999, the ability to increase the storage capacity of Millstone Unit 3

spent fuel pool (SFP) from 756 assemblies to 1860 assemblies. The Connecticut Coalition Against Millstone (CCAM) and the Long Island Coalition Against Millstone (CAM) became parties to the proceeding, arguing against increasing the storage capacity of the Unit 3 SFP. Licensing Board activities (i.e., filings, arguments etc.) were ongoing throughout the summer of 2000. On October 26, 2000, the ASLB issued a Memorandum and Order with regard to Contention 4, and ruled that "NNECO has demonstrated that it can adhere to administrative controls . . . without posing an undue or unnecessary risk to plant workers or the public." CAMM/CAM filed a motion to reopen the record on Contention 4, based on new developing information (i.e., the licensee's acknowledgment of two missing rods from the MNPS Unit 1 SFP). The ASLB initially denied the motion to Reopen the Record but subsequently argued to reopen the record. The aforementioned issues remain unresolved.

Coordination with Regional Staff

OI communicated regularly with NRC Region I Health Physicist Todd JACKSON and Regional Counsel throughout this investigation. OI also provided a status briefings to Division of Nuclear Materials Safety (DNMS) management as requested.

Allegation: Failure To Report Missing Or Lost Radioactive Fuel Rods In A Timely Manner

Evidence

Review of Documentation

JACKSON, Health Physicist, NRC, RI, provided the following:

(1) Northeast Utilities (NU) Unit 1 Decommissioning Condition Report (CR) M1-00-0548, dated November 16, 2000 (Exhibit 4).

The CR documents paperwork discrepancies regarding the physical location of a tie rod and spacer capture rod and other attempts to document or determine what happened to those rods;

(2) Northeast Nuclear Energy Semi-Annual Special Nuclear Material Balance Report (SASNMBR) (DOE/NRC 742 Forms) for MP1, MP2, and MP3, dated October 25, 2000 (Exhibit 5).

The SASNMBR is a required submission from the licensee to the NRC every six months. The SASNMBR does not make any reference to the tie rod and spacer capture rod in question;

(3) Northeast Nuclear Energy MNPS, Unit No. 1, Docket No. 50-245 Licensee Event Report (LER) 2000-02-00, dated January 11, 2001 (Exhibit 6).

The LER is a required submission to the NRC and notified the NRC of the missing/unaccounted for rods;

- (4) NU memorandum from T. G. PIASCIK to file, subj: "Fuel Rods," dated May 15, 1979 (Exhibit 7).

The memorandum documents that two fuel rods, fuel rod serial No. BP0406, further identified as a bent tie rod, and fuel rod serial No. BK0136, further identified as a spacer capture rod, were "stored in the fuel rod storage rack in the North-West corner of the spent fuel pool until they can be incorporated in a scavaged [sic] fuel assembly." Also, a fuel index card, dated with a May 12, 1979, entry, indicates the tie rod and spacer capture rod in question are in the NW corner of the Unit 1 SFP.

- (5) NU memorandum from T. G. PIASCIK to Reactor Engineering SNM file, subj: "Spent Fuel Pool Inventory," with attachments (SFP maps), dated October 8, 1980 (Exhibit 8).

Included in the attachments are SFP maps, to include maps dated April 30, 1980 and September 18, 1980. The April 30, 1980 map shows "2 fuel rods MS557" in the NW corner of the Unit 1 SFP, whereas the September 18, 1980 map does not indicate a location for the 2 fuel rods, and a March 13, 1979, map, showing the SE corner of the Unit 1 SFP; and

- (6) "Reportability Determination Regarding 10 CFR Criteria," dated December 14, 2000 (Exhibit 9).

This report documents the "30-Day Reportability Determination For M1-00-0548," reflecting the licensee's view. The licensee's evaluation: "The location of the fuel rods remains undetermined. Although the complete allowed 30-day investigation period has not expired, it has been conservatively decided to make this report."

In response to an OI subpoena Charles C. THEBAUD, Jr., Corporate Counsel, Morgan, Lewis, and Bockius, LLP, Washington, D.C., provided OI with:

- (1) Shift Narrative Logs (SNLs) from June 1, 2000 to November 16, 2000 (Exhibit 10).

The majority of the SNLs will be kept in the OI case file, except for the following: August 30, 2000, FR 0472, "Mike HILL [sic] commence spent fuel serial number gathering on the 108"; October 24, 2000, FR 0295, "Camera removed from the fuel pool, work in pool complete for the day"; November 15, 2000, FR 0210, "Rock RADASCH and Mike HILL [sic] completed inspections for today all equipment is out of the pool"; and November 16, 2000, FR 0204, "Submitted CR M1-00-0548. Possible loss of accountability of 2 spent fuel rods. A Reportability Determination has been requested";

[REDACTED]

RECHARGE DIRECTOR, OFFICE OF INVESTIGATION SECTION

(2) Various notes taken from Carol MANDIGO's Journal, to include entries from August 2000 through November 28, 2000, "written first week of Jan. 2001," FR 0089-FR 0090 (Exhibit 11).

In August 2000 MANDIGO's notes document that Mike HILLS sought out MANDIGO's records regarding fuel pins from MS557. MANDIGO's response was, "what pins." Follow on discussions on MS557 with HILLS and Rockwell RADASCH. "Pool maps showing pins found in SNM records. Map dated 5/9/80 shows pins in SFP"; and a November 13, 2000, meeting with HILLS, RADASCH and Lee HILL, issue of missing fuel rods discussed. MANDIGO and HILL recommend CR be written as soon as possible on missing fuel rods;

(3) Calendar/Day Planner of RADASCH, for October and November 2000, FR 0060-FR 0061, respectively (Exhibit 12).

There are entries for October 23 and 24, 2000, indicating raised fuel assembly inspection activity in the Unit 1 SFP and fuel record searches for various other dates in October 2000. Concerning November 2000, there are various entries for fuel record searches prior to November 16, 2000, as well as possible searches of the Unit 1 SFP on November 14 and 15, 2000, for the two fuel pins;

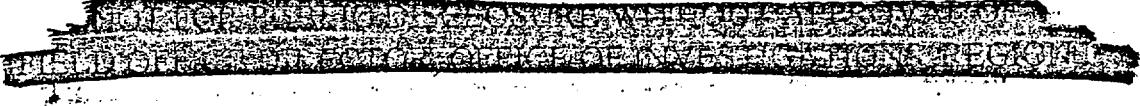
(4) Notes of HILLS regarding MS557 and two fuel pins/rods, "Is MS557 complete? Where are missing F/R," FR 0063-FR 0070, various dates from summer 2000 through November 14, 2000 (Exhibit 13).

The notes include: a MS557 Timeline describing maps of the Unit 1 SFP, circa 1979-1981. "The two MS 557 F/R's appear on 5/12/79 and disappear between 4/30/8 [sic] and 9/18/80"; August 17, 2000, "Searched all 1980 and 1981 MTF's. Did not find any mention of MS 557 or the two stray rods"; that a "Visual inspection of MS 557 conducted on 9/12/00 revealed that the F/A [fuel assembly] is as stated in the late 1970's. It is missing a spacer capture rod and a tie rod"; an entry dated October 18, 2000, "Spent fuel pool activities for 10/16-10/26," survey edge of pool between racks for the 2 missing fuel rods, "other places to survey?"; and other various information related to the fuel rods;

(5) "Interviews Conducted Prior to Project Plan or Guideline," undated (Exhibit 14).

This report documents individuals who were interviewed, to include HILLS and MANDIGO, prior to the project plan;

(6) Northeast Nuclear Energy Company Memorandum to File, prepared by HILLS, subj: "Inspections of MS 557 and SRP-2D-AWO M1-00-01881," FR 0783, dated December 11, 2000, and Northeast Nuclear Energy Company Memorandum to File, prepared by HILLS, subj: "Inspections of MS 508-AWO M1-00-01883, FR 0784, dated December 11, 2000 (Exhibit 15).



Observations of HILLS are captured in this memorandum: "Prior to November 16, 2000 fuel assembly MS 557 was visually inspected without disturbing the fuel assembly, utilizing a color camera system. The results of this inspection showed that the fuel assembly upper tie plate had been modified and that the spacer capture rod protruded above the tie plate. The spacer capture rod appeared to be clean and was thought to be a dummy rod. The inspection revealed the lattice location of the second missing rod, a tie rod, was empty. These inputs were part of the decision into filing of the CR. Discussions held with GE demonstrated that the observations to date could not positively eliminate the possibility that the rods were indeed in MS 557, thus further inspections were scheduled," and "Canister SRP-2D was also visually inspected from the top prior to November 16, 2000 and the inspection results indicated that the fuel assembly contained the proper number of rods," and observations about MS 508;

- (7) Unit 1 Corrective Action Program U1 RP 4, Rev. 1, FR 0091, dated January 19, 2000, and Unit 1 Corrective Action Program U1 RP 4, Rev. 001-01, FR 0147, dated September 21, 2000 (Exhibit 16).

These Unit 1 Decommissioning documents are administrative procedures that apply specifically to the MNPS Unit 1 Decommissioning Project; and

- (8) "Special Nuclear Material (SNM) Master List," FR 1012 and FR 1013, respectively, reviewed and validated October 2, 2000 (Exhibit 40).

HILLS submitted this report to SNM, for his submission as part of the SASNMBR, dated October 25, 2000. Note: HILLS claimed that he did not make a representation that the tie rod and spacer capture rod were in the Unit 1 SFP.

