RAS 4160

March 18, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50-423-LA-3
	)	
	)	ASLBP No. 00-771-01-LA-R
(Millstone Nuclear Power Station, Unit No. 3)	)	

SUMMARY OF FACTS, DATA, AND ARGUMENTS ON WHICH DOMINION NUCLEAR CONNECTICUT WILL RELY AT THE REOPENED PROCEEDING SUBPART K ORAL ARGUMENT

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Written Summary and Sworn Testimony*

*Exhibits 1 to 5 were filed under separate cover on March 15, 2002.

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I. Introduction

In accordance with the schedule established in the Atomic Safety and Licensing Board ("Licensing Board") Memorandum and Order (Telephone Conference Call, 10/31/01; Schedules for Proceeding), issued on November 5, 2001, Dominion Nuclear Connecticut, Inc. ("DNC") hereby submits its "Summary of Facts, Data, and Arguments On Which Dominion Nuclear Connecticut Will Rely at the Reopened Proceeding Subpart K Oral Argument" ("DNC's Summary"). As required by 10 C.F.R. § 2.1113(a), DNC's Summary consists of this written summary as well as attachments with supporting facts and data in the form of sworn written testimony and exhibits. In this filing, DNC demonstrates that there is no genuine dispute of fact to be resolved through an adjudicatory hearing. Accordingly, consistent with 10 C.F.R. § 2.1115(a)(2), the issue in this reopened matter should be promptly resolved in DNC's favor.

II. Procedural History for this Reopened Subpart K Proceeding

This proceeding arises out of a request by Northeast Nuclear Energy Company ("NNECO")[1] for a license amendment to increase the storage capacity of the Millstone Unit 3 Spent Fuel Pool ("SFP") from 756 assemblies to 1,860 assemblies ("License Amendment 189"). License Amendment 189 utilizes additional storage racks in the SFP and authorizes storage of fuel assemblies in three "regions," where the regions are characterized by specified reactivity limits (*i.e.*, limits based on fuel enrichment, burnup, and decay time). The NRC issued License Amendment 189 on November 28, 2000, after finding that the amendment posed "no significant hazards considerations" under 10 C.F.R. § 50.92. *See* 65 Fed. Reg. 75,736 (2000).

The Licensing Board in this case originally granted standing to the Connecticut Coalition Against Millstone ("CCAM") and the Long Island Coalition Against Millstone ("CAM") (collectively, "Intervenors") and admitted three of their contentions (Contentions 4, 5, and 6) for adjudication.[2] The hearing was conducted under the procedures of 10 C.F.R. Part 2, Subpart K. On October 26, 2000, after submission of papers and an oral argument, the Licensing Board issued a Memorandum and Order that denied the request for an evidentiary hearing on the three admitted contentions and resolved all the issues.[3] The Commission later affirmed that decision in two parts.[4]

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1 At the time this proceeding began, NNECO was the licensee for Millstone Unit 3. On March 31, 2001, DNC became the operating licensee and party in interest in this matter.

2 *Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), LBP-00-2, 51 NRC 25 (2000). The Licensing Board admitted Contentions 4, 5, and 6 dealing with criticality questions and rejected eight other proposed contentions.

3 *See Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), LBP-00-26, 52 NRC 181 (2000).

4 *See Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), CLI-01-10, 53 NRC 353 (2001); *Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), CLI-01-3, 53 NRC 22, 25-27 (2001).

On December 18, 2000, while the Licensing Board's decision was under review by the Commission, the Intervenors filed a motion to stay appellate proceedings and reopen the record on Contention 4 based upon the licensee's notification to the NRC regarding a loss of accountability for two Millstone Unit 1 spent fuel rods. The Commission subsequently remanded the motion to reopen the record to the Licensing Board "for its consideration in the first instance."[5] After first denying the motion, on May 10, 2001, the Licensing Board reconsidered and issued a Memorandum and Order that granted the Intervenors' motion to reopen the record to address a limited issue summarized below.[6] The "Reopened Issue" remains before the Licensing Board in this Subpart K proceeding and is the subject of DNC's Summary and the oral argument scheduled for April 2, 2002.

III. Strict Threshold for an Adjudicatory Hearing in a Subpart K Proceeding

The procedures in 10 C.F.R. Part 2, Subpart K, were established in response to a congressional mandate found in the Nuclear Waste Policy Act of 1982, 42 U.S.C. § 10101, *et seq.* ("NWPA"). The NWPA was passed to establish a federal program for funding and development of a permanent disposal repository for spent nuclear fuel and other high-level nuclear waste. *See* H.R. Rep. No. 97-785, pt. 1, at 32 (1982). Congress determined that the operators of civilian nuclear power reactors have "primary responsibility" for interim storage of spent fuel, and that they should do so "by maximizing, to the extent practical, the effective use of existing storage facilities at the site of each civilian nuclear power reactor, and by adding new onsite storage capacity in a timely manner where practical." 42 U.S.C. § 10151(a)(1). Congress

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5 *See Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit No. 3), CLI-00-25, 52 NRC 355, 357 (2000).

6 *See Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Unit No. 3), LBP-01-17, 53 NRC 398 (2001).

also declared that the purpose of the NWPA was to promote the "addition of new spent nuclear fuel storage capacity" at civilian reactor sites. *Id.* at § 10151(b)(1). The NWPA directed federal agencies to "encourage and expedite the effective use of available storage, and necessary storage" at reactor sites. *Id.* at § 10152. Congress recognized that several methods could be used to increase the spent fuel storage capacity, specifically including the "use of high-density fuel storage racks." *Id.* at § 10154.

The NWPA § 134(a)-(b), 42 U.S.C. § 10154(a)-(b), further states that for any reactor operating license amendment "to expand the spent nuclear fuel storage capacity at the site of a civilian nuclear power reactor," the Commission was to provide parties to any hearing on the expansion amendment with the opportunity to present facts, data, and arguments, by way of written summaries and sworn testimony, and an oral argument. Based on the summaries, sworn testimony and the argument, the Commission then would designate "any disputed questions of fact, together with any remaining questions of law, for resolution in an adjudicatory hearing" — but only if the Commission finds that "there is a genuine and substantial dispute of fact which can only be resolved with sufficient accuracy by the introduction of evidence at an adjudicatory hearing" and "the decision of the Commission is likely to depend in whole or in part on the resolution of such dispute."

The NRC implemented NWPA through a 1985 rulemaking that added Subpart K to 10 C.F.R. Part 2. 50 Fed. Reg. 41,662 (1985). The statutory requirements related to limiting adjudicatory hearings on spent fuel storage matters are incorporated in the Commission's regulations at 10 C.F.R. §§ 2.1113 and 2.1115. Section 2.1115(a)(1)-(2) specifically provides that the presiding officer shall "[d]esignate any disputed issues of fact, together with any remaining issues of law, for resolution in an adjudicatory hearing," and "[d]ispose of any issues

of law or fact not designated for resolution in an adjudicatory hearing." Under the Commission's regulations, 10 C.F.R. § 2.1115(b), an issue may be designated for an adjudicatory hearing only if:

- there is a genuine and substantial dispute of fact; *and*
- the dispute can be resolved with sufficient accuracy only through introduction of evidence at an adjudicatory hearing; *and*
- the NRC's ultimate decision is likely to depend in whole or in part on the resolution of the dispute.

Any issues that do not meet all three of these criteria are to be disposed of by the Licensing Board promptly after the oral argument. *Id.* at § 2.1115(a)(2).

The NRC made it clear in the 1985 rulemaking that the threshold for an adjudicatory hearing in Subpart K is quite high:

> The Commission continues to believe that the statutory criteria are sufficient. As the Commission pointed out in connection with the proposed rules, the statutory criteria are quite strict and are designed to ensure that the hearing is focused exclusively on real issues. They are similar to the standards under the Commission's existing rule for determining whether summary disposition is warranted. They go further, however, in requiring a finding that adjudication is necessary to resolution of the dispute and in placing the burden of demonstrating the existence of a genuine and substantial dispute of material fact on the party requesting adjudication.

50 Fed. Reg. at 41,667. *See also Carolina Power & Light Company* (Shearon Harris Nuclear Power Plant), LBP-00-12, 51 NRC 247, 255 (quoting 50 Fed. Reg. 41,662, 41,667 (1985)) (2000).

As a result, in the present case the Intervenors bear the heavy burden of demonstrating that they are entitled to an adjudicatory hearing. The Intervenors must demonstrate a genuine and substantial fact issue in dispute *and* that the NRC's decision is likely to depend on the resolution of that dispute. While the NRC's summary disposition regulation, 10

C.F.R. § 2.749, requires a factual issue that is "material" to justify an evidentiary hearing, the Subpart K requirement is that an adjudicatory hearing be held only if the NRC's decision "is likely to depend in whole or in part" on the resolution of the factual dispute. This Subpart K threshold is a much stricter threshold than "materiality." The factual dispute must play a central role in the ultimate disposition of the proceeding. Otherwise, no adjudicatory hearing is required.

In this case, the Licensing Board can dispose of the Intervenors' issues on the basis of the sworn testimony and written submissions because the issues are neither substantial nor central to the Commission's decision. The record demonstrates that the Reopened Issue has no bearing on either Contention 4 in this proceeding or License Amendment 189.[7] Additionally, even if the Licensing Board were to find a factual dispute that is genuine and substantial, an adjudicatory hearing is not required unless it is shown that the dispute can only be resolved through traditional adjudicatory procedures, such as live testimony subject to cross-examination. Upon a review of facts it is again clear that there is no basis whatsoever to conclude that further hearings on the Reopened Issue are warranted.

IV. Summary of Facts and Arguments in Response to Reopened Issue

A. Restatement of Reopened Issue

In Contention 4 the Intervenors asserted the potential for a nuclear criticality accident. They claimed that the additional spent fuel racks to be installed in the Millstone Unit 3 SFP and the three-region storage configuration would create an "undue and unnecessary risk to worker and public health and safety," specifically because the proposal would allegedly involve

[7] Contention 4, of course, defines the limits of the Licensing Board's jurisdiction. Contention 4 is more narrow than even License Amendment 189, which defined the original limit on the scope of this proceeding.

trading physical protection against criticality for a "complex array" of "administrative controls." The Intervenors further asserted that past experience at Millstone suggested that NNECO's ability to carry out such controls successfully is suspect. The Licensing Board, in its Prehearing Conference Order (LBP-00-02, 51 NRC 25, 34), adopted the following restatement of Contention 4:

> The new set of administrative controls trades reliance on physical protection for administrative controls to an extent that poses an undue and unnecessary risk of a criticality accident particularly due to the fact that the licensee has a history of not being able to adhere to administrative controls with respect, inter alia, to spent fuel configuration.

In its October 2000 Memorandum and Order (LBP-00-26) dismissing Contention 4, the Licensing Board determined that none of the issues raised by the Intervenors met the criteria of Subpart K for an issue to be designated for further evidentiary hearings. The Licensing Board concluded, "[a]fter an exhaustive review of the entire record on this contention" (LBP-00-26, 52 NRC 151, 197), that the Intervenors' claim "that fuel misplacements do indeed occur is not disputed," but that in the incidents in the industry cited by the Intervenors the reactivity limit (K_{eff}) of 0.95 was not breached (*id.)*. In addition, the Licensing Board found that "[s]afety margins[relative to a criticality event] are maintained by the regulatory requirement that rack reactivity be less than 0.95, while the use of soluble boron adds defense-in-depth against an accidental criticality." *Id.* at 200. And, the Licensing Board concluded, "NNECO 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." *Id.* The Licensing Board decided Contention 4 in favor of NNECO.

The Reopened Issue is directed toward reconsideration of these conclusions on Contention 4 (and is ultimately limited in scope by Contention 4). The Reopened Issue is

premised upon the finding that two fuel rods at Millstone Unit 1 were found to be unaccounted for, based upon a review of Unit 1 records in 2000. The two fuel rods had been removed from a Millstone Unit 1 fuel assembly (MS-557) in October 1972 to allow General Electric ("GE"), the Unit 1 fuel vendor, to examine the fuel assembly in order to study the effects on the fuel assembly of a saltwater intrusion into the reactor water at Unit 1 in September 1972. After the examination, the two rods could not be reinserted into the fuel assembly. The records indicate that the two rods were subsequently stored separate from the fuel assembly and outside the storage racks in a storage container tied to the side of the Millstone Unit 1 spent fuel pool. However, appropriate documentation was not maintained and accountability was lost. NNECO therefore initiated a comprehensive Fuel Rod Accountability Project ("FRAP") to attempt to determine the location and/or disposition of the two fuel rods. In addition to the investigation team, the FRAP included a Root Cause Assessment Team ("RCAT") to separately investigate and identify the root causes and contributing factors for the loss of accountability of the two fuel rods. The FRAP also included oversight from an Independent Review Team ("IRT") comprised of industry and regulatory experts.

In its May 2001 Memorandum and Order (LBP-01-17), the Licensing Board reopened the proceeding on Contention 4 to evaluate the issue of the two fuel pins at Millstone Unit 1, but only:

> ...to the extent it bears upon the adequacy of administrative controls at the Millstone-3 SFP and DNC's ability or willingness to implement such controls successfully. The scope of this reconsideration is limited to 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, 53 NRC 398, 408. As such, the Licensing Board has reopened the proceeding only to examine whether there is any commonality between any procedures implicated by the Unit 1

event and the Unit 3 procedures that support the revised Unit 3 spent fuel assembly storage configuration and reactivity limits authorized by License Amendment 189.

B. Summary of Facts and Arguments

Relevant facts related to License Amendment 189 and Contention 4 were documented in the prior phase of this proceeding, principally in the affidavits submitted on June 30, 2000. This substantial record included the affidavits of Messrs. Joseph Parillo, Michael Jensen, and David Dodson, and the affidavit of Dr. Stanley Turner of Holtec International.

The relevant facts related to the Reopened Issue are documented in the affidavits and exhibits included in this filing, with some reference to the prior affidavits of record. The new material includes the affidavits of Messrs. Hugh McKenney, Daniel J. Meekhoff, and Joseph Parillo. In addition, DNC is submitting a "panel" affidavit from three outside experts: Messrs. Robert V. Fairbank, Jr., Richard N. Swanson, and Hugh L. Thompson, Jr. These outside experts were personally and substantially involved in the FRAP and RCAT investigations, and the related IRT. Their affidavit draws upon their work and their conclusions as previously documented in:

- Millstone Unit 1 Fuel Rod Accountability Project, Number M10063, Final Report (October 1, 2001);
- Root Cause Investigation, Loss of Accountability of Two Fuel Rods at Millstone Unit 1 (CR# M1-00-0548), approved October 25, 2001.

These two significant reports are included as Exhibits 4 and 5, respectively. (Exhibits 1 to 3 are responsive to questions from Judge Kelber and are discussed in the McKenney Affidavit, ¶ 54.)

This record, overall, demonstrates that License Amendment 189 involves a spent fuel storage approach that is safe, based upon defense-in-depth, and that is consistent with the intent of the NWPA. The record shows that there is substantial margin-of-safety with respect to

a nuclear criticality accident. In this context, the Reopened Issue does not present any basis to alter the Licensing Board's prior conclusion on Contention 4. The record shows that the Unit 1 issue does not bear on handling and storage of fuel assemblies in particular and, more generally, does not bear on administrative controls employed at the Unit 3 SFP today. The root cause and extent of condition for this event have been thoroughly analyzed and, to the extent any observations were made that apply to Unit 3 procedures, corrective actions or enhancements have been made. The record also shows that the Unit 1 issue resulted from certain historical weaknesses and factors, and therefore does not bear on the willingness and capability of DNC today to implement the administrative controls necessary for License Amendment 189. The facts and arguments are summarized in the following discussion.

1. DNC Has Comprehensive Fuel Handling Controls To Implement License Amendment 189

The record first shows that DNC has comprehensive procedures to control fuel handling operations at Millstone Unit 3, including procedures to implement the reactivity limits of License Amendment 189. These procedures are discussed by Mr. McKenney in his affidavit and include:

- QA calculations to obtain measured fuel burnup.
- Dual review of the determination that a fuel assembly meets the applicable reactivity limits.
- Controls on the movements of fuel assemblies.

McKenney Affidavit ¶¶ 9-11. These controls were successfully applied to the new Unit 3 spent fuel storage racks during refueling outage ("RFO") 7 in early 2001. *Id.*, ¶¶ 12-15.

DNC also has comprehensive Special Nuclear Material ("SNM") accounting procedures, which cover both fuel assemblies and fuel rods. This system of procedures ensures

that fuel movements are controlled so that fuel is placed in an appropriate location, and also that a record is maintained of the location of the fuel. *Id.*, ¶¶ 15-18. Very importantly, these procedures at Unit 3 — unlike Unit 1 in the past — extend to both fuel assemblies and individual fuel rods removed from assemblies. *Id.*, ¶ 19. The documentation of location of fuel SNM (both assemblies and any rods removed from assemblies) is tracked in both a paper card file and in a computer-based system known as "Shuffleworks." *Id.*, ¶¶ 20-22. Shuffleworks was not employed at Unit 1 at the time the two rods were lost. *Id.*, ¶ 21. It was adopted at Unit 3 in the 1990's. *Id.*, ¶ 54. Shuffleworks can be used to generate up-to-date SFP and core maps. *Id.*, ¶ 23. Examples are provided as Exhibits 1-3.

The record also includes a discussion of the procedures for periodic surveys and inventories of Unit 3 SNM. *Id.*, ¶ 30-35. An "Inventory of Record" is a key element of these procedures. For fuel SNM, the Inventory of Record has been defined as the SFP and core maps. *Id.*, ¶ 30. The Inventory of Record for Millstone Unit 3 has been reconciled against all other SNM databases (including government forms) and will be updated at least twice a year going forward. *Id.* The Inventory of Record establishes a clear delineation of fuel SNM at the unit; it is used as the basis for periodic physical inventories. *Id.* The procedure for periodic inventories at Unit 3 has also been enhanced to require serial number verification (not just a piece count) of fuel assemblies by location in the SFP once every twelve months (for assemblies that have been moved since the last verification). *Id.*, ¶ 34.

In total, Unit 3 procedures are comprehensive in providing controls for implementing the reactivity limits of License Amendment 189, for controlling fuel movements, for accounting for the location of fuel SNM (whether a fuel assembly or a fuel rod removed from an assembly), and for periodically reconciling records and taking physical inventories. The

RCAT evaluated these procedures for Unit 3 with respect to a number of individual attributes relevant to the Unit 1 event. For all the attributes, the Unit 3 procedures were rated as either "white" (meets requirements) or "green" (no obvious improvement opportunities.) *Id.*, ¶ 46-47, 60-61. DNC also utilized the Corrective Action Program to identify and implement enhancements where warranted (such as for "white" attributes). *Id.*, ¶ 61.

2. *At Unit 3, Individual Fuel Rods Are Positively Controlled In A Fuel Storage Box*

At Millstone Unit 3, unlike Millstone Unit 1 in the 1970's and 1980's, any fuel rod permanently removed from a fuel assembly (*e.g.*, a defective fuel rod) is stored in a container called the Fuel Storage Basket ("FSB"). McKenney Affidavit, ¶ 24. There is only one FSB for Unit 3. *Id.*, ¶ 25. The FSB is controlled and stored in the fuel storage racks in the same way a fuel assembly is stored. *Id.* The location of the FSB is tracked by the procedures described above, similar to how a fuel assembly is tracked. The records show the movement of fuel rods to the FSB as well as the location of the FSB in the SFP storage racks. *Id.*, ¶ 29. The FSB is also tracked in Shuffleworks and its location is shown on the Shuffleworks map of the SFP. *Id.*, ¶ 54.

The FSB at Unit 3 presently contains only one fuel rod — the only fuel rod permanently removed from a fuel assembly at Unit 3 since the unit began operation. *Id.*, ¶¶ 25, 36-38. DNC has visually verified the presence of one fuel rod located in the FSB. *Id.*, ¶ 43. It has never been a practice at Unit 3 to store fuel rods or the FSB outside of approved storage locations. *Id.*, ¶ 42.

From a control perspective, the use of the FSB is an important difference from how fuel rods were stored at Unit 1 at the time accountability for the two Unit 1 MS-557 fuel rods was lost. At Unit 1, the practice of storing individual fuel rods removed from assemblies in containers outside the fuel storage racks significantly contributed to the likelihood that the two

Unit 1 rods were disposed of as non-fuel radioactive material. *Id.*, ¶50; Expert Panel Affidavit, ¶¶ 51-52. Specifically, the two Unit 1 rods were stored in proximity to irradiated Local Power Range Monitors ("LPRMs"). The two rods may not have been recognized by contract workers as fuel rods, and most likely were cut up (in 1979) and/or later disposed of (in 1988) in shipments to a low level radioactive waste disposal site. Expert Panel Affidavit, ¶¶ 19, 51. In contrast, the Unit 3 FSB is stored in the fuel racks; the FSB handling tool cannot contact stored fuel rods; and individual rods can only be removed from the FSB with special tooling, which is not currently on-site at Millstone. McKenney Affidavit, ¶ 26. Accordingly, the use of the FSB at Unit 3 is a key reason the historic Unit 1 practices and experience do not bear on the Unit 3 SFP.

3. The Unit 1 Event Did Not Extend To Handling And Control Over Fuel Assemblies At Either Unit 1 Or Unit 3

In assessing whether the Unit 1 issue bears on the adequacy of the administrative controls at Unit 3 to implement License Amendment 189, another very fundamental point stands out. License Amendment 189 requires controls related to movements of fuel assemblies, to assure that those assemblies are qualified for a particular region of the SFP (for criticality purposes), are moved correctly to a designated location in that region, and remain there. The Unit 1 issue related to handling of individual fuel rods removed from assemblies. Expert Panel Affidavit, ¶ 21. The handling of two fuel rods, disassembled from a fuel assembly, does not involve, and does not equate to, a situation in which a fuel assembly could be moved to a location for which it is not qualified.

The RCAT specifically found that: (a) the event at Unit 1 was restricted to two individual fuel rods; (b) physical accountability of fuel assemblies was adequately controlled at *both* Unit 1 and Unit 3; and (c) the vulnerabilities that allowed fuel rod accountability to be lost

at Unit 1 did not extend to fuel assemblies at *either* Units 1 or Unit 3. *Id.*, ¶¶ 21-28.; *see also* Exhibit 5 at ii, 19-20, 56-57. Therefore, there is fundamentally no nexus between the Unit 1 issue and License Amendment 189 or Contention 4. By its very nature and given the RCAT conclusions, there is no basis in the Unit 1 event on which to conclude that the Unit 3 license amendment will lead to mis-loaded fuel assemblies or a criticality event as alleged in Contention 4.

4. The Unit 1 Event As It Relates To Fuel Rods Was Limited To Unit 1

Even if handling and control of fuel rods were relevant, somehow, to License Amendment 189 (which is what is at issue here), the Unit 1 matter was in any event limited to Unit 1. This conclusion is supported in two ways. First, reviews and reconciliations establish that no Unit 3 fuel rods have been lost. Second, the vulnerabilities that existed at Unit 1 with respect to fuel rods were determined to be not applicable at Unit 3. The first line of reasoning is summarized in this section; the second is summarized in the following section.

Shortly after identification of the Unit 1 issue, NNECO initiated a review of historic SNM records at Millstone with respect to individual fuel rod movements to ascertain the extent of the Unit 1 condition. McKenney Affidavit, ¶ 36. For Millstone Unit 3, in contrast to Unit 1, procedures and records existed to track individual fuel rod movements for fuel rods removed from an assembly. *Id.* The records reflected that only the one fuel rod discussed above has been permanently removed from its host assembly. *Id.*, ¶ 37. This was a leaking fuel rod removed from an assembly in 1995. It was stored in the FSB as indicated above. *Id.*, ¶ 38. The review concluded that controls were in place at the time to assure accountability over the fuel rod and the FSB. *Id.*, ¶ 41. The location of the FSB has always been tracked and the presence of the one rod in the FSB has been visually verified. *Id.*, ¶¶ 38, 43.

In addition, as part of the corrective actions for the Unit 1 event, initiated in response to the RCAT investigation, DNC performed an overall reconciliation of records. *Id.*, ¶ 44, 61. The relevant inventory databases were validated against each other, including validations that Millstone records and government records agree on the SNM inventory at Millstone Unit 3, and a validation that SFP maps, the paper records (the "card file"), and the Shuffleworks database all match. *Id.*, ¶ 44.

The RCAT in particular recognized the importance of establishing a validated "Inventory of Record." The presence of the single individual fuel rod in Unit 3 was correctly and accurately reflected in records (unlike at Unit 1). Expert Panel Affidavit, ¶ 43. Moreover, DNC has defined the Inventory of Record to be used as a basis for inventories going forward, validated the accuracy of that basis, and reconciled the physical fuel inventory with that validated basis. These actions confirmed that Unit 3 has all the spent fuel it should have (including fuel rods) and that fuel accountability records have retained their integrity. *Id.*

5. *The Unit 1 Event Was The Product Of Historical Factors That Do Not Bear On Unit 3 Fuel Accountability And Handling Controls Used Today*

Notwithstanding that no Unit 3 fuel rods have been lost, there is further assurance that the Unit 1 issue does not have any bearing on Unit 3 — much less on the procedures actually relevant to implementing License Amendment 189. The root cause investigation and the Millstone corrective action process provide assurance that the historical factors leading to the loss of fuel rod accountability at Unit 1 did not apply at Unit 3 and will not apply in the future.

As discussed above, the RCAT comprehensively evaluated the root cause of the Unit 1 loss of accountability of fuel rods and determined that the vulnerabilities that caused that event or that were contributing factors generally did not apply at Unit 3. McKenney Affidavit, ¶ 47. Mr. Swanson was the RCAT Team Leader and his testimony thoroughly summarizes the

conclusions of the RCAT related to the relevance of the Unit 1 event to Unit 3 SNM procedures. Expert Panel Affidavit, ¶¶ 21-52. To summarize further, he highlights the unique causative factors related to the Unit 1 event and important differences at Unit 3. Key differences include:

- Differences In SNM Control Procedures: Perhaps most important to the current issue, Unit 1 procedures — for historical reasons — contained flaws with respect to control and inventory for individual fuel rods. Most fundamentally, the procedures did not anticipate that individual fuel rods would be removed from fuel assemblies and did not specifically address individual fuel rods until a September 1990 procedure revision. *Id.*, ¶ 36-37. In direct contrast, Unit 3 procedures have required that any individual fuel rods removed from assemblies be tracked and inventoried as SNM. This procedure was applied to the single rod removed from an assembly in 1995. *Id.*, ¶ 38.

- Differences In Fuel Rod Storage: At Unit 1, there was no designated rod storage container such as the Unit 3 FSB discussed above. The Unit 1 rods were stored in proximity to radioactive waste rather than in the spent fuel storage racks. This created a vulnerability that has never existed at Unit 3. *Id.*, ¶¶ 25-28.

- Differences In SFP Work Controls: The level of control and oversight for SFP evolutions at Unit 1 in the 1970's and 1980's was not comparable to the controls applied today at Unit 3. *Id.*, ¶ 33. Inadequate controls at Unit 1 may have contributed to the fuel rods being treated as LPRMs in a 1979 LPRM cutting campaign and a 1988 Unit 1 SFP clean-up campaign. *Id.*, ¶ 32. Putting aside that Unit 3 does not have LPRMs, by the time Unit 3 began commercial operation in the mid-1980's, radwaste characterization requirements and work controls were far more rigorous than in the past because of new low level waste classification requirements. *Id.*, ¶ 34. In addition, Unit 3 adopted additional procedural guidance for SFP operations in 1997. *Id.*

- Differences In Oversight: Mr. Swanson also highlights the differences in oversight of fuel inventory and control between Unit 1 in 1979 and Unit 3 today. *Id.*, ¶¶ 45-46. There has been a clear evolution in the management and oversight of nuclear activities, making Unit 3 significantly less vulnerable to a similar event.

In total, the RCAT assessed the "extent of condition/generic implications" of the Unit 1 issue for Millstone Station. The vulnerabilities that existed for Unit 1 have been analyzed

for Unit 3. As mentioned above, with respect to ten attributes relevant to the Unit 1 issue, the RCAT found that Unit 3 procedures and practices today — in all cases — at least meet requirements ("white") and for many attributes there were no obvious opportunities for improvement identified ("green"). Exhibit 5, at 56-60. As also discussed above, enhancements have been made at Unit 3 with respect to "white" findings in response to the RCAT observations. *See, e.g.*, McKenney Affidavit, ¶ 60-61. Therefore, even if the Unit 1 issue were somehow germane to License Amendment 189, there is no basis on which to conclude that SNM control and accountability procedures today at Unit 3 are in any sense inadequate or vulnerable to a similar event.