THEBAUD also provided OI with:

- (1) MNPS Procedure Special Nuclear Material Inventory and Control MC-5, Rev. 2, Effective Date November 1, 1999 (Exhibit 17).

On page 27 of 59 it states: "IF any of the following occur, INITIATE a CR;," specifically citing a "Discrepancy found with physical location of any SNM."

- (2) SASNMBR, dated April 25, 2001 (Exhibit 18).

The report documents that: "An investigation is ongoing at Millstone Unit1 to determine the location of two full-length irradiated fuel rods, as reported in NRC License Event Report (LER) 2000-002-00 and 2000-002-01, dated January 11, 2001 and March 30, 2001, respectively"; and

(3) "Millstone Unit 1 Spent Fuel Inspection Summary AWO M1-00-00847," prepared by Rockwell L. RADASCH, dated September 13, 2000 (Exhibit 19).

The above inspection took place between August 29, 2000 and September 12, 2000. The report also documents about MS557: "No serial number. The word "SCRAP" is engraved on this assembly. One fuel tie rod has been removed."

Testimony

AGENT'S NOTE: Unless indicated otherwise, all interviewees were represented by THEBAUD.

Interviews of Michael P. HILLS (Exhibit 20 and 21)

HILLS, Consultant, Nucon, former NU employee at MNPS, was interviewed on March 8, 2001, at his residence by OI:RI and on June 20, 2001, at MNPS. He provided as follows:

AGENT'S NOTE: HILLS was not represented by THEBAUD during his first interview.

HILLS has worked for Nucon at MNPS since his retirement from NU in 1996. HILLS worked as an engineer in the decommissioning organization during the last 30 months of his NU employment. HILLS has worked as decommissioning engineer on staff for Unit 1, gathering data and putting together fuel records for the decommissioning of the dry storage. HILLS stated his supervisor was Christopher KUDLA, but it changed a few months ago to Robert FAIRBANKS (Exhibit 20, pp. 4-6).

When asked who discovered that two fuel rods were missing, HILLS stated: "probably myself." HILLS explained: "As part of the fuel rods reconciliation, we saw the letter -- I first saw the letter probably early last summer while another individual and myself were sorting through the records trying to put together a file for the storage facility." According to HILLS, he and Rockwell RADASCH were trying to put together a historical record or a historical document for each fuel assembly in the fuel pool. "In the process of doing that, Mr. RADASCH and I, who works with me, basically came upon a letter that was written in 1979 by the reactor engineer at that time, Tommy PIASCICK, or T. G. PIASCICK. The letter described the fact that he had identified two fuel rods and had placed them in a cannister in the front of the pool (NW corner of the pool). And when we looked at that letter, it was, at that time, a curiosity or an issue that had to be resolved, and then we carried forward from there." HILLS advised that it was "early summer. I would say June, mid-June," when they found the letter. HILLS said: "At the time, I basically took the letter -- took a copy of the letter and put it up on my board as an issue that has to be resolved prior to the finish of the project." HILLS said he was not sure whether he notified

KUDLA about the letter at that time, June 2000 (Exhibit 20, pp. 8-10 and 20; Exhibit 21, p. 43; and Exhibit 7).

HILLS stated that the letter turned up in the Kardex file, a 4 by six card, and "there's about 3,000 of them. And they track the history of movement for each fuel assembly." HILLS said: "My thought in June, when I discovered it, is that it was a very unique letter to find. I was not knowledgeable of any fuel pins in the pool. And in fact, I thought that there were no fuel pins in the pool. It was probably one of a number of issues that we uncover that we look for closure from a follow-on letter or another piece of data. And so as we continued to search during the summer, we just basically kept looking for something that would bring closure to it" (Exhibit 20, p. 11 and Exhibit 7).

HILLS explained: "During June, July, and I would say part of August, it was really treated as a - I treated it as an oddity in the documentation with a presumption that I would find some other piece of document that would say, Yes, we put it back into its parent assembly, or Yes, that it went it [sic] someplace or was shipped someplace official or it was stored in another container that was partially filled in the fuel pool. Tommy's letter stated that he was going to place this into a, what he referred to as a scavenged fuel assembly" (Exhibit 20, pp. 12 and 19; and Exhibit 7).

HILLS stated that material transfer forms (MTFs) are "a record of movement of a fuel assembly, and it would have included the record of movement of an individual fuel rod if there were one." As early as August [17,] 2000, HILLS looked at MTFs from 1979-1981, in an attempt to find out more information about the fuel rods. HILLS said: "The search of the MTFs, the material transfer forms, would have indicated if there was specific activity with bundles. We were looking for specific activity for Bundle [MS] 557 and MSB125, the cannister, SRP-2D, logical places for these fuel rods to have been transferred to" (Exhibit 21, pp. 25, 26, 89, 92, and 98-100, and Exhibit 13).

HILLS said that Carol MANDIGO, Scientist and Special Nuclear Material Accounting Clerk, NU/DNCT, was informed of the potential problem with the fuel rods in the late summer of 2000. HILLS stated, "Part of mindset [sic], I think was the fact that is hasn't happened [lost fuel rods before]. I didn't feel it could. But that's opinion. At the end of August, early September, the one thing to note is I went away to Spain for three or four weeks." HILLS added, "So the investigation sort of takes a one-month hiatus while I'm gone" (Exhibit 20, pp. 15-17, and Exhibit 21, p. 27 and 28).

AGENT'S NOTE: RADASCH apparently continued on with various related work, to include the serial number verification effort, in HILLS' absence [early September 2000].

HILLS said the serial number verification inspection was part of an ongoing process during the serial number verification process, the NW corner of the Unit 1 SFP was an attempt to physically sight the two fuel rods. "We did note at the time that MS like it had a center rod in it, but we didn't know what the center rod was, and it had appearance at the time of having a missing rod in it." HILLS also said: "There was location of the capture rod that was elevated, but it did not make sense why it was there was an elevated rod in that location. You could not tell what it was," HILLS the equipment that we had available to us, there was no way of determining whether there. You could not see below the top nozzle" (Exhibit 21, pp. 18-24, 74-75, and Exhibit 13).

Regarding the raised fuel assembly inspection in October [believed to be on the 23rd 2000, HILLS said: "The purpose of the raised fuel assembly search was that there approximately 72 fuel assemblies in the pool that are not fully seeded for a number. There was an NRC commitment made in the 1995 time frame, or in the '96 time frame that they would not conduct any routine fuel movements unless they reseeded all the assemblies that were raised and explained why they were raised. And that was a recommitment made in the 1995/1996 time frame." Additionally, HILLS indicates the purpose of the inspection was to go in and look at each assembly, photograph it, and photographs we could then put together a procedure saying how we would treat each assembly; what we would do to seed it, and what we would do [to] inspect it." HILL that during the raised fuel assembly inspection the NW corner of the Unit 1 SFP was in an attempt to physically sight the two fuel rods (Exhibit 21, pp. 29, 30, 35 and 3 and Exhibit 12).

AGENT'S NOTE: HILLS acknowledged that he had lost confidence after the serial number verification and raised fuel assembly inspections (between October 23 and 24, 2000) that the two fuel rods were in the NW corner SFP. HILLS was asked why not write a CR at this point, HILLS said, "A couple things play into that; is that there are many other locations in the pool where It is a significant event that would cause that container to change locations rerack of 1989." HILLS also said, "But I treated that as -- these fuel rods were still be treated as a discrepancy in the data, and not a discrepancy in the location" (Exhibit 21, pp. 52-55).

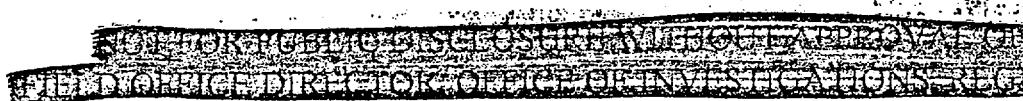
HILLS stated that he talked with Lee HILL, MANDIGO's supervisor, in October 2 about the fuel rod situation, however, he was unaware if MANDIGO had informed HILL pre the fuel rods (Exhibit 20, p. 19).

Regarding the Semi-Annual Special Nuclear Material Balance Report (SASNMBR October 25, 2000, HILLS acknowledged that he provided input to the report. HILL

"My role in this document is to provided the Millstone Unit 1 inventory for that six-month period. The inventory is required by our procedures (MC-5, possibly titled special nuclear material control), and it's essentially a piece count of all the special nuclear material on-site." HILLS stated the inventory report is provided to HILL, he (HILL) then com 1, 2, and 3 and publishes that memo. HILLS said that there was no discussion about the fuel rods as missing at that time, to include in the SASNMBR. HILLS explained point, I didn't feel that -- at that point, I still felt they were in the pool and that I had sufficient work to raise the question of whether or not they were actually missing from or just unaccounted for." HILLS stated: "my confidence was still up that the pins were in the fuel pool and I would find them." HILLS commented that the work he did in August with cameras did not give him enough information in his mind to report the fuel rods as missing in the SASNMBR. HILLS acknowledged that he could have reported the discrepancy in the documentation as part of his submission to the SASNMBR (Exhibit 20, pp. 21-26; Exhibit 21, pp. 132-136; Exhibit 5; and Exhibit 40).