6. *The Failure to Discover the Unit 1 Issue More Promptly Was the Result of Factors that Do Not Apply to Unit 3 Today*

The Unit 1 issue was identified by an engineer reviewing paperwork at Unit 1 in 2000. Meekhoff Affidavit, ¶ 17. The lack of accountability with respect to the two Unit 1 rods was not detected earlier for reasons explained by Mr. Swanson. Unit 1 conducted periodic inventories of SNM, as required. However, Unit 1 fuel inventories involved physical "piece counts" and focused on verifying that rack locations expected to contain fuel assemblies actually did. Unit 1 procedures did not clearly define the basis against which physical inventories were to be compared and did not adequately require periodic verification of the basis. Expert Panel Affidavit, ¶¶ 39-40. This weaknesses did not cause the loss of accountability, but it did lead to the failure to detect it earlier. *Id.*, ¶ 40. In other words, once the two rods were no longer on the Unit 1 SFP map, there was no basis on which to look for the rods during an inventory.

As already discussed, at Unit 3 fuel rods removed from assemblies have always been tracked as items of SNM. The one fuel rod that has been removed is stored in the FSB. Therefore, there have not been any manifestations of procedural weaknesses at Unit 3 (such as

lost rods) similar to the loss of accountability for two rods at Unit 1. Nonetheless, specific corrective actions or procedural enhancements at Unit 3 initiated during the RCAT review centered on more clearly defining the Inventory of Record to serve as the basis for future inventories, validating that Inventory of Record, and reconciling the physical fuel inventory and the validated Inventory of Record. *Id.*, ¶¶ 43-44. As discussed above, the SNM records reconciliation assures that the basis for future inventories is sound. In addition, enhancements have been made to Unit 3 procedures for inventories and verifications that will assure timely detection of accountability problems in the future. McKenney Affidavit, ¶¶ 30-32, 34-35, 60-61.

In sum, the mere fact that at Unit 1 "it took so long" to identify the discrepant condition was the product of unique circumstances and particular procedural flaws. These have been evaluated for Unit 3 and enhancements to Unit 3 procedures have been made (notwithstanding that there is no evidence of a problem at Unit 3 in the past). Accordingly, there is no basis in this argument to support the Intervenors' contention.[8]

7. The Unit 1 Event Does Not Bear On The Willingness And Capability Of DNC To Implement License Amendment 189

The Intervenors' contention is also premised on a theory that the licensee is not "willing or capable" of implementing the License Amendment 189 administrative controls. This argument, however, lacks any merit. It is based on rote recitations of historical violations that predate the significant recovery program at Millstone Unit 3 in the mid-1990's discussed in the

[8] Also, suggestions have been made by the Intervenors that the fact that the fuel rods were not definitively located during the FRAP investigation is somehow support for the contention in this case. That argument is frivolous. First, the reality is that accountability was lost many years ago and the trail is very cold. Second, the FRAP located the only four plausible locations for the two fuel rods. Time, resources, and public safety dictate against pursuing any further specificity in the location of the rods. Finally, the lack of a definitive location does not in any way — as a matter of fact or logic — relate to DNC's ability to address the causes of the isolated Unit 1 event or DNC's ability to implement License Amendment 189 at Unit 3.

June 2000 affidavit of David Dodson in this proceeding. It is based upon events, including the missing Unit 1 fuel rods, that predate the April 1, 2001 transfer of the Millstone station to DNC. And, the argument completely fails to draw any disciplined correlation between the documented findings with respect to the causes and contributing factors leading to the loss of accountability for the two Unit 1 fuel rods and DNC's willingness and capability today to implement the specific License Amendment 189 administrative controls.

As discussed at length in the Expert Panel Affidavit by Mr. Thompson and Mr. Swanson, the Unit 1 issue was the product of a convergence of several unusual historical factors that have no applicability today to Millstone Unit 3. These include:

- The reactor design — Unit 1, as a boiling water reactor, utilized LPRMs; Unit 3, as a pressurized water reactor, does not.

- A historic reliance at Unit 1 on the fuel vendor — Unit 1 was a GE "turnkey" plant with a vendor role on fuel issues that tended to diminish licensee ownership and control. This does not apply today at Unit 3.

- The 1972 salt water intrusion event — This historic Unit 1 event was the initiator for removal of the two fuel rods from assembly MS-557 in the first place.

- The Unit 1 fuel storage practice for loose rods — By storing rods in proximity to waste/LPRMs, a vulnerability was created that does not exist with the Unit 3 SFP (given the use of the FSB).

- The historic evolution with respect to spent fuel storage onsite — Changes in federal policy created the unexpected need to rerack at Unit 1, which created a need for the SFP clean-up campaigns. This evolution did not impact newer units such as Unit 3 (with bigger SFPs) in the same way.

- An insufficient turnover in 1980 — When the Unit 1 Reactor Engineer ("RE") left the company, he and the new RE apparently did not sufficiently communicate on the issue of the two orphan rods.

- Historic fuel handling procedures for Unit 1 — As discussed above, these procedures were inadequate for tracking the two fuel rods at the time. This has not been the case for Unit 3 procedures, which have included individual fuel rods removed from assemblies as units of SNM.

Expert Affidavit, ¶¶ 53-63. In sum, specific historical factors and a combination of unusual circumstances at Unit 1 contributed directly to the loss of accountability of the two spent fuel rods. *Id.*, ¶ 64. None of these involved — even historically — a lack of willingness or capability to implement administrative controls. *Id.*

Mr. Thompson, as part of the FRAP IRT, had a substantial opportunity to review how the present-day management and staff at Millstone reacted to the FRAP and RCAT efforts. He comments in his testimony that the "licensee's response to the circumstances of the two missing fuel rods was comprehensive and thorough and demonstrates a complete willingness to implement and enhance SNM inventory controls." *Id.*, ¶ 67. He also observed that, post-transfer of the station to DNC, DNC "executives and managers were available to support all actions needed to ensure that Millstone Station was fully addressing the regulatory requirements associated with the SFP." *Id.* This testimony from a former, long-time NRC Director, provides assurance of DNC's ability to implement and enhance procedures as needed in the future. Certainly, no further oversight of Unit 3 SFP operations or implementation of License Amendment 189 is justified on the record of this case.

Additionally, two attributes of the Unit 1 event touched upon by the RCAT were "Ownership" and "Oversight." Exhibit 5, at 56, 59-60. The RCAT found that "management observation of work in and around the SFPs is. . . greater" than at Unit 1 in the past (*id.*, at 59); that Reactor Engineering personnel "demonstrate a greater degree of active involvement and ownership of SFP activities" (*id.*); and that "quality assurance oversight of SNM control and

accountability has been effective from 1997 through the date of this report" (*id.*, at 60). The RCAT identified these as "white" attributes today (*i.e.*, meets requirements).

One example of DNC's responsiveness to the RCAT assessment of Ownership and Oversight and to the Unit 1 issue is discussed in the affidavit of Daniel Meekhoff. Mr. Meekhoff has been designated by DNC as the Supervisor, Nuclear Operations Support, responsible and accountable for the management and oversight of fuel storage and handling for all three Millstone units. Meekhoff Affidavit, ¶ 1, 12. This site supervisory position is a management/organizational control that DNC's sister company, Virginia Electric and Power Company, has employed at the Surry and North Anna stations. *Id.*, ¶ 11-12. This supervisor will be able to apply at Millstone "best practices" from all Dominion sites, and will enhance management ownership, accountability, and oversight of all SFP activities. *Id.*, ¶ 12-13. Certainly, the creation of this position fully demonstrates DNC's commitment to safety and compliance, including implementation of administrative controls.

Mr. Meekhoff also addresses the Intervenor's claim that the Unit 1 issue was not promptly reported to the NRC and that this somehow evidences bad faith or a lack of willingness or capability to implement administrative controls. This, reporting issue (which obviously is not a fuel handling or SNM control issue at all) was cited by the NRC, in its February 2002 Special Inspection Report on the Unit 1 fuel rod issue, as an apparent violation of reporting requirements because NNECO did not initiate a Condition Report and notify the NRC in September 2000; rather, it made a report in November 2000. As explained by Mr. Meekhoff, rather than evidencing bad faith, this two-month "delay" was in reality simply a matter of judgment. Meekhoff Affidavit, ¶¶ 16-19. It did not involve any intent to avoid or delay a report, as confirmed by the inspection report and the NRC's Office of Investigations. *Id.*, ¶ 18. This minor

reporting matter — while NNECO was the licensee — has no bearing whatsoever on DNC's willingness or capability to implement the License Amendment 189 fuel handling administrative controls.[9]

In sum, the Intervenors have no case that DNC is not willing or capable of implementing appropriate fuel handling procedures and other administrative controls. DNC operates two Millstone units and, in doing so, implements countless controls successfully. The Unit 3 SFP and SNM control procedures involved in implementation of License Amendment 189 are not substantially different in complexity from myriad other controls implemented daily at the station. The Intervenors' "willingness and capability" arguments should be summarily rejected.

8. The Unit 1 Event Does Not Change The Substantial Margin Of Safety With Respect To A Criticality Accident Provided At the Unit 3 SFP

In addition to all of the above, the record in this proceeding on Contention 4 — compiled now in two phases — establishes that the Millstone Unit 3 spent fuel storage strategy authorized by License Amendment 189 is safe, with a substantial margin-of-safety relative to a nuclear criticality accident in the SFP. The margin-of-safety was previously addressed in the undisputed June 30, 2000 affidavits of Mr. Parillo and Dr. Turner. These affidavits summarized the licensing basis and beyond-design basis criticality calculations demonstrating that misloaded fuel assemblies — even multiple misloaded assemblies and misloaded assemblies coupled with soluble boron dilution — would not result in a criticality event. Against this backdrop, the Unit

[9] In a similarly strained attempt to impugn DNC's ability to implement procedures, the Intervenors in their March 7, 2002 response to DNC's January 25, 2002 discovery request in this proceeding indicate that they will rely on Licensee Event Report ("LER") 2001-007-00 (December 12, 2001). This LER reports an issue involving the identification of inadequate work practices in the past at Millstone Unit 2. This Unit 2 LER on its face has nothing to do with the issues in this Unit 3 proceeding. It evidences little more than a reporting/corrective action process working as intended. Indeed, it actually tends to demonstrate the current capabilities at Millstone to identify and address past problems.

1 issue relates to two isolated fuel rods. Nothing in this Unit 1 matter challenges the margin-of-safety involved in License Amendment 189.

As discussed above, at Unit 3 fuel rods are stored in the FSB which is controlled in the same manner as a fuel assembly. From a criticality perspective, the FSB is treated as any other fuel assembly. Based on its contents at the time, a determination is made as to the regions in the SFP (Region 1, 2, and/or 3) for which the FSB is qualified for storage. With only one fuel rod, the effect of the FSB on the K_{eff} of the spent fuel pool is negligible. McKenney Affidavit, ¶ 26. The FSB currently can be stored in any region of the SFP, so misloading of the FSB would not be significant from a criticality perspective. *Id.*, ¶ 27. Nonconservatisms in reactivity equivalencing calculations as reported in NRC Regulatory Issue Summary 2001-12, dated May 18, 2001, do not change these conclusions. Parillo Affidavit (2001), ¶¶ 4-10. The clear, undisputed evidence related to criticality matters completely repudiates Contention 4 and the Reopened Issue. There simply is no substance to the Intervenors' claim that License Amendment 189 would somehow lead to a criticality event. The Reopened Issue and Contention 4 should be dismissed.[10]

[10] The lack of substance and understanding in the Intervenors' case is dramatically exposed by their March 7, 2002 response to DNC's interrogatories of January 25, 2002 in this reopened proceeding. In Interrogatory 9, DNC asked the Intervenors to explain how the loss of individual fuel rods would lead to a criticality event in the Unit 3 SFP (the very focus of Contention 4). Intervenors' counsel found this simple question, directed at the ostensible point of the Intervenors' own contention, to be "nonsensical." Clearly it is the Intervenors' response that is, in context, nonsensical. The Intervenors clearly have nothing of technical merit to offer to the Licensing Board.

C. Responses to Licensing Board Questions

The following provides cross-references to DNC's sworn testimony that responds to Judge Kelber's questions for DNC made during prehearing telephone conference calls of May 24, 2001 and February 28, 2002:

	Question	Affidavit/Exhibit
1.	Describe Unit 2 and Unit 3 Technical Specifications and regulations governing SFP inventory and corresponding plant procedures.	McKenney Affidavit, ¶ 53 (see also ¶¶ 9-11, 15-23)
2.	Provide any computer-generated core and SFP inventories for Unit 1 and Unit 3.	McKenney Affidavit, ¶ 54 (see also ¶ 21); Exhibits 1-3
3.	Discuss any industry use of bar codes as a means to control fuel inventory.	McKenney Affidavit, ¶¶ 55-58
4.	Discuss the applicability to Millstone Unit 3 of Regulatory Issue Summary 2001-12, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations," dated May 18, 2001.	Parillo Affidavit, ¶¶ 4-10
5.	Describe how the Corrective Action Program was applied for the Unit 1 issue to Units 2 and 3.	McKenney Affidavit, ¶¶ 60-61, ¶¶ 43-48; see also Exhibit 5 and Expert Panel Affidavit, ¶¶ 20-51

D. Conclusion on Reopened Issue

Based upon the above, there is no genuine and substantial dispute of fact raised by the Reopened Issue that would justify an adjudicatory hearing on reopened Contention 4.[11] It is undisputed that NNECO lost accountability and, most likely, control over two fuel rods removed from fuel assembly MS-557 at Millstone Unit 1 in the early 1970's. However, the evidence shows that this event does not bear upon the adequacy of the administrative controls employed

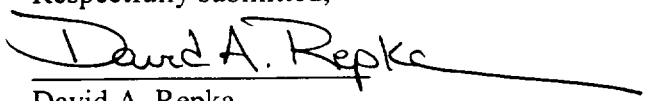
[11] As noted above, the scope of the Reopened Issue is ultimately bounded by Contention 4, because that contention was the basis for the Licensing Board's jurisdiction over the fuel rod matter.

by DNC today at Millstone Unit 3 — most particularly those administrative controls used for control of fuel assemblies in order to implement the reactivity limits of License Amendment 189. There is no genuine and substantial dispute of fact, much less one that could be resolved with sufficient accuracy only through the introduction of evidence at a hearing, or one that is central to the Licensing Board's or the Commission's ultimate decision on the Reopened Issue and Contention 4.

V. Conclusion

For the reasons discussed in this written summary, and based upon the complete evidentiary record in this proceeding, there is no genuine and substantial issue of fact to be resolved in an adjudicatory hearing. In accordance with 10 C.F.R. § 2.1115 (a)(2), the Reopened Issue should be resolved in favor of DNC. Contention 4 should be dismissed and this proceeding should be terminated.

Respectfully submitted,



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Dated in Washington, D.C.
this 18th day of March 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50-423-LA-3
	)	
(Millstone Nuclear Power Station, Unit No. 3)	)	ASLBP No. 00-771-01-LA-R
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Summary of Facts, Data, and Arguments On Which Dominion Nuclear Connecticut Will Rely at the Reopened Proceeding Subpart K Oral Argument" in the captioned proceeding have been served on the following by deposit in the United States mail, first class, or as noted by an asterisk (*) by placement with Federal Express for overnight delivery, this 18th day of March 2002. Additional e-mail service has been made this same day as shown below.