HILLS said that he was familiar with MNPS Procedure Special Nuclear Material Inventory Control MC-5, Rev. 2, effective date November 1, 1999 ("I am one of the authors of the parent of this procedure"). On page 27 of 59 it states: "IF any of the following occurs, INITIATE a CR;" specifically citing a "Discrepancy found with physical location of fuel rods." HILLS said this is the procedure that is related to the SASNMBR. When asked why he wrote a CR in October 2000, HILLS replied, "The problem that I was dealing with at that time was that I had -- or that I had determined in my own mind to be a -- well, call it a discrepancy, an inconsistency in the data from 1979-1980, and I had not completed at this time -- gone far enough to determine where these things should be had they been put back in the assembly, and I just had not found the record." HILLS pointed to page 36 of 59 of the procedure which states that an item control area (ICA) is: "an area within the protected area of a power plant designated as a location authorized for storage or use of special nuclear material." HILLS believes the SFP is an ICA, and he still felt that fuel rods would be found in the SFP in regards to the NW corner of the Unit 1 SFP, HILLS claims that: "The northwest corner of the SFP is location in and of itself" (Exhibit 21, pp. 136-146, 154, and 160-162; and Exhibit 17, pp. 36-37).

HILLS stated that he prepared Condition Report (CR) M-1000548, dated November 15, 2000. HILLS explained: "Essentially, in my mind, I wrote the CR when I became convinced that the fuel was not in any place reasonable. I thought about it. I had done more inspection in the month of October/November. On November 15th or 16th, but right there is when I lost sight of the fact that I knew where these things were or that they would turn up in a reasonable fashion." HILLS also said that he started to consider that the fuel rods were possibly in the fuel pool, but may have been shipped. HILLS added, "In the November [possibly the 14th] time frame, we reentered the fuel pool with the purpose of looking for the canister, the fuel rod canister with the camera that we had, which is a color camera, non-radiation tolerant



The purpose of the search in November was to look in any spaces in the fuel pool that we could see into." HILLS said that he had attended a meeting with HILL, MANDIGO, and RADASCH a few days before the CR was written. HILLS acknowledged that during the meeting it was agreed that a CR would be written if the above referenced November search was negative for the two fuel rods (Exhibit 20, pp. 28-30; Exhibit 21, pp. 66 and 67; Exhibit 4; Exhibit 10; and Exhibit 12).

HILLS stated that he was not familiar with 10 CFR 20.2201(a)(1)(ii), which requires that each licensee to report by telephone to the NRC, within 30 days after the occurrence of any lost, stolen, or missing licensed material becomes known to the licensee. In his second interview on June 20, 2001, HILLS said: "Yes. I had good familiarity with that in the November [2000] time frame." When asked if he thought about pulling out the aforementioned regulation in the June 2000-October 2000 time period, HILLS said, "No." HILLS acknowledged that he may have received some training during his career in this area, but that it was several years ago (Exhibit 20, p. 43 and Exhibit 21, pp. 62-67).

HILLS said that he was aware that there were ongoing Atomic Safety and Licensing Board (ASLB) panel proceedings in the summer 2000 time period that concerned the expansion of the Millstone Unit 3 SFP/ongoing licensing efforts. HILLS denied that the ASLB proceeding impacted his decision not to write a CR before November 16, 2000 (Exhibit 20, pp. 57 and 58).

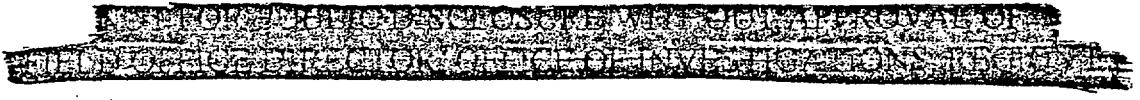
HILLS said that he was familiar with 10 CFR 20.1003 (Definitions), specifically, "Lost or missing licensed material means licensed material whose location is unknown." HILLS claims that since he felt the fuel rods where in the Unit 1 SFP, he knew their location (Exhibit 21, pp. 58 and 59).

Interviews of Carol D. MANDIGO (Exhibits 22 and 23)

MANDIGO, Scientist, NU/DNCT, MNPS, was interviewed on February 14, 2001, and March 27, 2001, by OI:RI at MNPS and provided as follows:

AGENT'S NOTE: MANDIGO was not represented by THEBAUD during her first interview. The objective of MANDIGO's first interview was to determine when the licensee first became aware of the fuel rod situation and was not designed to get all the details surrounding the issue.

MANDIGO said that she has worked for NU/DNCT since 1973. MANDIGO stated her duties include "the accounting side, which is budgeting, forecasting, and tracking bills," and nuclear fuel accountability for all three Millstone units (Exhibit 23, pp. 8 and 9)



MANDIGO said that she first heard about the situation involving the fuel rods in August 2000 from HILLS and RADASCH. MANDIGO said: "Mike [HILLS] asked me if I knew anything about assembly MS 557, and I said, yes. It is a bundle, you know, one of the first core bundles. He says, well, what do you know about the two rods that were taken out of it? And at that point I said, what two rods? Because that was the first time that I ever heard that the rods were out of the bundle." MANDIGO also stated: "I can't remember exactly what was said, but there was something along the lines that he [HILLS] had discovered a memo that showed two rods to be out of the bundle, and did I have any records on it? And at that point we went looking to see if I had any records. My records showed that bundle to be intact. I pulled out the record that shows and said, you know, the bundle is intact. And he said, well, this memo that I saw said that there was two rods out of the bundle. And we went looking in the spent fuel pool maps and at that point we discovered a couple of maps that were in my file, that showed rods to be out of the bundle. And the dates on the maps were from the 1979-1980 range" (Exhibit 23, pp. 10-12 and Exhibit 11).

MANDIGO informed her supervisor, Lee HILL, of the above information in August 2000. MANDIGO was asked whether or not there was any consideration given to writing a CR at this point, MANDIGO said, "No." MANDIGO said: "I personally, I believed that since the records we had were at least 20 years old, that in the meantime somewhere in the last 20 years the rods had either been placed into the bundle, back into the bundle, or they could have been placed, we still had an STR rod, a bundle cannister out there. They might have been placed in that cannister, or they might still be in the pool, in a different, in any of many locations in the pool. So I just believed it was a recordkeeping [sic] item, that we had to get a record straight, at that point" (Exhibit 23, pp. 17 and 18).

MANDIGO did not have any involvement in the searches of the SFP. MANDIGO stated: "I knew they were ongoing, I didn't know when, or where, or what, you know, what they looking at, at a particular time" (Exhibit 23, p. 22).

MANDIGO acquiesced that she knew that there had been searches of the northwest corner of the Unit 1 SFP, which were negative for fuel rods in question and prior to the submission of SASNMBR, dated October 25, 2000. On whether to report the fuel rod situation via the SASNMBR, MANDIGO said: "There were discussions. I can't tell you exactly who they were with. But there were a number of discussions as to where the rods should be indicated on that, in the report for October of 2000." MANDIGO also said: "We had, Lee [HILL] and I had talked about the representation of the two fuel pins, and the decision had been made that since the search had not been completed at that time, that we would - - since we report to NMSS as one number, in the pool, the rods were going to be contained, you know, soon to be contained in that number, because we didn't have any evidence elsewise [sic]. And that is why we reported it as still being in the pool" (Exhibit 23, pp. 24-32; Exhibit 22; and Exhibit 5).

MANDIGO participated in a November 13, 2000, meeting to discuss the Independent Spent Fuel Storage Installation (ISFSI) data with HILLS, HILL, and RADASCH. Also discussed at the meeting was the need to document the missing fuel rods in a CR. According to MANDIGO, there was some discussion with HILLS and HILL prior to the meeting, and in both conversations she stated that there was a limit as to how long you could go without writing a CR. MANDIGO and HILL had discussed before the meeting that there was a need to write the CR. MANDIGO and HILL then recommended at the meeting that a CR be written. As a result, during the aforementioned meeting it was agreed to document the unaccountable/missing fuel rods via a CR (Exhibit 23 and Exhibit 11).

MANDIGO said that she was aware early on of the ongoing ASLB proceedings involving "licensing activities" and the expansion of the Unit 3 SFP. MANDIGO stated that she did not offer any information or testify in ASLB proceeding number 00-771-01-LA concerning the expansion of the Unit 3 SFP (Exhibit 23, pp. 57-59).

Interviews of Rockwell L. RADASCH (Exhibits 24 and 25)

RADASCH, Maintenance/Support Engineer, Tekton, was interviewed on March 27, 2001, and on June 18, 2001, by OI:RI at MNPS and provided as follows:

RADASCH worked at the Maine Yankee Atomic Power Station from 1970 to 1997. From December 1997 to the present, RADASCH has worked at MNPS; he started to work on Unit 1 Decommissioning in July 1999. RADASCH said that he reported to Jim VEGILA, an Entergy employee in the July 1999 time period (Exhibit 24, pp. 8-10).

RADASCH said that he worked on a lot of corrective action issues for MNPS Unit 1 and the ISFSI. RADASCH said that he worked with HILLS and KUDLA, and he (KUDLA) "was kind of overall manager of that effort" (Exhibit 24, pp. 11-14).

RADASCH stated: "I first understood that two pins were displaced from this fuel assembly in the last summer time frame [summer of 2000]. And what I understood, at that time, is that the pins were removed from the bundle, but they were still in the pool. So we didn't characterize those as, or I didn't characterize each fuel bundle as damaged or undamaged. And in going through the records [card files] for the MS series fuel it was obvious, from the records, that two pins had been removed from 557 stored in the northwest corner of the pool. And so that is when I became aware of the fact two pins were removed from MS 557" (Exhibit 24, pp. 15 and 16).

RADASCH said that he and [HILLS] discussed the fuel rod issue with MANDIGO to see if she had any records of where the fuel pins were. RADASCH stated: "We were looking for any fuel pool maps that might demonstrate where these things were. We talked to other people about that. I think we talked to Lee HILL, we had a meeting with him" (Exhibit 24, p. 22).

RADASCH was asked when he considered the fuel rods to be missing and stated: "In the fall of 2000, after we had, you know, done several physical searches in the pool." RADASCH also said: "But I mean, there was every belief that those two pins were in the pool. And it was just a matter of going up there and finding them. And we had physical inspection activities that were scheduled, and planned up there [Unit 1 SFP]. And, you know, it was the belief that they would show up. There was never any belief that these things were not in the pool." RADASCH clarified the fall of 2000 to mean November 2000 (Exhibit 24, pp. 23 and 24).

RADASCH was asked about the serial number verification process that occurred [between August 29 and September 12, 2000]. RADASCH acknowledged that, as part of that process, the team looked at the NW corner of the Unit 1 SFP for the fuel rods, but it was unfruitful. RADASCH said that he wrote a report or a memorandum upon completion of the serial number verification inspection. Regarding MS 557, RADASCH wrote: "No serial number. The word "SCRAP" is engraved on this assembly. One fuel tie rod has been removed" (Exhibit 24, p. 50, Exhibit 10, and Exhibit 11).

When asked if he (RADASCH) considered the fuel rods to be missing at that time [September 12, 2000], he stated: "we didn't treat them at that time as missing, it is just that they didn't, they weren't where the records said they were." When asked why he did not write a CR at this point, RADASCH said: "Because Mike [HILLS] was, you know, was responsible for this, we had discussed it, and he was going to, you know, he had -- he led me to -- he gave me the impression, in discussing it with him, that a CR would be written at such time, when we determined that these fuel pins were missing, okay? But there were other places to look, we hadn't determined that these fuel rods were missing at the time. The only thing we determined is that those fuel rods weren't in the northwest corner of the fuel pool, but there were many other places that those could have appeared in the pool. Mike was going to address that, but not until he determined that these fuel rods were missing, okay? So I reported to the unit 1 reactor engineer, I felt that I had done, and brought it to the appropriate level of attention But we weren't there yet, we weren't there" (Exhibit 24, pp. 26-29 and 47).

RADASCH was asked to clarify the above in regards to writing a CR as early as the summer of 2000; he said there was no discussion about writing a CR to his recollection. RADASCH also said: "Well, that was finally decided in the fall of last year, after subsequent inspections of the spent fuel pool that determined that they weren't not only in the northwest corner, but they weren't in other places where they could have been, either. And at that point the line was drawn that said, they are no longer, they are no longer mislocated [sic], now they are missing. And that was in the fall of last year." RADASCH was asked if there was any resistance to writing a CR; he said: "Absolutely not, there was no resistance to writing a CR." RADASCH also said: "he [HILLS] was going to write the CR when he made the call that these fuel rods were missing. But he had several search plans identified before he was going to claim that these were actually missing" (Exhibit 24, pp. 30-36).

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Concerning the raised assembly inspection on October 23 and 24, 2000, RADASCH said: "The purpose of that was to identify any fuel bundles that were raised, i.e., not fully seated in their racks." RADASCH does not recall how this inspection was documented. RADASCH stated that upon completion of the raised fuel assembly work he felt the fuel rods were not in the NW corner of the Unit 1 SFP (Exhibit 24, pp. 51 and 84; and Exhibit 25, pp. 22-24).

RADASCH claims that he had no input into the SASNMBR, dated October 25, 2000. RADASCH said that he was not familiar with 10 CFR 20.1003 (Definitions), specifically, "Lost or missing licensed material means licensed material whose location is unknown." RADASCH claims that he had no knowledge of the 10 CFR 20.2201(a)(1)(ii) [reporting requirements] (Exhibit 24, pp. 65 and 66; Exhibit 25, pp. 5-9; and Exhibit 5).

RADASCH recalls a meeting [in November 2000, believed to be the 13th] where the topic of writing a CR surfaced. RADASCH said: "What I remember was that a condition report was discussed, and it was discussed to the extent that one would be written when it was determined that the fuel pins were, in fact, missing. When and if they were determined to be missing." RADASCH stated that [on November 14 and 15, 2000], "we spent time in the spent fuel pool doing a search for missing pins." RADASCH added: "So that appears to be a final search to look in some other locations, prior to writing the CR. And it would give the appearance that there was a determination made at that time that the pins were not going to be found in the spent fuel pool based on the searches we had done to date, so the CR was then written" (Exhibit 24, pp. 66-72 and Exhibits 10-12).

Interview of Christopher S. KUDLA (Exhibit 26)

KUDLA, Engineer/Project Manager, Independent Contractor, was interviewed on March 28, 2001, by OI:RI at MNPS and provided essentially as follows:

KUDLA said that he reported to "Jim VEGILA" in the June 2000 time period and that HILLS and RADASCH worked for him (KUDLA). KUDLA believes that he first heard about the tie rod and spacer capture rod in July/August 2000. KUDLA said that he was on vacation in June 2000; stating "I wasn't there" (Exhibit 26, pp. 11-25).

KUDLA said that he tried to focus on contract issues and that HILLS and RADASCH were trying to put together a data base. KUDLA said he was not aware during the serial number verification [between August 29 and September 12, 2000] and raised fuel assembly inspections [October 23 and 24, 2000] that HILLS and/or RADASCH had looked at the NW corner of the Unit 1 SFP, attempting to specifically locate the tie rod and spacer capture rod (Exhibit 26, pp. 33-35 and 37-39).

KUDLA said he looked at a picture taken of MS 557. He stated, "First off nobody has ever lost fuel, so I don't think any of us believed that it was missing. And then, you know, did GE put it back in there? And it was strange, because this thing, this waffle if you want to call it, is clogged out, it looks like they shoved the thing back in there. I mean, it looked like the issue got closed by the picture. So I wouldn't write anything. I mean, I'm seeing something that looks, it is a center capture rod, it is in there, I just don't have a piece of paper that tells me how it got in there." When asked about the tie rod, KUDLA said: "there is a letter, I guess, that we found, it says that the threads are bent, and GE typically, in other plants, they clip that out, you see this waffle grid up there, and you can't tell there is rod there. And we couldn't lift fuel, we didn't have the capability to lift the fuel. So, I mean, lifting the fuel answers the question. We didn't have the capability to do it." KUDLA do not inform an Entergy, NU, or any DNCT employees of the above information (Exhibit 26, pp. 46-56, Exhibit 15, and Exhibit 19).

When asked if thought there was a difference between missing and lost, KUDLA said: "I'm not an expert on, you know, the 10CFR [sic]. I can tell you about part 71 and part 72, for dry fuel storage, you would get bored stiff with it." KUDLA stated that he had no input into the SASNMBR, dated October 25, 2000 (Exhibit 26, pp. 55 and 68; and Exhibit 5).

When asked if he was briefing Entergy personnel about the fuel rod situation, KUDLA said: "as part of our project every Tuesday we used to have a project manager's meeting, it covered all the major projects, the project managers would be there, and we would each go through the schedule, where we stood, what was going on, that kind of thing. But, I mean this was not a topical issue that was brought up because, you know, at the time we didn't think it was an issue" (Exhibit 26, pp. 113-115).

Interview of Lee O. HILL, Jr. (Exhibit 27)

HILL, Team Leader, Nuclear Supply Group/Special Nuclear Material (SNM) Accountant, Dominion Nuclear Of Connecticut (DNCT), MNPS, was interviewed on March 28, 2001, by OI:RI at MNPS and provided essentially as follows:

HILL said that he is MANDIGO's supervisor and that MANDIGO is responsible for preparing the 742 reports, which she submits to NMSS. "And she is responsible for maintaining all of the, we call it the master list, a record of all the S&M on site." HILL stated that his office relies on the information that is submitted to it (Exhibit 27, pp. 10 and 11).

When asked when he first heard about the fuel rod situation, HILL said: "It was in mid to late August, as I recall. Mike HILLS, Chris KUDLA, and Rock RADASCH were working on trying to establish a data base for all of the spent fuel that was at Millstone I" (Exhibit 27, p. 14).

When asked if he briefed his supervisor, John GUERCI, about the fuel rod situation, HILL said: "You know I don't recall whether I did. I might have mentioned it to John. If I did, it was certainly not something I would consider to be a major issue at that point. It is very likely I did not mention it to John, I can't recall." When asked what he thought he had in August 2000, HILL said: "I figured we just had a records problem." HILL also said: "There was no reason to believe that those pins are physically out of the pool. I mean your radiated material leaving the pool is not trivial matter. So there is - - there is no expectation on my that those pins were any place but in that pool. Millstone I had a reputation for not being really good about recordkeeping [sic] over many years. The fact that those pins were moved, or were not there, and could have been moved elsewhere in the pool, wouldn't have surprised me at all. So I just thought we had a recordkeeping [sic] problem" (Exhibit 27, pp. 17 and 27).

HILL was asked about the possibility that the rods were outside of the Unit 1 SFP and he said: "It is inconceivable that you have special nuclear material that would be - - that could have gotten out of the pool, in an uncontrolled way" (Exhibit 27, p. 19).

HILL was aware that MANDIGO was looking through SNM records searching for "any indication of disposition of those pins. My understanding, also, is that there were plans being made to physically search the pool. There were a couple of problems with that, I understand. One was that there was some NRC commitments that have to be fulfilled before you can move any fuel in the pool." HILL believes that physical searches were being made through October and November 2000, but, apparently, he was not aware of the serial number verification inspection in late August/early September 2000 that actually looked at the NW corner of the Unit 1 SFP for the tie rod and spacer capture rod (Exhibit 27, pp. 21 and 22).