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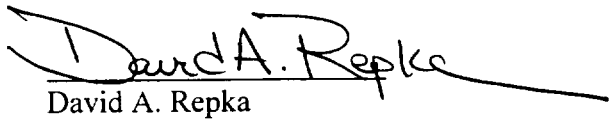

David A. Repka
Counsel for DNC, Inc.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50-423-LA-3
	)	
(Millstone Nuclear Power Station, Unit No. 3)	)	

AFFIDAVIT OF HUGH McKENNEY

I, Hugh McKenney, being duly sworn, state as follows:

1. I am a nuclear engineer employed by Dominion Nuclear Connecticut, Inc. ("DNC"). I am currently a supervisor, responsible for the reactor engineering team at Millstone Power Station. My responsibilities encompass Millstone fuel handling procedures, review and approval of nuclear material transfer documents, and approvals of surveillances related to fuel handling.

2. The Atomic Safety and Licensing Board ("ASLB") has reopened the record with respect to Contention 4 in this proceeding related to License Amendment 189. The License Amendment was issued on November 28, 2000 and authorized increasing the capacity of the Millstone Unit 3 Spent Fuel Pool ("SFP"). The License Amendment also authorized a three-region SFP configuration, with fuel storage in each region governed by fuel reactivity considerations. Contention 4 deals with the alleged complexity of the administrative controls employed to prevent an accidental criticality in the SFP. The purpose of this affidavit is to

respond to the issues raised by the ASLB and the Intervenors in connection with the decision to reopen the record on Contention 4.

3. At the time License Amendment 189 was issued, Northeast Nuclear Energy Company ("NNECO") was the Millstone licensee. DNC is now the licensee for Millstone Power Station. Previous affidavits in this proceeding have addressed the controls that NNECO, and now DNC, have implemented at Millstone Unit 3 with respect to the handling and placement of fuel assemblies in the three-region SFP, and why these controls provide reasonable assurance that there is no undue risk of a criticality accident in the Millstone Unit 3 SFP. However, in light of the event at Millstone Unit 1 involving two missing fuel rods, the ASLB has questioned "the relationship, if any, between the errors leading to the misplacement or loss of the two fuel rods from the Millstone–1 SFP and current operations at the Unit–3 SFP." Accordingly, in this affidavit, I address the implications of the Unit 1 issue for the SNM controls relevant to the License Amendment for Unit 3.

4. In this affidavit I will address a number of topics in response to the ASLB's question regarding the relationship between the two lost fuel rods at Unit 1 and current procedures to support the reconfigured Unit 3 SFP. First, I will summarize the controls described in the earlier testimony in this matter that are used to control fuel assembly movements. These procedures assure that criticality is maintained within specified limits during and following movement of fuel assemblies. Second, I will address how these controls were successfully applied in the most recent refueling outage at Unit 3. Third, I will summarize the SNM inventory control procedures that apply at Millstone Unit 3. These controls apply to, among other things, both intact fuel assemblies and individual fuel rods removed from assemblies. Fourth, I will describe how individual fuel rods removed from a fuel assembly are

stored in a dedicated storage container at Unit 3. Fifth, I will discuss how DNC conducts periodic surveys, inventories, and reconciliations of SNM at Millstone Unit 3. Sixth, I will discuss the reviews and verifications that have been performed to confirm that SNM has been successfully controlled in the past at Millstone Unit 3, particularly with respect to fuel rods removed from assemblies. These efforts have specifically confirmed that the Unit 1 experience did not extend to Unit 3. Seventh, I will discuss the root cause assessment related to the Unit 1 issue and the improvements made to the Unit 3 process as a result of the lessons learned. Finally, I will respond to Judge Kelber's questions from a prehearing conference held in connection with this matter.

Professional Qualifications

5. I hold a B.S. degree in Nuclear Engineering from the University of Lowell in Lowell, Massachusetts

6. I have been employed at Millstone Power Station for 6 years, first by NNECO from February 1995 through March 2001, and now by DNC.

7. Prior to my employment at Millstone, I worked as a Reactor Engineer employed by Yankee Atomic Electric Company from 1986 to 1995. During that time I was responsible for SNM inventory control. During my employment by NNECO at Millstone Unit 3, I have also been assigned to Reactor Engineering and have specifically performed duties associated with the SNM inventory control program, such as initiating Material Transfer Forms, performing physical inventories, and participating in refueling activities. I have also specifically filled SNM control functions related to fuel movements in the SFP. In Fall 2000, I was selected as the Reactor Engineering team lead for the Millstone Power Station and have served in that capacity since.

8. A copy of my complete professional qualifications is included as Attachment A to this affidavit.

Millstone Unit 3 Fuel Assembly Controls

9. As previously discussed in this proceeding, License Amendment 189 authorized NNECO, and now DNC as the license transferee, to install and use additional storage racks in the Millstone Unit 3 SFP. In addition, the License Amendment included Technical Specifications defining three storage regions in the SFP, with limits on the fuel assemblies that may be stored in each of the regions. The limits are based upon fuel reactivity considerations (*i.e.*, enrichment, burnup, and decay time). These controls replaced the previous controls for the Unit 3 SFP that defined two regions with storage limitations based on enrichment and burnup. The new racks have been installed at Millstone Unit 3 and the new 3-region controls are in place. They were successfully implemented during Refueling Outage 7 ("RFO 7") in early 2001, as is described in more detail below.

10. Also as previously discussed in this proceeding, NNECO in the past, and now DNC, utilize a variety of controls to assure that fuel assemblies are properly placed in regions for which they are qualified. These include:

- QA calculations to obtain measured fuel burnup;
- Dual review of the determination that a fuel assembly meets the reactivity limits of the applicable Technical Specification; and
- Controls on the movements of fuel assemblies.

11. As discussed in the prior affidavit of Michael Jensen in this proceeding, procedure EN-31022, "Spent Fuel Pool Criticality Requirements," provides administrative controls to ensure that only fuel assemblies qualified for a particular SFP region are moved to that region.

As also discussed in Mr. Jensen's prior affidavit, fuel assembly movements are specifically controlled in accordance with several procedures, including MC-5, "Special Nuclear Material Inventory and Control;" EN 31001, "Supplemental SNM Inventory and Control;" and EN 31026, "New Fuel Assembly and Insert Receipt and Inspection." These procedures remain in effect and provide reasonable assurance that fuel assemblies will be moved to a region for which they are qualified, even with the implementation of the third region established by License Amendment 189. These are the controls that directly assure that fuel assembly movements are positively controlled and that the SFP will remain in a non-critical configuration.

Implementation of Controls During RFO 7

12. At Millstone Unit 3, the new spent fuel pool configuration — that is, the new racks, new region designations, and new reactivity limits — were implemented prior to RFO 7. During outage RFO 7, which dated from February 3, 2001 to March 31, 2001, NNECO/DNC managed almost 400 fuel assembly movements. These included moves of used fuel from the core to the SFP, and moves of new fuel and used fuel from the SFP to the core. In addition, NNECO managed 129 fuel moves within the SFP related to establishing the new pool configuration. There was no SFP criticality event before, during, or after the outage. Also, no fuel assemblies were mis-loaded.

13. During RFO 7, NNECO (the licensee at the time) initiated one condition report ("CR") related to fuel movement. This CR, dated February 16, 2001, documented that, while moving fuel assembly J28 to SFP storage location 1C-29, the fuel handler inadvertently positioned the refueling bridge over location 1C-28. The checker (required by procedure) identified the discrepancy. The fuel assembly was never lowered. This was an example where the verification procedure worked exactly as designed, and a potential error was avoided. The

plant corrective action process was used to identify the apparent cause and corrective actions were taken. It should also be noted that — from a nuclear criticality perspective — fuel assembly J28 was qualified for placement in both SFP locations 1C-28 and 1C-29.

14. The RF07 refueling operations, including fuel movements, were conducted under the oversight of the NRC inspection staff. Based upon a review of NRC inspection reports covering the relevant time period, DNC is not aware of any NRC findings regarding implementation of the Unit 3 administrative controls related to handling and placement of fuel assemblies in the spent fuel pool regional storage configuration. *See* NRC Inspection Report No. 05000423/2000-14 (March 23, 2001), at 7; NRC Inspection Report No. 05000423/2001-002 (May 4, 2001), at 10.

Millstone Unit 3 SNM Accountability Controls

15. A prerequisite for fuel SNM inventory control at Millstone Unit 3 is a complete and accurate characterization of all fuel at the unit. Therefore, whenever fuel (or any SNM greater than 0.5 grams) is shipped, a Department of Energy ("DOE")/NRC Form 741 ("Special Nuclear Material Transaction Report") is required from the shipper (at the time of shipment) and from the recipient (upon receipt). These forms are filed with the government and tracked under the Nuclear Material Management and Safeguards System ("NMMSS"). In the case of fuel received onsite at Millstone Unit 3, DNC verifies the serial number. This verification would apply equally for a fuel assembly or a fuel rod. (The unit of SNM delivered is usually a fuel assembly and the serial number of the assembly is verified. If the unit were a fuel rod, the serial number of the rod would be verified.) DNC also verifies the shipper's Form 741 and sends the appropriate recipient's Form 741. These 741 forms allow DNC and the government to account for the inventory of fuel at Millstone Unit 3 by, in effect, a double accounting.

16. The gross weight of all SNM located at Millstone is reported every 6 months in a DOE/NRC Form 742 ("Semi-Annual SNM Balance Reports"). In issuing a Form 742, the totals are updated to reflect shipments received onsite or sent offsite, and changes in isotopic inventory based upon burnup and decay (as calculated using computerized material balance models) since the prior Form 742 was filed.

17. DOE, through the NMMSS, will publish data as requested summarizing SNM transactions for each NRC licensee over a specified period of time in a "TJ23 report." A TJ23 report allows the licensee to benchmark or reconcile licensee records versus the government's records. In addition, when a licensee files the semi-annual Form 742 report, the NMMSS will reconcile the licensee data reflected in that report versus the government's database. This process assures that the licensee is maintaining SNM accountability and control on a material balance level.

18. The process of subsequently controlling fuel inventory involves, simply stated, defining the storage configuration, documenting each fuel movement, and updating the record of the storage configuration. At Millstone Unit 3, this process for SNM accountability is also governed by procedures MC-5 and EN 31001. In addition to ensuring that fuel movements are controlled to assure that the fuel is placed in an appropriate location (in both the core and the SFP), these procedures address the paperwork required to assure that the location of the fuel is known and documented. These procedures establish a number of checks and balances that provide reasonable assurance that a loss of accountability over fuel rods such as occurred at Millstone Unit 1 will not occur at Millstone Unit 3.

19. Importantly, as further discussed below in connection with the event at Millstone Unit 1, procedure MC-5 defines a unit of SNM as including, among others, both "fuel

assemblies" and "fuel rods." Therefore, the Unit 3 accountability controls apply equally to a fuel assembly or to an individual fuel rod that has been removed from an assembly. They apply when these units of SNM arrive onsite, when they are moved around the station (*e.g.*, between the core and the SFP, from one SFP location to another), or if and when SNM units are shipped offsite. The controls are summarized in the following paragraphs.

20. In accordance with the procedures, Millstone Unit 3 tracks the specific location of SNM via a "SNM card file." A "card" is prepared for each fuel assembly or each fuel rod. The card serves as a file of the movement history and the record of the current location/status of each unit of SNM. The SNM card file is updated after every SNM move.

21. In addition, pursuant to procedures, and unlike Unit 1 in the 1970's and 1980's, an electronic database is now maintained at Millstone that provides the current location of fuel in the SFP and the reactor core. This database, utilizing software known as Shuffleworks, was developed by Westinghouse/ABB and is a common SNM accounting tool in the nuclear industry. Shuffleworks allows the user to prepare documentation and track SNM moves in the SFP or in the reactor core. Shuffleworks also allows a "Before and After" comparison of the SFP and reactor core. This tool is used to ensure that fuel assemblies are properly placed in the designated SFP locations. Further, it can be used to provide a summary of the current locations of all fuel assemblies and fuel rods in the core or SFP.

22. Essentially, pursuant to the procedures, the movement of an SNM unit is controlled by a Material Transfer Form ("MTF"), Refueling Worklist, or other traveler. These are known as the History of Movement Records. They show a "from" and "to" location for each move for each unit of SNM. Upon completion of any move from one specific and unique location (*e.g.*, an SFP rack location) to another specific and unique location (*e.g.*, the core, a

different SFP rack location), the SNM Bookkeeper is required by procedure to update the SNM card file and the electronic Shuffleworks database to reflect the new location of the SNM item. Therefore, the card file and the database both reflect the current location for an SNM unit.

23. The information from the card file or the Shuffleworks database can be utilized to generate spent fuel pool and core maps. The maps are discussed further below in response to one of Judge Kelber's specific questions in this proceeding.

Individual Fuel Rod Storage Practices at Unit 3

24. A typical Millstone Unit 3 fuel assembly contains 264 fuel pins. At Millstone Unit 3, unlike Millstone Unit 1 in the 1970's and 1980's, any fuel rod permanently removed from a fuel assembly, when an assembly is reconstituted, is stored in a container called the Fuel Storage Basket ("FSB"). The Unit 3 spent fuel pool currently contains only 1 fuel rod. That rod is in fact stored in the FSB.

25. The purpose of the FSB is to act as a storage location for defective fuel rods. There is only 1 FSB for Unit 3. (The new racks do not change that fact.) The FSB is an array of 52 tubes configured in a specified center-to-center pitch of the tubes. The size of the FSB is about the size of a fuel assembly. *The FSB is stored in the fuel storage racks in the same way as a fuel assembly is stored.* The one fuel pin currently stored in the FSB is a failed fuel pin which was removed from a fuel assembly after one cycle of operation, and placed into the FSB in 1995.

26. Since the FSB contains only 1 fuel rod at this time, its effect on K_{eff} of the spent fuel pool is negligible. As a result, the FSB currently may be stored in any open fuel storage location in the Unit 3 spent fuel pool. While the FSB may be moved to different fuel storage locations in the spent fuel pool, the individual fuel rod in the FSB cannot be easily removed from the FSB. It is not credible that the rod could be inadvertently removed from the FSB during FSB

handling, due to the fact that the FSB handling tool cannot contact the stored fuel rod. A fuel rod stored in the FSB can only be removed from the FSB with special tooling, which is not currently available on-site. This special tooling would only be available during procedurally controlled evolutions, such as the one that initially stored the pin into the FSB. Hence, the individual fuel rod can only be moved as the FSB is moved. Should the FSB be misplaced or dropped, the reactivity effect is negligible and certainly bounded by the analyzed licensing basis misplacement or dropping of a fresh 5 weight-percent U-235 fuel assembly.

27. For both the prior spent fuel storage regions or the new regions that incorporate the new Unit 3 racks, considering the above criticality considerations, there are no special or additional Millstone Unit 3 administrative requirements relating to criticality control due to the storage of the one fuel rod in the FSB. *The FSB can be stored in any region of the spent fuel pool.*

28. If, in the future, additional fuel rods, are required to be stored in the FSB, the design change and procedure change processes would identify whether any restrictions would be required for the FSB, with regard to which regions of the spent fuel pool it can be stored in. If, as a result, the FSB could be stored only in certain regions of the spent fuel pool, the administrative controls are still not changed. The FSB would be treated as any other fuel assembly which can only be stored in certain regions of the spent fuel pool. That is to say, no new procedure or administrative requirements would be necessary, other than to add the FSB to the list of which fuel assemblies are qualified for storage in Region 1, 2 or 3.

29. The location of the individual fuel rod and the FSB are tracked by the procedures described above, similar to how a fuel assembly is tracked. If a fuel assembly is ever disassembled such that individual fuel rods are separated from the fuel assembly, procedure MC-

5 requires there will be a file card for the individual fuel rods removed from the assembly. For Millstone Unit 3, this file card would show that the fuel rods have been moved to the Unit 3 FSB described above. There is an additional "file card" for the FSB showing the location of the basket in the SFP storage racks.

Periodic Surveys and Inventories

30. In accordance with 10 C.F. R. § 70.51 and procedure MC-5, all SNM at Millstone is inventoried at intervals not to exceed 12 months. This physical inventory involves a piece count of all fuel assemblies in the Reactor Core and the SFP. Based upon the Unit 1 issue, the SNM program has also recently been modified to clarify the Inventory of Record of all SNM materials at each Millstone Unit. For fuel SNM, the "Inventory of Record" has been procedurally defined as the maps of the SFP and the Reactor Core. This Inventory of Record will be updated at least twice a year at the end of the First and Third Quarters. The Inventory of Record will also be updated during the annual physical inventory, if it falls between the other scheduled updates. All other SNM databases (the card file, Shuffleworks, the Form 741s and NNMMS TJ23 reports) will be reconciled against the Inventory of Record every 5 years. This reconciliation will assure a complete and accurate Inventory of Record to serve as the baseline for the periodic inventories of SNM/configuration at the unit.

31. During a periodic inventory, the Reactor Core and SFP maps are updated based on History of Movement Records since the last physical inventory. This process assures that the Reactor Core and SFP maps are maintained as an accurate Inventory of Record. The SFP map includes fuel assemblies and the FSB.

32. Fuel in the Reactor Core cannot be verified via a piece count because, during operation, the reactor head cannot be removed to conduct a piece count. The procedure therefore

allows verification of SNM inventory in the Reactor Core by confirmation that the reactor is operating (the head has not been removed since the reload).

33. As discussed in the prior affidavit of Mr. Jensen, more specific SNM inventory verifications are integrated to the core reloading process. For fuel assemblies loaded or reloaded into the Reactor Core, a serial number verification is performed, in accordance with plant procedures, to ensure that each fuel assembly has been placed into its proper reactor core location. In the SFP, after the core load is complete, a verification by piece-count is performed. This piece-count verification in the SFP confirms that there is a fuel assembly in each designated fuel storage location, and that no fuel assembly is present in fuel storage locations that should be empty.

34. As a result of lessons-learned from the Unit 1 experience, procedure MC-5 has also been enhanced to require serial number verification of fuel assemblies in the SFP once every twelve months, for all fuel assemblies moved since the prior such verification. A "baseline" fuel assembly serial number verification for Unit 3 was performed in 1999. An additional "baseline" fuel assembly serial number verification for Unit 3 will be performed later this year to support the procedural enhancement going forward. Fuel assembly serial number verifications have also been performed at Millstone Unit 3 in the past. A serial number verification was performed on all fuel assemblies that were moved into the new storage racks in the Unit 3 SFP with the issuance of License Amendment 189. In this process serial numbers for approximately 100 fuel assemblies were verified prior to placing the assemblies in the new racks.

35. During the procedurally-required reconciliation of the Inventory of Record against the other SNM databases (the card file, Shuffleworks, Form 741s, and TJ23 reports) discussed above, it is important to note that the Shuffleworks program output will be reviewed

against the card file, and the card file will be compared to the Shuffleworks output (*i.e.*, two-way inclusive reviews). The station records also will be reviewed to ensure that all NRC 741 forms are accounted for and that they match the NRC records listed in the TJ23 reports. Any discrepancy noted between the databases and the Inventory of Record will be investigated and corrected. All corrective actions will be controlled by the station Corrective Action Program. By performing this SNM reconciliation every 5 years, coupled with the enhanced serial number verification process described above, SNM at Unit 3 is ensured to be adequately controlled.

Unit 3 Fuel Inventory Records Review

36. Shortly after the determination the two fuel rods were unaccounted for at Unit 1 and the Unit 1 report was made to the NRC, NNECO initiated a review of historic SNM inventory and control practices at Millstone — specifically with respect to individual fuel rod movement. The review was designed to determine whether (in contrast to the Unit 1 situation) records exist for individual fuel rod movements that adequately document SNM accountability and whether there were SNM accountability controls employed at the time the rods were moved. From the review it was determined that only one individual fuel rod that has been permanently removed from fuel its assembly at Millstone Unit 3. The fuel rod has been tracked and properly stored in the spent fuel pool.

37. For Millstone Unit 3, the records reflect that, since operation of the unit began, only 15 individual fuel rod movements (that is, apart from an assembly movement) have been made. Only one fuel rod has been permanently removed from its host assembly. More specifically, at Millstone Unit 3, one fuel rod was removed from a single fuel assembly in 1995 during fuel reconstitution. Five fuel rods from two assemblies were removed, inspected, and

returned to their original fuel assemblies in 1993. Nine fuel rods from three fuel assemblies were removed, inspected, and returned to their original assemblies in 1999.

38. The fuel rod movement for the 1995 reconstitution (the one that resulted in one rod being permanently removed from its host assembly) was documented by a fuel reconstitution vendor procedure, a Material Transfer Form, and in the SNM card file. The single leaking fuel rod was removed from the fuel assembly and placed into the FSB. The FSB is and always has been stored in a spent fuel storage rack cell. As discussed above, the storage location of the FSB is documented on spent fuel pool inventory maps and its presence is periodically verified by the physical inventories of the spent fuel pool.

39. The fuel assembly and fuel rod movements for the 1993 fuel inspection (in which no rods were permanently removed from a host assembly) were documented by a vendor procedure which was used in place of Material Transfer Forms. The fuel assembly movements were documented in the SNM card file to provide a permanent record of the fuel assembly movement. The fuel rods were removed from the fuel assembly one rod at a time, inspected, and returned to their original locations within the fuel assembly.

40. The fuel assembly and fuel rod movements for the 1999 inspection (again, in which no rods were permanently removed from a host assembly) were documented by a vendor procedure and by Material Transfer Forms. The fuel assembly movements were documented in the SNM card file to provide a permanent record of the fuel assembly movement. The fuel rods were removed from the fuel assembly one rod at a time, inspected, and returned to their original locations within the fuel assembly.

41. We concluded from the review of the records and the controls and accountability practices employed that Millstone Unit 3 has maintained effective accountability of individual

fuel rods. The controls at Millstone Unit 3 have treated the fuel rod as a separate unit of SNM and have required documenting of fuel rod movements using either a procedure, traveler, or Material Transfer Form — resulting in multiple, redundant records.

42. In addition, we determined that the removed fuel rod at Millstone Unit 3 has always been treated similar to fuel assemblies and stored in the spent fuel storage racks. Unlike Unit 1, it has never been the practice at Unit 3 to store irradiated fuel assemblies or fuel rods outside of approved storage rack locations.

43. In addition to the retrospective review of records and procedures described above, DNC conducted a physical verification of the fuel rod at Unit 3 that has been removed from its host assembly. DNC visually verified the presence of the one Unit 3 fuel rod that has been removed from its host assembly and located in the FSB.

Inventory Reconciliation

44. To validate the current Millstone Unit 3 SNM databases and Inventory of Record, DNC also performed an overall reconciliation of records. This involved several steps. First, all Millstone Form 741s for receipt and transfer of SNM for the units were collected to establish a per unit aggregate inventory. Second, TJ23 reports from NMMSS were collected to establish the government's inventory for the Millstone units based on the government's Form 741s. DNC determined that the Millstone and government piece counts for fuel assemblies match and that the Millstone and government Form 741s match. Review of these two inventories identified only minor discrepancies (*i.e.*, typographical). The two inventories of SNM were therefore validated to each other. Third, to assure consistency between DNC's internal records, DNC validated the card file against the Shuffleworks database (piece count and location), and

validated the Shuffleworks database against the card file (again, piece count and location). No discrepancies were identified for SNM.

45. As part of this reconciliation effort, official Millstone records were also updated to assure full compliance with NRC records retention requirement.

Root Cause Report — Corrective Actions

46. DNC has reviewed and adopted the root cause report developed by the Root Cause Assessment Team ("RCAT") associated with the Unit 1 fuel rod issue (Exhibit 5). Many of the procedural enhancements, inventory verifications, and records reconciliations discussed above were directly responsive to the findings and observations of the RCAT. As a root cause of the Unit 1 issue, the RCAT found an over-reliance on the Reactor Engineer to compensate for weaknesses that existed at the time in the procedural controls applicable to Unit 1. The RCAT and DNC therefore focused on the adequacy of the current procedural controls. The RCAT specifically evaluated the extent of condition and the relevant attributes of the procedural controls as they apply today at Millstone Unit 3. The RCAT specifically found that the Unit 1 issue did not extend to control of fuel assemblies. Moreover, the RCAT found that Unit 3 is not similarly vulnerable to physical loss of fuel rods. The RCAT further determined that the factors contributing to the loss of the Unit 1 fuel rods are not applicable today at Unit 3.

47. On page 56 of the RCAT Report, the RCAT presented color-coded "windows" assessing the adequacy of individual attributes of the procedural controls related to SNM. For Unit 3, all of the attributes were rated as either "white" (meets requirements) or "green" (no obvious improvement opportunities). With respect to the "white" attributes, the RCAT completed its report before DNC had identified and completed all of its procedural corrective actions. Many of the actions and enhancements described above respond directly to these

"white" attributes. For example, the Inventory Records "white" is being addressed by defining the Inventory of Record as discussed above. The Inventory Reconciliation "white" has been addressed by the reconciliation completed and described above, and by enhancing the procedure to repeat the reconciliation every 5 years as also described above.

48. Ownership and Oversight are two other attributes touched upon by the RCAT. This issue is being addressed by Mr. Daniel Meekhoff in a separate affidavit in this proceeding. In addition, however, it is important to point out that, based upon the RCAT observations, the ownership of the SNM Control and Accountability Program has been communicated to the Millstone organization. The program owner is the Manager of Nuclear Fuels Engineering. This manager is responsible for the program, for the implementing procedures, and for oversight of the program.

Differences Between Unit 3 and Unit 1

49. One important difference between Millstone Unit 3 today and Millstone Unit 1 at the time accountability for the two fuel rods was lost was the procedural difference highlighted by the RCAT. At Millstone Unit 1 at the time, the procedure did not define an item of SNM in a way that captured individual fuel rods. Since Unit 3 began commercial operation, Unit 3 procedures have defined an individual rod removed from a fuel assembly as an item of SNM, assuring control if a rod is removed from an assembly.

50. Another important difference highlighted by the RCAT was the practice at Unit 1 of storing individual fuel rods in containers outside the fuel storage racks. This significantly contributed to the likelihood that the two Unit 1 fuel rods were cut up and disposed of as non-fuel radioactive material. At Unit 3, individual fuel rods are (and have been) stored in the FSB in the storage racks. The rods cannot be easily mistaken for other waste or easily removed.

Moreover, Boiling Water Reactors, such as Millstone Unit 1, generally have more non-fuel related waste components than Pressurized Water Reactors such as Millstone Unit 3. Consistent with this, Unit 1 had more non-fuel waste (such as local power range monitors) outside the racks than Unit 3.

Other Non-Fuel SNM

51. I am aware that in the past NNECO filed two Licensee Event Reports ("LERs") for Millstone Unit 1 related to loss of non-fuel SNM items. One, LER-94-016-00, was filed May 23, 1994, reporting two Millstone Unit 1 Intermediate Range Monitors ("IRM") that could not be accounted for. IRMs are nuclear instruments used to detect power level. It was determined that the two IRMs most probably were disposed of as low level radioactive waste. The other, LER-91-001-01 was an LER update filed on April 4, 1994 related to the loss of a sealed 1 mCi Cesium-137 source at Unit 1. Neither LER involved fuel rods or fuel assemblies and both LERs included a discussion of corrective actions.

Responses to Judge Kelber's Questions

52. During a prehearing telephone conference call conducted by the Licensing Board on May 24, 2001, Judge Kelber directed three questions to DNC regarding the issues in this proceeding. The following responds to those questions.

53. Describe the Unit 1 and Unit 3 Technical Specifications and regulations governing the SFP inventory and the corresponding plant implementing procedures: There are no Technical Specifications for either Millstone Unit 1 or Unit 3 which govern SNM inventory. Rather, the operating licenses for both units invoke the requirements of 10 C.F.R. Part 70, "Domestic Licensing of Special Nuclear Material," which requires that licensees establish procedures and records for SNM inventory control. For Millstone Unit 3, the key procedures

responding to this requirement are procedures MC-5 and EN 31001, which are discussed above. (In addition, while not related to SNM inventory, Unit 3 procedure EN 31022 addresses SFP criticality requirements. This procedure defines the controls to implement Technical Specification controls on reactivity related to regional storage.) For Millstone Unit 1, an additional procedure, EN 1067, "Supplemental Procedure for Inventory and Control of Special Nuclear Material," applies. (Technical Specifications related to the spent fuel pools address design features and limiting conditions for operation. These Technical Specifications address matters such as reactivity limits, fuel storage capacity, and soluble boron concentrations.)