HILL was asked about the SASNMBR, dated October 25, 2000, and whether or not he considered making a report about the tie rod and spacer capture rod. HILL said, "My belief is that they were in the spent fuel pool. I had no evidence to indicate that they were anywhere else." HILL also said: "I may have spoken, I don't recall specifically, I may have spoken with Carol MANDIGO about this. There was no thought on my part that we had a discrepancy. We had, as I said, we had no information to the contrary to modify our inventory reports. And until we had that, there was no reason to reflect other than what we had in those 742s" (Exhibit 27, pp. 27-29 and Exhibit 5).

HILL recalled a meeting with HILLS and RADASCH or KUDLA in November 2000 [possibly the 13th]. HILL claims that prior to the meeting he mentioned to MANDIGO that since the paperwork search was not productive, and if HILLS had not had any luck in the searches of the Unit 1 SFP, it was time to "raise a flag up the flagpole by, you know writing a CR." HILL stated that during the meeting HILLS expressed an interest in looking at other places in the Unit 1 SFP before he was ready to write a CR. HILL thinks that HILLS wrote the CR a few days after the meeting (Exhibit 27, pp. 22 and 23; and Exhibit 4).

HILL was asked about ASLB panel proceeding No. 00-771-01-LA and expansion c SFP, HILL said: "My knowledge of the spent fuel pool stuff at Millstone III is very knew there were some licensing activities going on, but specifically that I was not a specific meeting." HILL denied that the above proceeding impacted his decision or information about the fuel rods (Exhibit 27, pp. 48 and 76).

HILL claims that he has read the regulations under "10 CFR," and that if he thought was a problem, he would have gone back and checked. HILL said: "I didn't have : they [fuel rods] were missing in October" (Exhibit 27, pp. 62 and 63).

Interview of Vincenzo VEGILA (Exhibit 28)

VEGILA, Entergy, Pilgrim Nuclear Power Station (PNPS) and former Engineering MNPS, Unit 1, was interviewed on July 12, 2001, by OI:RI at PNPS and provided

VEGILA stated that he served as the Engineering Manager at MNPS Unit 1 from J October 2000. VEGILA was HILLS', RADASCH's, and KUDLA's supervisor. V VEGILA took over decommissioning projects in June 2000, KUDLA started to rep VEGILA said that Daniel MEEKHOFF took over for him in October 2000 because pending (license) transfer to DNCT in April 2001. VEGILA stated that he general the project managers and not the engineers (Exhibit 28, pp. 8-13 and 30).

In June 2000 VEGILA had oversight of the Independent Spent Fuel Storage Install project. VEGILA's priorities were the decommissioning projects and the "cold and (Exhibit 28, pp. 14-16).

In July 2000 VEGILA was aware that HILLS, RADASCH, and KUDLA were atte reconcile the records regarding the Unit 1 SFP, but was not aware that a tie rod and capture rod were unaccounted for. VEGILA learned in late September/early Octob through HILLS, that there was a discrepancy in the documentation regarding the a fuel rods and that HILLS and the others were going to continue reviewing records Unit 1 SFP. VEGILA said that when HILLS presented him with the information (records) about the fuel rods, he (HILLS) "didn't seem to be overly concerned abou factored into his level of concern. When asked why not write a CR based on the re inconsistencies, VEGILA stated: "No. We had not written a condition report on th records. Perhaps we should have. You know, I guess I could look at it as 20/20 hi we just didn't do it. If I had to do it over again, I probably would have, just a gene hey, the records are in bad shape. Everybody knew that the records were in bad sh working towards a resolution" (Exhibit 28, pp. 17, 18, and 25-29).

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VEGILA does not recall HILLS informing him about looking in the NW corner of the Unit 1 SFP for the fuel rods during the serial number verification inspection conducted in August-September 2000. VEGILA said that he was aware that a raised fuel assembly inspection of the Unit 1 SFP was conducted in October 2000, but, again, he was unaware that a search of the NW corner of the Unit 1 SFP was conducted for the fuel rods. VEGILA had no input into the SASNMBR, dated October 25, 2000 (Exhibit 28, pp. 28-31 and 35-37).

VEGILA does not recall briefing MEEKHOFF on the information concerning the fuel rods that he had learned from HILLS. VEGILA said that his turnover with MEEKHOFF "wasn't all that extensive." VEGILA claims that he informed MEEKHOFF about the records reconstitution being performed by KUDLA and HILLS, but not specifically about the fuel rod situation, because he felt that the "fuel pin issue was just part of a records reconstitution. I really -- my mind-set at the time wasn't that these things were missing; it was a problem with getting records together and the details of what was going on." When asked what he meant, VEGILA stated: "Well, in the back of my mind, I had every reason to believe that they were in the spent fuel pool. It never entered my mind, frankly. Maybe it was just a prior nuclear mind-set that they would have gone anywhere else" (Exhibit 28, pp. 32 and 33).

VEGILA said that he was familiar with MNPS Procedure Special Nuclear Material Inventory and Control MC-5, Rev. 2. On page 27 of 59 it states: "IF any of the following occur, INITIATE a CR;" citing a "Discrepancy found with physical location of any SNM." VEGILA claims that he interpreted the above information to be related to item control areas (ICAs). VEGILA stated: "If an SNM, a piece of SNM is not located in the ICA where you think it is, then it's an issue. The location of SNM within an ICA, you know, whether it's here, there, or anywhere, as long as it's in the ICA, in my mind, the way I've interpreted it in the past was that didn't -- that wasn't a discrepancy because the location was still in the ICA. Now, that being said, I didn't consciously think that in October 2000. I didn't connect MC5 specifically with the location of the -- or lack of location with the fuel pins in the northwest corner of the pool" (Exhibit 28, pp. 38-40 and Exhibit 17).

Interview of Daniel J. MEEKHOFF (Exhibit 29)

MEEKHOFF, Project Manager for System Evaluation and Recategorization and Technical Advisor to the Director of Unit Operations, DNCT, MNPS, was interviewed on March 8, 2001, by RI:OI and provided essentially as follows:

AGENT'S NOTE: MEEKHOFF was interviewed at home and did not have legal counsel present.

MEEKHOFF said he learned about the fuel rod situation: "right around November 16th, I believe, the day before we wrote -- I think that CR was written November 17, 2000 -- to document the

fact that these two rods weren't in the last location where documentation showed them to be." MEEKHOFF stated that, at the time the CR was written, HILLS was working for him and HILLS notified him about the CR (Exhibit 29, pp. 3 and 4; and Exhibit 4).

According to MEEKHOFF, HILLS told him that he (HILLS) was working on records reconstruction or a records reconstitution to prepare for going to dry storage when he came across a fuel index card that indicated that two fuel rods were in the NW corner of the Unit 1 SFP in a canister. MEEKHOFF said that HILLS did not tell him when he first learned of this information (Exhibit 29, pp. 5 and 6).

Interview of Frostie A. WHITE (Exhibit 30)

WHITE, Contractor/Root Cause Engineer for Fuel Rod Accountability and former Supervisor for Regulatory Affairs, Excel Services, Inc., MNPS, Unit 1, was interviewed on June 21, 2001, by OI:RI at MNPS and provided as follows:

WHITE began working at MNPS Unit 1 on November 6 or 7, 2000. WHITE stated that she first became aware of the fuel rod situation through HILLS [possibly November 15, 2000], when he brought a draft of a CR and identified the issue. WHITE explained that HILLS asked for her input and she "word engineered it a little bit, just to make sure that we captured all the activities that he was in the process of doing or had completed." When asked what she changed, WHITE said: "Again, it was basically grammar," and "there was nothing changed as to the content" (Exhibit 30, pp. 10 and 13-15; and Exhibit 4).

On how she became the Root Cause Engineer for Fuel Rod Accountability, WHITE said: "root causes is a requirement for a level one condition report, a report with NRC LER, and that was part of the efforts, and so they thought that I would be a good part of the team." WHITE also stated: "we are trying to determine loss of accountability and why it happened, and secondly, based on the likely scenario that what ultimately -- the ultimate disposition and what happened to the rods, and why that happened as well" (Exhibit 30, pp. 6 and 7).

Interview Report of Harold L. ROTHSTEIN (Exhibit 31)

ROTHSTEIN, Manager of Spent Fuel Storage Systems Engineering Department and Manager of the Nuclear Department, Washington Power/Washington Group International, was interviewed on July 25, 2001, in Princeton, NJ, by OI:RI, and provided essentially as follows:

ROTHSTEIN was not represented by legal counsel during this interview.

ROTHSTEIN stated that he worked for Raytheon Engineers and Constructors (RE&C) which later became Washington Power. ROTHSTEIN indicated that the majority of his career "has

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been involved with spent fuel storage work, primarily re-racking or increasing spent fuel pool capacity by putting in higher density racks, and later dry storage of the spent fuel in any of the various dry storage systems that are available" (Exhibit 31, pp. 5 and 6).