54. Provide the Licensing Board with any computer-generated core and SFP inventories for Unit 1 and Unit 3: As discussed above, both Millstone Unit 1 and Millstone Unit 3 now use the Shuffleworks program to assist in the planning of movements of fuel assemblies and other components, both in the core and in the SFP, and for maintaining the record of the status of SNM items. (Shuffleworks was adopted at the Station in the 1990's and did not exist at the time accountability over the two Unit 1 rods was lost.) The Shuffleworks program can be used to generate maps showing the locations of fuel assemblies and other special nuclear material (such as rods or the FSB) in the core or in the spent fuel pool. A copy of an illustrative Millstone Unit 1 spent fuel pool map as generated by Shuffleworks is Exhibit 1. There is no fuel presently in the Unit 1 core, and therefore no Unit 1 core map. A copy of illustrative maps for the Unit 3 core and SFP are Exhibits 2 and 3. (Note that due to printing limitations, the SFP maps are originally printed as a number of maps, each addressing individual storage rack modules. Those module maps have been combined to create the overall Unit 3 SFP map. Note also that the Exhibits are not necessarily the current maps.)

55. Discuss whether there is any use in the nuclear industry of bar codes as a means to control SNM inventory. Bar code systems are currently used by different fuel assembly manufacturers to identify individual fuel rods during fuel assembly manufacturing. The bar codes are laser etched onto the fuel rod tube or bottom end plug. The bar codes are read by special machines during the manufacturing process. However, these fuel rod identification numbers are not readily visible or readable after the fuel assembly construction is complete (due to their location within the fuel assembly). Additionally, these bar codes are very likely not readable following operation due to the formation of the oxide layer and crud on the outside surface of the fuel rod.

56. Fuel assemblies are identified by unique identification numbers that are engraved onto their upper end fittings. Each fuel assembly has a unique plant specific "batch" identification number (*e.g.*, A16, B07, H73, etc.) and may also contain a unique "ANSI" identification umber. The plant typically uses the "batch" number when developing fuel movement sequences and inventory maps, since the "batch" number is visible when viewed from above with the assembly in either the reactor core or the spent fuel storage racks. The fuel assembly identification number is verified using an underwater television camera.

57. The "ANSI" identification number is provided per the requirements of American National Standard Fuel Assembly Identification, ANSI/ANS-57.8-1978. This standard describes a system for the unique identification of nuclear fuel assemblies. This uniqueness is provided by assigning each fuel assembly a fabricator or facility identification prefix and a serial number. However, the "ANSI" identification numbers were not widely used until after 1975. Additionally, the "ANSI" numbers are only visible when viewed from the side of the fuel

assembly and are not visible when viewed from above when the fuel assembly is in the core or spent fuel storage racks.

58. I am not aware of any plants in the U.S. nuclear industry which use bar codes for identification and tracking of fuel assemblies. In fact, an automated inventory system using bar codes (or a similar system) is very likely not feasible for the following reasons:

- Bar codes (or a similar system) would probably be made unreadable by the deposition of oxides or crud onto the surface that occurs during the normal service of the fuel assembly in the nuclear reactor.
- Bar codes (or a similar system) in recently discharged fuel assemblies would probably be made unreadable by the distortion caused by convection currents created by the high temperature water flowing past the fuel assembly. Recent developments in digital camera technology have improved the ability to read "batch" serial numbers when a significant heat induced distortion exists. DNC utilizes this technology at Millstone to read "batch" serial numbers during serial number verifications described above. However, a digital camera and computer technology used to automatically scan and interpret bar codes would be "state-of-the-art." This type of camera system is not presently available to Millstone.
- There are no fuel assembly bar codes on any fuel assemblies currently stored in the Millstone 3 spent fuel pool. Based on the following, it would be impractical to add bar code tags to the existing fuel assemblies:

- The bar code tags would have to be mechanically attached to the assembly upper end fitting using some sort of metal tie wrap or clip. This could only be accomplished by underwater tooling.
- The addition of bar code tags and their attachments would create the potential for foreign material to enter the reactor coolant system and potentially damage the fuel clad or reactor coolant components.
- The bar code tags would have to be physically removed from fuel assemblies before the assemblies could be re-used in the reactor.

In conclusion, an automated SNM inventory system using bar codes (or a similar system) does not appear to be a practical alternative for stored spent fuel assemblies.

59. During a prehearing telephone conference call conducted by the Licensing Board on February 28, 2002, Judge Kelber directed two more questions to DNC. One of these questions is being addressed in a separate affidavit of Joseph Parillo. The second question is addressed below.

60. Describe how the corrective actions resulting from the Unit 1 issue were addressed for Units 2 and 3: As discussed in Paragraphs 46 and 47 above, DNC reviewed and adopted the comprehensive root cause and "extent of condition" assessment of the RCAT. The RCAT Report (Exhibit 5) included the team's analysis of the implications of the Unit 1 issue for Units 2 and 3 (see Section 4.5.2 of the RCAT Report). The RCAT concluded that:

- None of the Millstone Units is vulnerable to a similar event;
- Loss of fuel control and accountability was limited to the two MS-557 fuel rods for the entire station; and

- The way in which SNM is controlled and inventoried in 2001 is substantially different than at Unit 1 when the event occurred in the 1970's.

The basis for the RCAT conclusion was presented by showing an assessment of the practices and procedures at Millstone Units 2 and 3 for each of the vulnerabilities identified as relevant to the Unit 1 issue.

61. The RCAT report was treated as an important self-assessment DNC document under the Millstone Corrective Action Program ("CAP"). Specific actions to address observations of the RCAT were identified and implemented through the CAP. (This was done particularly to address areas of "white" classifications. Importantly, demonstrating responsiveness, these actions were initiated based on ongoing discussions with the RCAT and did not await the completion of the RCAT Report.) Specific actions taken with respect to Millstone Units 2 and 3 under the CAP included:

- Fuel records were verified for Units 1, 2, and 3 as part of the inventory reconciliation discussed above;
- Communications were made and procedures were subsequently enhanced to better define the "inventory of record" to be used as the basis for physical inventories; and
- Fuel inventories were reconciled with their respective "inventories of record," as discussed above.

Therefore, the Millstone CAP has been used in this situation to ensure that the root causes of the Unit 1 failure were well-understood, to determine that the Unit 1 issue did not extend to Units 2 and 3, to ensure that the vulnerabilities associated with the Unit 1 event do not apply to Units 2 and 3, and to assure continuous, station-wide improvement in plant processes and procedures.

Conclusions

62. For all of the reasons discussed above, I am confident that the new Unit 3 SFP three-region storage configuration authorized by License Amendment 189 has been and can continue to be successfully implemented. Procedures that apply to movements of fuel assemblies assure that fuel assemblies will be moved to qualified regions. Likewise, the approach utilized for storage of individual fuel rods at Millstone Unit 3 assures positive control of any fuel rods removed from host fuel assemblies. The various reviews, reconciliations, and assessments discussed above also confirm that SNM generally, and fuel rods specifically, have been controlled effectively at Unit 3. In addition, enhanced SNM inventory controls and procedures — such as the Shuffleworks database — are also now in place at Millstone Unit 3 for tracking the movements and location of SNM. I have no concern that the errors leading to the loss of accountability with respect to two Unit 1 rods will recur at Unit 3.

63. The information presented above is true and correct to the best of my knowledge and belief.

Hugh McKenney

Sworn and subscribed to before me on this 14 day of March, 2002.

Notary Public

My Commission Expires: _____

WM. E. BROWN
NOTARY PUBLIC
MY COMMISSION EXPIRES MAR. 31, 2006

ATTACHMENT A

PROFESSIONAL QUALIFICATIONS OF HUGH McKENNEY

Experience: **February 1995 to Present — Millstone Power Station**

Various Positions

Reactor Engineering Supervisor – Responsibilities:

- SNM Program
- Reactor core monitoring
- Engineering support for shift Operations
- Training reactor engineering staff
- Refuel operations of reactor core
- Spent Fuel Pool operations and support
- Reactor start up physics testing
- Site Operations Review Committee - Member
- Emergency Response Organization - Member

Fire Protection Engineering Supervisor - Responsibilities:

- Design configuration of fire safe shutdown systems
- Safe Shutdown Analysis - Owner
- Fire Hazards Analysis - Owner
- Millstone Fire Protection Program - Owner

Senior Engineer - Oversight (Quality Assurance) - Responsibilities:

- Development of initial recovery plan verification for Millstone Engineering
- QA Surveillance of engineering line organization activities

Senior Engineer - Reactor Engineering - Responsibilities:

- Core monitoring activities
- SNM activities
- Refueling activities
- Operations support
- SFP activities

January 1986 to February 1995 — Yankee Atomic Electric Co.

Various Positions

Senior Engineer - System Engineering - Responsibilities:

- Millstone 2 and 3 fire safe shutdown analysis
- Motor operated valve engineer
- Repower design effort, Yankee Nuclear Power Station

Reactor Engineer - Yankee Nuclear Power Station - Responsibilities:

- SNM activities
- Reactor core monitoring activities
- Refueling activities
- Steam generator ISI Program owner
- Station operating experience coordinator
- Shift Technical Advisor - Yankee Nuclear Power Station
- Operations support activities

1984 - December 1995 — University Of Lowell Research Foundation

Operator - University of Lowell Research Reactor - Responsibilities:
USNRC licensed operator - April 1995
Operation and maintenance of 1MW research reactor

Education:

University of Lowell, Lowell MA -
Matriculated - Energy Engineering Masters Program 1984-1985
Graduate, Bachelors of Science - Nuclear Engineering - 1984

B

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50-423-LA-3
	)	
(Millstone Nuclear Power Station, Unit No. 3)	)	

AFFIDAVIT OF DANIEL J. MEEKHOFF

I, Daniel J. Meekhoff, being duly sworn, state as follows:

1. I am employed by Dominion Nuclear Connecticut, Inc. ("DNC") as the Supervisor, Nuclear Operations Support for the Millstone Power Station. My responsibilities encompass the management and oversight of fuel storage and handling for all three Millstone units.

2. The Atomic Safety and Licensing Board ("ASLB") has reopened the record with respect to Contention 4 in this proceeding related to License Amendment 189. The License Amendment was issued on November 28, 2000 and authorized increasing the capacity of the Millstone Unit 3 Spent Fuel Pool ("SFP"). The License Amendment also authorized a three-region SFP configuration, with fuel storage in each region governed by fuel reactivity considerations. Contention 4 deals with the alleged complexity of the administrative controls employed to prevent an accidental criticality in the SFP. In light of the event at Millstone Unit 1 involving two missing fuel rods, the ASLB has questioned "the relationship, if any, between the errors leading to the misplacement or loss of the two fuel rods from the Millstone–1 SFP and

current operations at the Unit–3 SFP." The purpose of my affidavit is to respond in particular to the issue raised by the ASLB and the Intervenors in connection with the decision to reopen the record on Contention 4 related to the implications of the Unit 1 issue with respect to the "willingness and capability" of DNC to implement fuel handling and Special Nuclear Material ("SNM") controls at Millstone.

3. At the time License Amendment 189 was issued, Northeast Nuclear Energy Company ("NNECO") was the Millstone licensee. DNC is now the licensee for Millstone Power Station. Other affidavits in this proceeding address the controls that NNECO, and now DNC, have implemented at Millstone Unit 3 with respect to the handling and placement of fuel assemblies in the three-region SFP, and why these controls provide reasonable assurance that there is no undue risk of a criticality accident in the Millstone Unit 3 SFP. Other affidavits also address the SNM inventory controls used at Millstone, as well as the implications of the two lost fuel rods at Millstone Unit 1 with respect to those SNM controls. These affidavits show that there is little direct relationship between the controls implicated by the Unit 1 issue and the controls utilized (both historically and going forward) at Unit 3. Nonetheless, in this affidavit I address the approach that DNC is implementing at Millstone with respect to the management and oversight of fuel handling and SNM inventory control to assure that at Millstone there will continue to be the "willingness and capability" to implement License Amendment 189 and associated controls.

Professional Qualifications

4. I hold a B.S. degree in Management from Post College in Waterbury, Connecticut.

5. I have been employed at Millstone Power Station for 22 years, first by NNECO and, since March 31, 2001, by DNC.

6. I began my career at Millstone as a Plant Equipment Operator ("PEO"). In that capacity I was directly involved in outage management activities, fuel handling (core off-loads and re-loads), and other tasks involving the SFP (such as storage and removal of non-fuel radioactive waste).

7. In 1982 I was licensed by the NRC as a Unit 1 Reactor Operator and in 1983 as a Unit 1 Senior Reactor Operator ("SRO"). As an SRO, I was specifically qualified to supervise fuel handling operations and understood fully that reactivity management is required for safe fuel handling procedures. Subsequently in my career I worked in both Millstone Unit 1 and Unit 2 Operator Training. Safe fuel handling has always been an element of our operator training programs. This certainly extends to Millstone Unit 3 as well.

8. I have also worked at Millstone as a Unit Supervisor and a Shift Manager, directly supervising operators in the control room as well as PEOs. I am very familiar with the disciplined approach utilized at Millstone with respect to the conduct of licensed activities, which includes the implementation of countless "administrative controls" related to both plant operations and refueling.

9. A copy of my complete professional qualifications is included as Attachment A to this affidavit.

Millstone Nuclear Fuels Management

10. As previously discussed in this proceeding, License Amendment 189 authorized NNECO, and now DNC as the license transferee, to install and use additional storage racks in the Millstone Unit 3 SFP. In addition, the License Amendment included Technical Specifications defining three storage regions in the SFP, with limits on the fuel assemblies that may be stored in each of the regions. The limits are based upon fuel reactivity considerations (*i.e.*, enrichment, burnup, and decay time). These controls are now in place and have been employed successfully.

11. DNC's parent company, Dominion Resources, through its Virginia Electric and Power subsidiary, operates nuclear units at the Surry and North Anna stations. The management of Dominion, and now DNC at Millstone Power Station, is committed to utilizing at Millstone the same management approaches that have been successfully utilized at the Surry and North Anna stations.

12. One management/organizational control that Dominion has employed at its Surry and North Anna stations is a designated Operations Support supervisor responsible and accountable for all aspects of spent fuel handling and storage, including the safe fuel storage strategy, the fuel handling procedures, refueling operations, and SFP housekeeping. This supervisor's responsibilities specifically include oversight of the various in-house organizations that are involved in these issues (including Operations, Maintenance, Reactor Engineering, Fuels Management), as well as vendors and contractors. DNC's Millstone site management has established this same supervisory position for Millstone to align the Millstone organization with the Surry and North Anna organizations. I am filling the position at Millstone.

13. DNC management believes that this position has been one key to the success of fuel handling at Surry and North Anna. Having a supervisor with an Operations background in

this role helps to assure that administrative controls (*e.g.*, Technical Specifications, procedures, licensing basis) are recognized and followed. In addition, with the transition to DNC we will be able to identify and apply "best practices" across all three Dominion sites.