ROTHSTEIN stated that has performed work (as Project Leader) for MNPS, which included generating a report entitled Northeast Nuclear Energy Company "Independent Assessment of Millstone Unit 1 Spent Fuel Pool System Issues," prepared by RE&C, dated April 30, 1997. ROTHSTEIN said: "Millstone had various nuclear regulatory finishing inspections of the spent fuel storage systems at Millstone Unit 1 in the 1995/1996 time frame. And NRC concluded that the Northeast Nuclear Energy Company process for identification and resolution of deficiencies regarding spent fuel storage was not comprehensive. NRC requested, as a result, an evaluation of the process for its comprehensiveness regarding identification and resolution of deficiencies." ROTHSTEIN stated the licensee complied with the NRC's request. ROTHSTEIN said that his report credited the licensee for due diligence and the foresight to "establish their spent fuel storage projects department." ROTHSTEIN said his report concluded that: "The problems uncovered were primarily due to inadequate documentation of closure by Northeast Utility to inattention by Northeast Utilities to conflicting documentation statements, rather than real technical issues beyond these problems. Of importance is the fact that no new problems of apparent safety significance were uncovered by the independent assessment team" (Exhibit 31, pp. 6-8 and 11).

AGENT'S NOTE: NRC has a copy of the aforementioned report from (RE&C).

ROTHSTEIN said that in a recent telephone conversation (July 2001) with Irv MERMELSTEIN, a Washington Power licensing engineer assigned to Millstone, the subject of unaccounted for/missing fuel rods in the [Unit 1 SFP] came up. ROTHSTEIN said to MERMELSTEIN something to effect of, oh, is that still an issue? "And I [ROTHSTEIN] said, well, it sounds like something I heard about years ago when we finished our 1997 report (Exhibit 31, pp. 12 and 13; and Exhibit 33, pp. 9-16).

ROTHSTEIN recalls a conversation with Michael McNAMARA (approximately April 1997) when closing out the above referenced report, wherein McNAMARA may have said something about "not being sure of the location of or maybe missing fuel rods, or parts of a fuel bundle, or something to that effect, the implication being, as I remember it, that there were some rods that weren't where they were expected to be and may be underneath the racks or some other location in the pool yet to be found." Upon being informed of the PIASCICK memorandums and maps, ROTHSTEIN said that he was unaware of them and did not come across them in his work for MNPS (Exhibit 31, pp. 13-17, Exhibit 7, Exhibit 8, and Exhibit 33, pp. 9-16).

[REDACTED]

[REDACTED]

Interview of Michael P. McNAMARA (Exhibit 32)

McNAMARA, Vice President of Nuclear Projects, Holtec International, and former NU employee at MNPS, was interviewed on August 14, 2001, at RI by OI and provided essentially as follows:

McNAMARA was not represented by legal counsel during this interview.

McNAMARA went to work at NU in 1987 and in 1994 he was asked to become Project Manager for what was later known as the Spent Fuel Project. McNAMARA said that the Spent Fuel Project "was a project created to ensure long term spent fuel storage of the three units at Millstone." McNAMARA stated that his group "participated in strategic planning and development to enable all three units at Millstone to achieve end-of-life wet storage in the pools" (Exhibit 32, pp. 5 and 6).

McNAMARA advised that his group's work included: "a combination of spent fuel pool re-racking and transfer, inter-unit transfer from Unit 1 at Millstone and Unit 2 at Millstone to Unit 3 pool at Millstone, which is one of the largest pools in the country and has ample capacity to do that." McNAMARA also said: "I created a department, brought in outside consultants to augment the staff and employed several Northeast Utilities folks to staff this project" (Exhibit 32, pp. 6 and 7).

McNAMARA said that ROTHSTEIN was contracted in the 1996/1997 time period to perform an assessment of the Unit 1 SFP and Spent Fuel Storage issues. McNAMARA also said: "Yes, in fact, that Spent Fuel Pool Assessment was a commitment made to the U.S. NRC as a result of the inspection that prompted many, many issues and questions as well as the many issues and ACR's [Adverse Condition Reports] that came up in that same time frame" (Exhibit 32, pp. 11 and 12).

McNAMARA stated that most of ROTHSTEIN's work was conducted off-site. McNAMARA said that the Northeast Nuclear Energy Company "Independent Assessment of Millstone Unit 1 Spent Fuel Pool System Issues," prepared by Raytheon Engineers and Constructors (RE&C), dated April 30, 1997, does not discuss any unaccounted for, missing, or lost fuel rods.

McNAMARA attested: "Let me state this. There has never been any discussion by anyone, that I know, to me or that I'm aware of, regarding these missing pins, rods, pellets, whatever terminology is being used to describe them, ever. I know of no such issue ever discussed, until I was made aware of Harold's [ROTHSTEIN's] statement. And I, I'm still at a loss to explain it." (Exhibit 32, pp. 14 and 15).

Regarding the above issue, McNAMARA also said: "We were in position at that point in time of being provided information regarding discrepant conditions that were spent fuel related. We supported them without reservation. If you review the record you will see that I, I personally

[REDACTED]

wrote LER's to the NRC. I personally made phone calls to the NRC to report conditions that we discovered. We wrote numerous ACR's and brought them into management's attention in the interest of disclosing these issues before someone else had to discover them. We wanted to, we wanted to flush them all out, to get them all out so that we could get going on reconciliation. So, had I known this one, it would have been immediately disclosed. There would have been no reservation on anyone's part in my department or they knew that I would disclose it" (Exhibit 32, pp. 17 and 18).

AGENT'S NOTE: The licensee disclosed the above information to the NRC. On July 27, 2001, THEBAUD provided interview summaries conducted by the licensee to include ROTHSTEIN, McNAMARA, and others (Exhibit 33). No licensee interviewee could corroborate ROTHSTEIN's information.

The following individuals do not appear to have been aware of the tie rod and spacer capture rod situation until November 15-17, 2001 (Exhibits 34-39):

Frank C. ROTHEN, Vice-President for Nuclear Services, NU, was interviewed on August 8, 2001, at MNPS. ROTHEN stated that he became aware of the fuel rod situation after the CR was written, or the morning of November 17, 2000. ROTHEN talked with Lee OLIVIER, who expressed concern over the issue. ROTHEN said that OLIVIER looked at this situation from an Operations background, wanting "to know where everything is right now, right then" (Exhibit 34, pp. 10-17 and 29).

When asked about the camera work conducted by HILLS and RADASCH in the Unit 1 SFP, ROTHEN stated: "I know that they did some work with cameras in the pool [he learned after November 17, 2000], and I know it [was] useless, because we had to go back and do it again. They didn't videotape them, it wasn't done in a manner that we could verify, with coordinates where they had gone, etcetera. It wasn't a very disciplined approach. So I'm aware that they did that. The time frame I'm not sure. It kind of aggravated me a little bit that they had spent the time, effort, and money, and that it was useless from an investigation perspective, and we had to go back and do it again. And the quality of it didn't meet the project standards. So we had to redo all that" (Exhibit 34, pp. 42 and 43).

ROTHEN said: "I have found no indication, anywhere in this, that anybody acted improperly, did anything wrong . . ." (Exhibit 34, p. 75).

Larry G. TEMPLE, former General Manager Decommissioning, Entergy, MNPS Unit 1, currently working at Entergy's Northeast Headquarters, White Plains, NY, on the transition to acquire Indian Point 2 (IP2) and becoming future General Manager of IP2, stated that he learned about the tie rod and spacer capture rod situation on November 15, 2000 (Exhibit 35, pp. 16 and 17).

Byran S. FORD, former Decommissioning Director, Entergy, MNPS Unit 1, and currently Entergy Nuclear Generation Company (ENG), Pilgrim Nuclear Power Station (PNPS), said that he believes he first heard about the issues involving two fuel rods from the Unit 1 SFP the day before the CR was written (Exhibit 36, pp. 12 and 13).

John GUERCI, Manager/ Process Owner of Nuclear Fuel and Safety Analysis, DNCT, was interviewed at MNPS. GUERCI stated that he found out about the fuel rod situation a day or two before the CR was written (Exhibit 37, pp. 11 and 12).

William SPAHN, Shift Manager, DNCT, was interviewed at MNPS. SPAHN stated that he was the shift manager when CR M1-00-0548 was initiated and he signed same. SPAHN said that he knew that morning [November 16, 2000] that the CR was coming and had conversations with management that day. SPAHN was unaware of any information about the missing/unaccounted for tie rod and spacer capture rod prior to the CR being written (Exhibit 38, pp. 10-15 and Exhibit 4).

Sworn Statement of Vasant BHARDWAJ (Exhibit 39)

BHARDWAJ, Manager of Engineering Programs and Component Engineering, James A. Fitzpatrick Nuclear Power Plant, Entergy Nuclear Northeast, and former Decommissioning Manager, MNPS Unit 1, provided the following:

BHARDWAJ provided a sworn statement that was notarized in the state of New York stating: "I did not have any conversation with anyone, including Messrs. KUDLA, HILLS or RADASCH, about the possibility of missing fuel rods before November 15, 2000. Additionally, I was not aware of any steps taken by anyone to locate or account for the two spent fuel rods before November 15, 2000. In my role managing Unit 1 separation projects, I routinely attended daily meetings of Unit 1 management. I have no recollection of the issue of two missing fuel rods being discussed before November 15, 2000" (Exhibit 39).

Agent's Analysis

Although HILLS discovered an inconsistency/discrepancy in documentation, i.e., PIASCICK's memorandums, the Kardex file card, and maps, circa 1979 and 1980, and had reviewed some MTFs for the period 1979-1981, apparently as early as August 17, 2000, he, RADASCH and KUDLA have made it clear that they continued to believe that the tie rod and spacer capture rod were in the Unit 1 SFP. Additionally, a serial number verification evolution (conducted between August 29 and September 12, 2000), and a raised fuel assembly inspection conducted (October 23/24, 2000) involving the Unit 1 SFP, presented opportunities to look for the tie rod and capture rod, specifically in the NW corner of the Unit 1 SFP. Despite not physically sighting either fuel rod, HILLS, KUDLA, and RADASCH, continued to still believe, based on their

extensive experience and common sense, that the tie rod and spacer capture rod were still in the Unit 1 SFP. There is no known testimonial or documentary evidence to suggest that HILLS, RADASCH, and/or KUDLA considered writing a CR on the issue until November 13-15, 2000, after completion of SFP camera searches conducted on November 14 and 15, 2000, which were negative for the tie rod and capture rod. Independently, testimony from MANDIGO and HILL supports HILLS' position that he (HILLS) continued to believe that the rods were in the Unit 1 SFP, and that nobody else involved in this matter seriously considered writing a CR any sooner.

Even though HILLS had submitted data as part of the SASNMBR in October 2000, had a working knowledge of 10 CFR 20.100.3 Definitions, i.e., "Lost or missing licensed material means licensed material whose location is unknown," and a solid grasp of MNPS Procedure MC-5, Rev. 2, 1.6.4, dated November 1, 1999, he emphatically stated that he did not write a CR sooner because he truly believed that the rods/pins were in the Unit 1 SFP, and that they were really only dealing with a paperwork discrepancy.

Although, HILLS and others acknowledged that they were aware of the ASLB proceedings involving MNPS Unit 3, they vehemently denied any correlation or impact on the decision not to write a CR sooner. OI is not aware of any evidence to suggest otherwise.

OI believes and witness testimony suggests that the lack of aggressive licensee (NU)/Entergy management oversight of, and accountability for contractors work (i.e., HILLS, RADASCH, and KUDLA), possibly contributed to the CR being written on November 16, 2000, vice sometime sooner. That, compounded by the unwillingness of those involved to seriously consider the possibility that the rods were lost (because nobody had ever lost rods before), resulted in what appears to be a somewhat lengthy delay in formally reporting this situation to the NRC.

Conclusion

Based on the evidence developed during this investigation, OI did not substantiate that either the licensee or licensee personnel/contractors deliberately delayed properly reporting to the NRC that two fuel rods/pins were unaccounted for/missing/lost from the MNPS Unit 1 SFP.

LIST OF EXHIBITS

<u>Exhibit No.</u>	<u>Description</u>
1	Investigation Status Record, dated February 13, 2001.
2	Allegation Disposition Record, dated February 13, 2001.
3	Allegation Disposition Record, dated February 15, 2001.
4	Northeast Utilities (NU) Unit 1 Decommissioning Condition Report (CR) M1-00-0548, dated November 16, 2000.
5	Northeast Nuclear Energy Semi-Annual Special Nuclear Material Balance Report (SASNMBR) (DOE/NRC 742 Forms) for MP1, MP2, and MP3, dated October 25, 2000.
6	Northeast Nuclear Energy MNPS, Unit No. 1, Docket No. 50-245, Licensee Event Report (LER) 2000-02-00, dated January 11, 2001.
7	NU Memorandum from T. G. PIASCIK to file, subj: "Fuel Rods," dated May 15, 1979.
8	NU Memorandum from T. G. PIASCIK to Reactor Engineering SNM file, subj: "Spent Fuel Pool Inventory," with attachments (SFP maps), dated October 8, 1980.
9	"Reportability Determination Regarding 10 CFR Criteria," dated December 14, 2000.
10	Shift Narrative Logs (SNLs) from June 1, 2000, to November 16, 2000.
11	Various notes taken from Carol MANDIGO's Journal, to include entries from August 2000 through November 28, 2000.
12	Calendar/Day Planner of RADASCH, for October and November 2000.
13	Notes of HILLS regarding MS557 and two fuel pins/rods, various dates from summer 2000 through November 14, 2000.

- 14 Licensee Interviews Conducted Prior to Project Plan or Guideline," undated.
- 15 Northeast Nuclear Energy Company Memorandum to File, prepared by HILLS, subj: "Inspections of MS 557 and SRP-2D-AWO M1-00-01881," dated December 11, 2000, and Northeast Nuclear Energy Company Memorandum to File, prepared by HILLS, subj: "Inspections of MS 508-AWO M1-00-01883, dated December 11, 2000.
- 16 Unit 1 Corrective Action Program U1 RP 4, Rev. 1, dated January 19, 2000, and Unit 1 Corrective Action Program U1 RP 4, Rev. 001-01, dated September 21, 2000.
- 17 MNPS Procedure for Special Nuclear Material Inventory and Control MC-5, Rev. 2, Effective Date November 1, 1999.
- 18 SASNMBR, dated April 25, 2001.
- 19 "Millstone Unit 1 Spent Fuel Inspection Summary AWO M1-00-00847," prepared by Rockwell L. RADASCH, dated September 13, 2000.
- 20 Transcribed Interview of HILLS, dated March 8, 2001.
- 21 Transcribed Interview of HILLS, dated June 20, 2001.
- 22 Interview Report of MANDIGO, dated February 14, 2001.
- 23 Transcribed Interview of MANDIGO, dated March 27, 2001
- 24 Transcribed Interview of RADASCH, dated March 27, 2001.
- 25 Transcribed Interview of RADASCH, dated June 18, 2001.
- 26 Transcribed Interview of KUDLA, dated March 28, 2001.
- 27 Transcribed Interview of HILL, dated March 28, 2001.
- 28 Transcribed Interview of VEGILA, dated July 12, 2001.
- 29 Transcribed Interview of MEEKHOFF, dated March 8, 2001.
- 30 Transcribed Interview of WHITE, dated June 21, 2001.

- 31 Transcribed Interview of ROTHSTEIN, dated July 25, 2001.
- 32 Transcribed Interview of McNAMARA, dated August 14, 2001.
- 33 Summaries of Interviews conducted by the licensee, various dates.
- 34 Transcribed Interview of ROTHEN, dated August 8, 2001.
- 35 Transcribed Interview of TEMPLE, dated July 27, 2001.
- 36 Transcribed Interview of FORD, dated July 12, 2001.
- 37 Transcribed Interview of GUERCI, dated June 19, 2001.
- 38 Transcribed Interview of SPAHN, dated June 21, 2001.
- 39 Sworn Statement of BHARDWAJ, dated August 17, 2001.
- 40 "Special Nuclear Material (SNM) Master List," reviewed and validated October 2, 2000.

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EXHIBIT 3

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Data Show World Awash in Stolen Nuclear Material

Wed Mar 6, 8:53 PM ET

By Andrew Quinn

SAN FRANCISCO (Reuters) - International researchers have compiled what is the world's most complete database of lost, stolen and misplaced nuclear material, depicting a world awash in weapons-grade uranium and plutonium that nobody can account for.

"It truly is frightening," Lyudmila Zaitseva, a visiting fellow at Stanford University's Institute for International Studies, said on Wednesday. "I think this is the tip of the iceberg."

Stanford announced its database as U.S. senators held a hearing in Washington to assess the threat of "dirty bombs," or radioactive material dispersed by conventional explosives.

The Stanford program, dubbed the Database on Nuclear Smuggling, Theft and Radiation Sources, is intended to help governments and international agencies track wayward nuclear material worldwide, supplementing existing national programs that often fail to share information.

The project took on added urgency following the Sept. 11 attacks on New York and Washington, which spurred fears that extremists might seek to use nuclear weapons in the future.

"It blows the mind, the lack of information," said George Bunn, a veteran arms negotiator and a member of the database group. "What we're trying to say is: 'the facts'?"

CHILLING FACTS

The facts, even on cursory examination, are chilling.

Zaitseva said that, over the past 10 years, at least 88 pounds (40 kg) of weapon uranium and plutonium had been stolen from poorly protected nuclear facilities former Soviet Union. While most of this material subsequently was retrieved, 4.4 pounds (2 kg) of highly enriched uranium stolen from a reactor in Georgia missing.

Other thefts have included several fuel rods that disappeared from a research reactor in the Congo in the mid-1990s. While one of these fuel rods later resurfaced in Italy reportedly in the hands of the Mafia -- the other has not been found.

The Stanford group, led by nuclear physicist and arms control researcher Fried Steinhausler, decided to form its database after becoming alarmed over the patchy nature of most of the available information.

Combining data from two existing unclassified databases and adding new info from sources ranging from government agencies to local media reports, the team evaluated each entry for accuracy and probability.

An expert at the Federation of American Scientists, the oldest U.S. arms control group, welcomed the establishment of the database, saying it could play a crucial role helping governments ascertain the real level of nuclear threat.

"This is a smart step," said Michael Levi, director of the group's Strategic Security Project. "Knowing what's out there is the first step to bringing it back in."

'ORPHAN' RADIATION ALSO A THREAT

The database includes illicitly obtained weapons-grade nuclear material as well as "orphaned" radiation sources -- scientific or medical material that may have been misplaced or simply thrown away but which still poses a health and security threat.

Steinhausler said the database would be open only to approved researchers, and

the Stanford group was beginning to contact government agencies in the United States and Europe about sharing information to build more effective international surveillance of nuclear material.

"We cannot supply the means to improve the situation," Steinhauer said in a statement. "We're pinpointing weaknesses and loopholes and saying, 'Do something about it.'"

Zaitseva, visiting Stanford from the Kazakhstan National Nuclear Center, said her database was helping to build a dim picture of the market for stolen uranium, plutonium, and other dangerous materials.

But she added that while in many cases those behind nuclear thefts can be identified, the ultimate destination of the nuclear material has remained a mystery.

"We haven't found a single occasion in which the actual end users have been identified," Zaitseva told Reuters.