14. As discussed in other affidavits in this proceeding, the reasons for the loss of accountability with respect to the two fuel rods at Millstone Unit 1 were, in reality, unique to Unit 1. There is no history of loss of accountability with respect to fuel rods at Millstone Unit 3. Nonetheless, DNC recognizes that the Unit 1 Root Cause Assessment Team ("RCAT") specifically identified "weaknesses in coordination of SFP activities and procedural adherence," as well as "inconsistent supervision and inconsistently applied oversight of SFP activities by knowledgeable individuals," as elements of the root cause of the Unit 1 event. In other words, given the separate roles of different site organizations at Unit 1, as well as the fuel vendor (General Electric was involved in the fuel rod testing) and contractors (for example, to clean-up the Unit 1 pool), there were "ownership" and "oversight" problems at Unit 1. Without concluding that these problems ever existed at Unit 3, the creation of my new position as Supervisor, Nuclear Operations Support for Millstone Station — with the responsibility for fuel handling and storage — is directly responsive to these elements of the Unit 1 root cause. The very definition of the job is to assure a single point of ownership, accountability, and oversight.

15. The RCAT also identified process weaknesses with SNM inventory and control and radwaste characterization at Unit 1 as an element of the root issue. As discussed in other affidavits, this element was specifically found to <u>not</u> apply at Units 2 and 3. Nonetheless, we have enhanced Unit 3 procedures and will, as part of DNC's continuous improvement philosophy, review and revise procedures as needed on an ongoing basis to integrate internal and

external lessons learned. As indicated above, the association with Surry and North Anna will be a benefit in this area.

Perspectives on Reporting of Unit 1 Issue

16. It is also important to recognize that the way the Unit 1 issue was identified and reported to the NRC by NNECO in late 2000 should not, contrary to suggestions of others, undermine the Licensing Board's confidence in DNC's commitment, willingness and capability to effectively implement administrative controls at Millstone. The timing of the report has been recently identified by the NRC Staff as an apparent non-intentional violation of reporting requirements. Nonetheless, the issue does not reflect any systemic weakness.

17. As reflected in the NRC Staff's February 28, 2002 Special Inspection Report (Special Inspection 05000245/2001013), a question regarding two Unit 1 fuel rods was first identified in mid-2000 by an individual who was performing a careful paperwork review and who exercised a questioning attitude. Obviously at the time the individual identified the Unit 1 issue, he did not know the full scope of what we know today. Rather, he had found historic (1979) documentation that two fuel rods removed from a particular assembly (MS-557) would be stored in the Northwest Corner of the SFP and would then be placed in a "scaveged" [sic] fuel bundle in the SFP. To pursue the matter, he decided to make visual inspections. On or about September 12, 2000, a visual inspection was made of the Northwest Corner of the SFP and of the top of fuel bundle MS-557 with an underwater camera. Although the two fuel rods were not found, the results of this inspection were not sufficiently conclusive to change the belief that the rods were still in the Unit 1 SFP, such as in a scavenged bundle. (It was not conclusively demonstrated that the two rods were not in assembly MS-557 until December 2000, when General Electric inspected MS-557 in a fuel prep machine and determined that the tie rod was

not in the bundle and the center spacer capture rod was a dummy rod.) Further special visual inspections were arranged to verify the location. After special inspections in mid-November, 2000 failed to find the two rods in some likely SFP locations, the individuals pursuing the matter concluded that a legitimate question regarding the location of the fuel rods existed, rather than just a question of a paperwork discrepancy. At this time, the issue was documented in an internal Condition Report. A telephone contact was promptly made to the NRC on the issue on November 16, 2000. In accordance with regulations, this was timely followed-up by a formal call to the NRC Operations Center on December 14, 2000. Also consistent with regulations, NNECO submitted a timely Licensee Event Report ("LER") — within 30 days of the Operations Center call — on January 11, 2001. The LER has been subsequently updated as needed to discuss the status and results of the Fuel Rod Accountability Project and root cause assessment.

18. The NRC Staff has indicated in the Special Inspection Report its judgment that a Condition Report should have been created following the September 12, 2000 SFP inspections, which may have triggered an earlier notification to the NRC (that is, by about two months). Certainly, however, the NRC Staff recognized that there was no intent to delay or avoid reporting to the NRC (see Special Inspection Report, at 31). The Special Inspection Report references the similar conclusion of the NRC's Office of Investigations.

19. The question of the timing of the Condition Report and subsequent call to the NRC in my view represents a matter of judgment. The judgment made by those involved was to trust their existing records (that the rods were in the SFP) and first look for the fuel rods in the most likely areas in the SFP. Those efforts were not complete on September 12; rather, they continued into November and December. They chose to initiate the Condition Report in mid-November. While in retrospect it might have been better to initiate a Condition Report in

September, or to speed up the pool inspections, there is no question that after the November pool inspections failed to locate the fuel rods, appropriate levels of management were notified, the Condition Report was promptly created, and the NRC phone call and subsequent written reports were timely made. The very comprehensive reviews of the Fuel Rod Accountability Project and the RCAT then were begun.

Conclusions

20. For all of the reasons discussed above, I am confident that the new Unit 3 SFP three-region storage configuration authorized by License Amendment 189 has been and can continue to be successfully implemented. DNC has responded to the Unit 1 event RCAT report by a number of procedural enhancements, verifications, and inventory reconciliations discussed by others in their affidavits. For my part, DNC has brought Millstone into an organizational alignment with the Surry and North Anna stations by creating my position as a single point for management responsibility and oversight with respect to fuel storage. I am confident we have the willingness and capability to implement not only the administrative controls associated with License Amendment 189, but also the many other procedural controls related to fuel storage, movements, and control at Millstone Station.

21. The information presented above is true and correct to the best of my knowledge and belief.

Daniel J. Meekhoff

Sworn and subscribed to before me on this ____ day of March, 2002.

Notary Public

My Commission Expires: _____

WM. E. BROWN
NOTARY PUBLIC
MY COMMISSION EXPIRES MAR. 31, 2006

ATTACHMENT A

PROFESSIONAL QUALIFICATIONS OF DANIEL J. MEEKHOFF

Experience:

2002 — Millstone Station

Supervisor, Nuclear Operations Support

- Responsible for management and oversight of fuel storage and handling for all three Millstone Units

1999-2001 — Millstone Unit 1 Decommissioning

General Manager, Decommissioning Millstone Unit

- Responsible for all aspects of Millstone Unit 1 following transition into the cold and dark state, including:
  - ⇒ Spent Fuel Pool Operations, including safe storage of fuel
  - ⇒ Unit material condition and cleanliness
  - ⇒ Asset Recovery
  - ⇒ Finance and Budget (Decommissioning Fund)

SERT Project Manager

- Manager for project which developed and implemented processes to evaluate all Millstone Unit 1 Structures, Systems and Components and maintain as available or transition those SSC into the abandoned state, including draining and deenergizing systems and disposing of all hazards.
- Configured Millstone 1 for SafeStor

Technical Advisor to the Director, Unit Operations, Millstone Unit 1

- Advised the Director, Unit Operations in all matters related to the safe storage and cooling of the Unit 1 Spent Fuel, acted as Director, Unit Operations in his absence.
- Reorganization Team Leader responsible to reintegrate Unit 1 into site organization.
- Project Manager, rapid response portion of fuel pin search.

1995-1999 — Millstone Unit 1 Operations

Shift Manager

- Responsible for or involved in multiple decommissioning activities, including modifications to Technical Specifications and development of Permanently Defueled Technical Specifications, methodology for FSAR to DSAR rewrite, development and review of the Post Shutdown Decommissioning Activities Report, trips to NRC headquarters to establish working relationships with the NRC, as well as interfacing between departments to breakdown barriers and enable work.
- Responsible for safe, efficient plant operations in compliance with License Requirements, Technical Specifications, Technical Requirements, Applicable Orders, Company Procedures and Policies
- Responsible to reinforce and improve on department standards, including professionalism, Teamwork, communications, training and qualifications.
- Responsible for authorization of maintenance and testing activities

Unit Supervisor

- Directly supervised activities of Control Operators and Plant Equipment Operators.
- Directed Control Room Operations during all modes of plant operation

1993-1995 — Millstone Unit 2 Operator Training

Supervisor, Operator Training

- Responsible for all aspects of Licensed and Non-Licensed Operator Training Programs, including assessment, design, development, implementation and evaluation.
- Assisted INPO as Peer Evaluator or Accreditation Renewal and assistance visits to other utilities.
- Upgraded performance standards of Operating Shifts.

1982-1993 — Millstone Unit 1 Operator Training

Senior Instructor

- Coordinated all Licensed and Non-Licensed Operator Training Programs
- Assisted INPO as Peer Evaluator on Training Evaluation and Accreditation Renewal visits as well as utility peer on Millstone Unit 1 Training Evaluations.
- Implemented multiple techniques for improvement of training and operation.

1980-1982 — Millstone Unit 1 Operations

Reactor Operator

- Responsible for performing Reactor Operations in a safe, conservative manner

Plant Equipment Operator

- Responsible for inspecting and servicing reactor auxiliaries, turbine generators, mechanical and electrical auxiliaries and other plant equipment

1975–1980 — USS U.S. Grant, SSBN 631

Engineering Watch Supervisor
Electrical Operator

Education:

Post College
Waterbury, CT

- B.S., Management
- Graduated Summa Cum Laude

Qualifications:

Millstone Unit 1
Waterford, CT

- Certified Fuel Handler
- Licensed Senior Reactor Operator
- Licensed Reactor Operator

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50-423-LA-3
	)	
(Millstone Nuclear Power Station, Unit No. 3)	)	

AFFIDAVIT OF DOMINION NUCLEAR CONNECTICUT OUTSIDE EXPERT PANEL: ROBERT V. FAIRBANK, JR., RICHARD N. SWANSON, AND HUGH L. THOMPSON, JR.

I, Robert V. Fairbank, Jr., being duly sworn, state as follows:

I, Richard N. Swanson, being duly sworn, state as follows:

I, Hugh L. Thompson, Jr., being duly sworn, state as follows:

1. (All) We were retained by Northeast Utilities ("NU") in connection with the Fuel Rod Accountability Project ("FRAP"), NU's project to search for, to investigate, and to analyze the issue of two missing fuel rods at Millstone Unit 1. On behalf of Dominion Nuclear Connecticut, Inc. ("DNC"), this affidavit summarizes our conclusions and responds to the issue identified by the Atomic Safety and Licensing Board ("ASLB") in this reopened proceeding.

2. (All) Specifically, in this affidavit, based on our direct involvement in the FRAP, we address whether there are any implications of the Unit 1 issue for the handling of spent fuel assemblies at Millstone Unit 3 today. Specifically, we address whether there is any relationship between the errors leading to the loss of accountability of the two Unit 1 fuel rods and current operations at the Unit 3 spent fuel pool ("SFP") with respect to fuel handling and special nuclear material ("SNM") inventory control. We also address whether there is any implication in the

Unit 1 event with respect to the willingness and capability of the present Millstone licensee, DNC, to implement the administrative controls necessitated by License Amendment 189 and the related, newly-installed Unit 3 spent fuel racks.

3. (All) We are making this affidavit together for readability and to eliminate redundancy. Notations are made by paragraph to identify which of us is sponsoring the statements in the paragraph.

Roles in the FRAP

4. (All) The FRAP consisted of three teams: the Fuel Rod Accountability Investigation Team, the Root Cause Assessment Team ("RCAT"), and the Independent Review Team ("IRT").

5. (RVF) The FRAP Investigation Team was responsible for conducting a comprehensive investigation to determine the location of the two Unit 1 fuel rods. The FRAP Investigation Team performed Unit 1 SFP inspections and physical inspections at other site locations, conducted site visits, searched document databases, identified, retrieved and reviewed relevant documents, and conducted personnel interviews. The investigation process and conclusions are documented in the Millstone Unit 1 Fuel Rod Accountability Project, Number M10063, Final Report, approved October 1, 2001 (Exhibit 4). The FRAP Investigation Team was comprised of over 20 full-time professionals and various support personnel. These professionals averaged over 28 years of experience in the nuclear industry. The team members included former managers of engineering, operations, and regulatory assurance. Other team members had experience as first-line supervisors, project managers, and engineers. Mr. Fairbank was the Project Manager for the FRAP Investigation Team.

6. (RNS) The RCAT augmented the FRAP Investigation Team, conducted additional investigation activities, and separately evaluated and identified the root causes and contributing

factors for the loss of accountability of the two Unit 1 fuel rods. The RCAT prepared a report that summarized the event, presented the root causes, and described event implications for Millstone Units 2 and 3. The report is titled Root Cause Investigation, Loss of Accountability of Two Fuel Rods at Millstone Unit 1 (CR# M1-00-0548), approved October 25, 2001 (Exhibit 5). The RCAT also recommended corrective actions to address identified weaknesses, including some actions taken for Millstone Units 2 and 3. The RCAT was comprised of contractors with significant relevant industry experience. Mr. Swanson was the RCAT Team Leader.

7. (HLT) The IRT provided oversight and ongoing review of key decisions, conclusions, plans, procedures, guidelines, methods, scenarios, schedules, external communications, selected internal communications, the root cause investigation, and other areas necessary to provide added assurance of the accuracy, quality, consistency, and auditability of project activities. The IRT was comprised of five non-NU and non-DNC personnel with significant relevant industry and NRC regulatory experience. The IRT remained independent of the FRAP Investigation Team and the RCAT, and provided an unbiased perspective on the findings of the FRAP and the RCAT. Mr. Thompson was a member of the IRT.

Professional Qualifications

8. (RVF) Mr. Fairbank has over 30 years of engineering and management experience in the nuclear industry (9 years in senior management positions). Mr. Fairbank earned a Bachelor of Science degree in Mechanical Engineering from Northeastern University and a Master of Business Administration degree from the University of Pittsburgh. A statement of his professional qualifications is provided as Attachment A.

9. (RNS) Mr. Swanson is a licensed Professional Engineer (Mechanical) with over 30 years of nuclear experience, including 16 years experience with nuclear utilities (11 years in senior

management positions), 6 years as an independent consultant, and eight years as an officer in the nuclear submarine force. He is professionally active in the American Nuclear Society and has chaired numerous workshop panels and lectured on subjects such as event investigation, performance oversight, identification of limiting weaknesses, and nuclear safety. Mr. Swanson earned a Bachelor of Science degree in Operations Analysis from the U.S. Naval Academy, a Master of Science degree in Engineering Management from Northeastern University, and a Master of Business Administration degree from Babson College. A statement of his professional qualifications is provided as Attachment B.