"We can only guess by the routes where the material is going. We can't say for sure if it is Iraq, Iran, North Korea ([news - web sites](#)), al Qaeda or Hezbollah. We can make assumptions."

She added that the dangers of an unsupervised, underground market in nuclear material were likely to grow, noting that a U.S.-sponsored program to secure weapons components in the former Soviet Union thus far had only locked up about a third of the estimated 600 tons of weapons-usable material.

"It's just not protected," she said. "This is hot stuff. If you steal 20 kilograms of plutonium, you can build a nuclear weapon."

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EXHIBIT 4

Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385



Dominion

DEC 17 2001

Docket No. 50-336
B18533

RE: 10 CFR 50.73(a)(2)(ii)
10 CFR 50.73(a)(2)(v)

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

Millstone Nuclear Power Station, Unit No. 2
Licensee Event Report 2001-007-00
Movement of Heavy Loads Not Addressed In Procedure

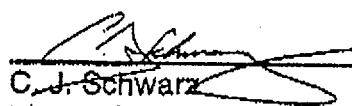
This letter forwards Licensee Event Report (LER) 2001-007-00, which related to a condition that was discovered at Millstone Nuclear Power Station, Unit No. 2, on October 22, 2001. This LER is being submitted pursuant to 10 CFR 50.73(a)(2)(ii) and 10 CFR 50.73(a)(2)(v).

There are no regulatory commitments contained within this letter.

Should you have any questions regarding this submittal, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

DOMINION NUCLEAR CONNECTICUT, INC.


C.J. Schwarz

Master Process Owner - Operate the Asset

Attachment (1): LER 2001-007-00

cc: H. J. Miller, Region 1 Administrator
J. T. Harrison, NRC Project Manager, Millstone Unit No. 2
NRC Senior Resident Inspector, Millstone Unit No. 2

IE02

MAR-04-2002 14:00

P.03/06

Docket No. 50-336
B18533

Attachment 1

Millstone Nuclear Power Station, Unit No. 2

LER 2001-007-00

NRC FORM 366 (1-2001)			U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001 Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 EB), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to bie1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20585. If a means used to impose 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.					
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)											
FACILITY NAME (1) Millstone Nuclear Power Station - Unit 2						POCKET NUMBER (2) 05000336			PAGE (3) 1 OF 3		
TITLE (4) Movement of Heavy Loads not Addressed in Procedure											
EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
10	22	2001	2001	- 007	- 00	12	17	2001	FACILITY NAME	DOCKET NUMBER	05000
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)								
			20.2201(b)	20.2203(a)(3)(ii)			X	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)		
POWER LEVEL (10)		100	20.2201(d)	20.2203(a)(4)				50.73(a)(2)(iii)	50.73(a)(2)(x)		
			20.2203(a)(1)	50.36(c)(1)(i)(A)				50.73(a)(2)(iv)(A)	73.71(a)(4)		
			20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)			X	50.73(a)(2)(v)(A)	73.71(a)(5)		
			20.2203(a)(2)(ii)	50.36(c)(2)				50.73(a)(2)(v)(B)	OTHER		
			20.2203(a)(2)(iii)	50.46(a)(3)(ii)				50.73(a)(2)(v)(C)	Specify In Abstract below or In NRC Form 366A		
			20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)				50.73(a)(2)(v)(D)			
			20.2203(a)(2)(v)	50.73(a)(2)(i)(B)				50.73(a)(2)(vii)			
			20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)				50.73(a)(2)(viii)(A)			
			20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)				50.73(a)(2)(viii)(B)			
LICENSEE CONTACT FOR THIS LER (12)											
NAME David W. Dodson, Team Lead - Compliance						TELEPHONE NUMBER (Include Area Code) 860-447-1791					
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)						EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR	
YES (If yes, complete EXPECTED SUBMISSION DATE).		X	NO								
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)(16)											
It has been identified that no safe load path exists for lifts of new fuel shipping containers and spent resin casks at Millstone Unit No. 2 in the area of the cask washdown pit and the associated lifting device is not single failure proof. Safety related commodities are located both in the pipe trench below the cask pit floor and on the west wall of the railroad access bay. Load lifts on the order of 24 feet are required to bring material into and out of the spent fuel pool area via this load path. Previously it was identified that a 50 ton reactor coolant pump motor was stored in the cask washdown pit and that the drop of this motor would result in failure of the floor and potential damage to safety related components in the pipe trench.											
The root cause for the failure to identify heavy load paths is inadequate work practices in the Millstone engineering department in the area of programs.											
Remedial corrective actions taken to date include marking the location of the pipe trench on the railroad access bay floor and removal of the reactor coolant pump motor from the cask washdown pit using a NUREG-0612 compliant lift. Additional corrective actions are being addressed in accordance with the Millstone Corrective Action Program.											

NRC FORM 366A
(1-2001)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station - Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	23 OF 3
		2001	-- 007 --	00	

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

1. Event Description

On October 22, 2001, with the plant in mode one at one hundred percent power, it was discovered that heavy loads have been historically moved at Millstone Unit No. 2 without appropriate procedural guidance. In order to support plant operation and refueling activities, various items need to be lifted and transported to locations within the power block and yard. These lifts and movements are controlled by procedures which take into consideration safety related structures, systems, components, and fuel which may be adversely effected by a load drop. Historically this issue has been addressed via the guidance provided in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." Commitments were established for procedural controls, conduct of operations for cranes, and safe load paths.

The Millstone Unit No. 2 Spent Fuel Pool Area, 38'-6" elevation of the Auxiliary Building [NF], as well as the cask washdown pit, is addressed by procedure MP 2712B1, "Control of Heavy Loads." The procedure shows the Spent Fuel Pool as a restricted area for lifts, with a safe load path adjacent to the pool. Historically, loads such as new fuel, spent resin casks, and other items have been lifted from the railroad access bay at the 14'-6" elevation, to and from the 38'-6" elevation, over a safety related pipe trench. Most recently, a spare reactor coolant pump [P] motor [MO] was lifted into the cask washdown pit. However, these loads have been lifted over the safety related pipe trench using a crane [CRN] that is not "single failure proof" as described in NUREG-0612.

The safety related pipe trench lies below the cask washdown pit and the railroad access bay floor. The trench contains conduit [CND], cable raceways [TRLY] and safety related piping, including redundant refueling water storage tank [TK] (RWST) suction headers and redundant emergency diesel Service Water [LB] headers. The drop of a heavy load in the area of the cask washdown pit could cause failure of the floor slab resulting in damage to the safety related pipe trench. In addition, the end wall of the railroad access bay supports various safety related items that could be damaged while performing heavy load lifts in the area.

The cask crane is not "single failure proof" as described in NUREG-0612. The crane is a conventional 100 ton beam crane. The factor of safety requirements for rigging, presented in NUREG-0612, can be extended to the hook and other load bearing components where the stress distributions do not change as the load is being either lifted or transported horizontally; however, it cannot be extended to the other parts such as the cable, sheaves, etc. where the stress distribution does change while the load is being lifted/transported. Thus a failure of one of these parts must be considered even though the probability of such a failure is very low. If one of these parts does fail, the load will not necessarily fall straight down. If a sheave were to fall or if the cable somehow rides up over the edge of a sheave, and then fails, the block will tilt prior to releasing the load. The center of gravity of the load will move to remain directly beneath the location of the support force. This support force location will be constantly changing as the cable unloads. Hence, an initial angle and/or slight tendency to tumble cannot be precluded.

Should a load drop have occurred, the floor of the cask pit could have failed and the resulting impact to the safety related structures below the floor may have resulted in a loss of safety function for the RWST and Service Water system. The ability to safely shutdown the plant under these circumstances would have been a significant challenge and is not an analyzed condition for the facility.

On the basis of the above, this condition is considered to be reportable under 10 CFR 50.73(a)(2)(ii) as an unanalyzed condition which could significantly degrade plant safety, and 50.73(a)(2)(v) as a condition that could have prevented the fulfillment of the safety function.

2. Cause

The root cause for the failure to identify heavy load paths is inadequate engineering work practices in the Millstone engineering department in the area of programs.

NRC FORM 366A (1-2001)		U.S. NUCLEAR REGULATORY COMMISSION			
LICENSEE EVENT REPORT (LER)					
FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station - Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	33 OF 3
		2001	- 007 -	00	
NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)					
<p>3. Assessment of Safety Consequences</p> <p>There were no actual consequences experienced as a result of this condition and the safety significance of this condition is judged to be low. Although a portion of the floor of the cask washdown pit is directly above the safety related pipe trench containing the redundant refueling water storage tank suction headers and redundant emergency diesel service water headers, movement of a heavy load, such as the spare reactor coolant pump, would be minimal in terms of risk. This is a result of the high reliability of those systems as well as the high load capacity of the cask crane. The cask crane capacity has never been challenged in that the most frequently lifted loads are well below the 100 ton crane capacity. The cask crane is subject to testing and preventative maintenance, and is operated by qualified personnel. Thus, these cranes exhibit high reliability.</p>					
<p>4. Corrective Action</p> <p>Remedial corrective actions taken to date include marking the location of the pipe trench on the railroad access bay floor and removal of the reactor coolant pump motor from the cask washdown pit using a NUREG-0612 compliant lift. Additional corrective actions are being addressed in accordance with the Millstone Corrective Action Program.</p>					
<p>5. Previous Occurrences</p> <p>No similar events/conditions were identified during the 24 months preceding this condition.</p>					
<p>Energy Industry Identification System (EIIS) codes are identified in the text as [XX].</p>					