10. (HLT) Mr. Thompson has over 35 years of nuclear experience. He has held several senior management positions with the NRC. He was Director of the Office of Nuclear Materials, Safety and Safeguards and served as NRC Deputy Executive Director for 10 years. At present, he is a consultant to the nuclear industry in the areas of nuclear safety, nuclear waste management, and licensing. Mr. Thompson earned a Bachelor of Science degree in Naval Science from the U.S. Naval Academy, a Master of Science degree in Nuclear Engineering from the Georgia Institute of Technology, a Juris Doctorate degree from George Washington University. A statement of his professional qualifications is provided as Attachment C.

Overview of FRAP

11. (RVF) The FRAP investigation was a rigorous and comprehensive effort involving over 52, 000 man-hours over an approximately 10 month period. The FRAP investigation followed two parallel paths. One path involved collecting and reviewing documents and performing personnel interviews. The other path involved performing detailed physical inspections, including the Unit 1 SFP.

12. (RVF) Tens of thousands of documents were identified and reviewed. Documents searched included both hard copy and those in electronic databases. Over 500 electronic database keyword searches produced nearly 17,000 documents that were screened for applicability. Thousands of hard copy records at various locations at Millstone and in storage at NU's corporate office in Berlin Connecticut were identified. Over 500 containers (*i.e.*, file cabinets, file shelves, file boxes, etc.) were identified and screened, 82 of those containers were deemed relevant and received a detailed review. Over 200 individuals were identified and interviewed. Over 100 of those individuals (considered to be potentially key interviews) were interviewed by two project team members, usually one member of the FRAP Investigation Team and one member of the RCAT. Site visits to General Electric Company ("GE") Vallecitos, GE Morris, GE Wilmington, Barnwell, and Hanford were conducted by FRAP Team members to review records and to interview individuals.

13. (RVF) The physical inspections performed in the Unit 1 SFP were governed by a global search plan. Locations to be inspected were derived from development and analysis of postulated scenarios. The scenarios were developed in order to hypothesize possible locations in the SFP where the rods could be located. Search locations were also identified by examining the entire SFP and its contents and identifying those locations that were physically capable of containing two fuel rods or large segments of cut fuel rods. SFP inspections began in the fall of 2000 during the station's initial response to the issue and continued through August 2001. All 2884 fuel assemblies were visually inspected for evidence of disassembly/reassembly, to determine whether the assembly might have been a location for inserting an additional rod and to assure that the assembly contained all of its rods. In addition, more than 400 of the 2884 fuel assemblies in the Unit 1 SFP were pulled and inspected during this effort. The assemblies

selected for detailed inspection were (a) unchanneled assemblies (unchanneled assemblies had a space between the assembly and the spent fuel storage rack sufficiently wide to permit storage of a spent fuel rod), or (b) raised assemblies that did not appear fully seated on the bottom of the fuel racks such that the assemblies might be resting on the missing fuel rods or segments of the missing rods. The assemblies inspected also included a few special cases where circumstances suggested that the assemblies would have been a possible location for putting an individual fuel rod. SFP inspections required over 12,000 man-hours. Additional onsite physical inspections were conducted at six locations outside the spent fuel pool to verify that the rods were not stored elsewhere on site.

14. (RVF, HLT) The FRAP investigation was rigorously performed using standardized written FRAP guidelines and station procedures. The project was staffed with qualified, experienced personnel who were trained on the requisite guidelines and procedures to ensure a high level of quality and consistency. The IRT reviewed FRAP Investigation Team activities and deliverables for accuracy, quality, consistency, and auditability. Additionally, as part of IRT oversight, highly–qualified third party assessors from Duke Engineering and Services Company performed assessments of the investigation to ensure compliance with the FRAP guidelines and station procedures.

Event Description

15. (RVF) In September 1972, Millstone Unit 1 condenser tubes failed and seawater leaked into the reactor coolant system. In October 1972, in order to evaluate the effects of the seawater on fuel, GE personnel disassembled fuel assembly MS-557 and stored all of its 49 fuel rods in seven specifically designed 8-rod containers. In April 1974, GE personnel reassembled MS-557 but they did not include one of the eight tie rods (because it had been slightly damaged during

handling) or the center spacer capture rod (which could not be re-installed because of its unique physical characteristics). Neither GE records nor Unit 1 Reactor Engineering records mentioned the two rods at the time of the reassembly of MS-557 in April 1974.

16. (RVF) In May 1979, the Unit 1 Reactor Engineer ("RE") asked GE personnel to read the serial numbers of two fuel rods in an 8-rod container in the Unit 1 SFP. Using the information obtained, the RE and GE personnel concluded that the rods were the two rods previously removed from MS-557. The RE created a data card for the two rods in May 1979 and SFP maps dated February and April 1980 show the two fuel rods from MS-557 in the Northwest Corner of the SFP. A September 1980 SFP map does not reflect the two MS-557 fuel rods. In late 1980, the Unit 1 RE who had identified the two rods with GE in May 1979 left Millstone and another engineer assumed the RE's responsibilities. The two REs did not recall having discussed the two rods during their turnover. No one interviewed had a clear recollection of actually seeing the two MS-557 fuel rods in the SFP after this turnover in late 1980.

17. (RVF) During document reviews conducted in connection with the decommissioning of Millstone Unit 1 in 2000, engineers found the records from 1979 and 1980 (including the data card the Unit 1 RE created in May 1979) indicating that during 1979 and 1980 two fuel rods from MS-557 were being stored separately from the parent assembly in the SFP. The engineers looked for additional information about the disposition of those fuel rods, but the most recent records they found which reflected the location of the fuel rods were those records created in 1979 and early 1980. The FRAP investigation ensued.

FRAP Conclusions

18. (RVF) The comprehensive investigation conducted by the FRAP Investigation Team concluded that fuel rods are safely located in four possible places: the Unit 1 SFP, the GE facility

in Vallecitos, California; the U.S. Ecology Low Level Radioactive Waste ("LLRW") facility near Richland, Washington; and the Chem-Nuclear LLRW facility at Barnwell, South Carolina. While the FRAP Investigation Team did not produce clear and convincing evidence of the specific location of the two fuel rods, the FRAP Investigation Team found no credible evidence that the rods are in any place other than these four locations.

19. (RVF) Of the four possible locations, the FRAP concluded that the LLRW facility at Barnwell had the most significant opportunity to receive the rods. In particular, in 1988, NU (Northeast Nuclear Energy Company was the operating subsidiary of NU and the licensee at the time) conducted a number of activities to prepare for a re-racking of the Unit 1 SFP in 1989. In January 1988, NU hired WasteChem to perform a major clean-up of irradiated hardware, contaminated materials, and filters in the Unit 1 SFP. WasteChem began this work without a precise list or characterization of the irradiated hardware and contaminated items in the pool to be processed and shipped. The clean-up effort resulted in several shipments to Barnwell in May 1988 that contained the segments of about 90 Local Power Range Monitors ("LPRMs") that had been cut into pieces many years earlier and stored in containers in the spent fuel pool. These LPRMs, which are very similar in appearance to fuel rods, were most likely cut in late 1979, shortly before the fuel rods disappeared from later spent fuel pool maps. Because the workers cutting the LPRMs in 1979 lacked experience with reactor components, the workers may have mistakenly cut the fuel rods believing them to be LPRMs, and placed them in a container with the LPRMs. Many, if not all, of the LPRMs were then shipped to Barnwell in the May 1988 clean-up shipments. In addition, there were three shipments during the relevant time that utilized shipping casks large enough to accommodate full length rods and the eight-rod container. These

were the only shipments made after May 1979 that were capable of accommodating full length fuel rods. These shipments were to Barnwell in May 1988 during the Unit 1 SFP clean-up.

Root Cause Assessment

20. (RNS) The Root Cause Assessment used the conclusions of the FRAP investigation regarding the potential locations of the two fuel rods, and did not duplicate FRAP activities. Based on these conclusions and several months of independent effort, the RCAT determined the root cause of the event was an unrecognized over-reliance on the Unit 1 Reactor Engineers to compensate for organizational and process weaknesses in implementing the SNM inventory and control procedures. That unrecognized over-reliance masked certain behaviors and conditions that led to the event, specifically:

- Process weaknesses associated with SNM inventory and control and radwaste characterization;
- Weaknesses in coordination of SFP activities and procedural adherence; and
- Inconsistent supervision and inconsistently applied oversight activities by knowledgeable individuals.

This root cause applies exclusively to Unit 1. The RCAT concluded that the vulnerabilities associated with physical accountability for individual fuel rods did *not* extend to physical accountability for fuel assemblies or to radiological controls. Additionally, the RCAT specifically evaluated the implications of these issues for Millstone Unit 3 and highlighted key differences between practices and procedures between the two units. These conclusions are summarized in this affidavit.

Differences Between Unit 1 Issue and Unit 3 Relevant to Regional Fuel Storage Controls

Background: What the Unit 1 Event Was and Was Not

21. (RNS) The Unit 1 event involved:

- The loss (physical loss and/or loss of accountability) of two individual fuel rods; and,
- A subsequent delay in detecting that loss.

This event was restricted to two individual fuel rods at Unit 1. The vulnerabilities that allowed fuel rod accountability to be lost did not extend to fuel assemblies, either at Unit 1 or Unit 3. Accountability of fuel assemblies was adequately controlled at both Units 1 and 3, and fuel assemblies were not at risk for a similar loss.

22. (RNS) With respect to the most likely scenario — in which the fuel rods may have been processed and shipped to the Barnwell or Hanford LLRW facilities — the mechanism by which accountability was lost was as follows:

- Individual fuel rods had an appearance similar to irradiated Local Power Range Monitor ("LPRM") hot sections;
- The presence of the two individual fuel rods removed from MS-557 and in the Unit 1 SFP was not known beyond a very small number of people;
- The two fuel rods were stored in the SFP in close proximity to irradiated waste (not the way fuel assemblies were stored). The container in which they were placed was open at the top, and allowed the rods to be easily removed using standard waste handling tools.
- LPRM hot sections were processed and/or removed from the Unit 1 SFP at several different times by personnel who thought all fuel was incorporated into intact fuel bundles, and were unaware that there were two individual fuel rods in the pool.

23. (RNS) The failure to more promptly discover the loss of the two orphan fuel rods was due to weaknesses in SNM inventory and control procedures. By its terms, the Unit 1 procedure in use at that time did not specifically apply to individual fuel rods. Again, the vulnerabilities

that allowed fuel rod loss to remain undetected did not extend to fuel assemblies; fuel assemblies were explicitly addressed by the SNM inventory and control procedures.

24. (RNS) As discussed at length in the Root Cause Investigation Report, a number of historical factors combined to make Unit 1 vulnerable to undetected fuel rod loss. The procedures, practices, and conditions in place at Unit 3 differ from those at Unit 1 in ways that preclude a similar loss at Unit 3. The next sections discuss the differences between Unit 3 (now) and Unit 1 (during the event) and shows that the Unit 1 event does not have adverse implications for Unit 3 regional fuel storage control.

Differences in Fuel Rod Storage

25. (RNS) As stated above, the Unit 1 event was restricted to individual fuel rods removed from the parent assembly. Fuel assembly accountability was maintained throughout the event. Irradiated fuel assemblies at both Unit 1 and Unit 3 were stored in fuel racks in their respective SFPs upon removal from their cores.

26. (RNS) In contrast to the practice for storage of assemblies, the two Unit 1 fuel rods removed from MS-557 were stored in 1979 in close proximity to irradiated waste, rather than in the fuel racks with other irradiated fuel. The container in which they were placed was open at the top and was not sealed. The Unit 1 rods could be easily removed from the container using standard tools for handling components stored in the spent fuel pool.

27. (RNS) In direct contrast to how these two Unit 1 rods were stored, the one Unit 3 rod permanently removed from its parent assembly was placed in a "Fuel Storage Basket" ("FSB") when removed from its associated fuel bundle. The FSB is placed in the Unit 3 fuel storage racks along with spent fuel assemblies.

28. (RNS) Investigation interviews elicited consistent statements from workers involved in Unit 1 SFP work between the 1970s through the 1990s that "everyone knew" that fuel rack contents were "off limits", and that clean-up activities were intended to dispose of irradiated hardware from non-rack locations. However, storing the two removable Unit 1 rods near irradiated waste in an unsealed container created a vulnerability for them to be mistakenly identified and treated as irradiated waste during subsequent fuel pool clean-up campaigns. The Unit 3 fuel rod is not similarly vulnerable because it is stored in the Unit 3 fuel racks in a sealed container.

Differences in Spent Fuel Pool Work Controls

29. (RVF, RNS) To reduce radiation levels to which plant personnel are exposed, SFPs throughout the industry are used to store a variety of irradiated components in addition to spent fuel. Examples include inspection equipment, refueling tools, and irradiated hardware to be processed and shipped as radiological waste. The Unit 1 SFP accumulated substantial irradiated hardware over time, requiring a number of clean-up campaigns beginning in the late 1970s and continuing through the 1990s.

30. (RVF, RNS) LPRMs comprised a substantial portion of the irradiated hardware inventory in the Unit 1 SFP, particularly through the mid-1980s. LPRMs are reactor core instruments that require replacement as they are expended during plant operation. They are approximately 43 feet in length and consist of a "hot" section (that portion within the active region of the core and with detectors (*i.e.*, fission chambers containing small amounts of SNM)) and a "cold" section (that portion outside the active region of the core). Disposal of LPRMs requires separation of the "hot" and "cold" segments, and then cutting of the hot ends into segments in order to fit into shielded casks for shipment to licensed LLRW facilities. To minimize radiation doses to

workers, the LPRM cutting operations were performed several feet under water using remote tools.

31. (RVF, RNS) When separated from the associated "cold" section, LPRM "hot" sections were between 12 and 13 ½ feet in length and about 0.7 inches in diameter. The two Unit 1 fuel rods from MS-557 were about 13 feet 2 inches long and about ½ inch in diameter. Radiation levels of the fuel rods and LPRM "hot" sections are both very high and could be mistaken for each other. The Unit 1 fuel rods and LPRM "hot" sections are difficult to tell apart when being handled under several feet of water.

32. (RVF, RNS) In September and October 1979, contract workers with limited experience in identifying reactor components were hired to cut numerous LPRMs that were stored in the Unit 1 SFP. They did not use visual aids (borescopes or periscopes) to enhance component identification underwater. They did not expect to find individual fuel rods stored outside the fuel racks in close proximity to irradiated LPRMs. Their training, experience, equipment, supervision, and task assignment did not equip them to distinguish an LPRM "hot" section from a fuel rod several feet under water. Although the FRAP did not find conclusive evidence that fuel rods were mistaken for LPRM "hot" sections, the FRAP concluded that the Unit 1 rods could have been inadvertently cut in 1979. (As discussed above, the fuel rods could have been included in the shipments to Barnwell in May 1988 as part of the effort to clean-up the Unit 1 SFP, including the LPRMs, in advance of the 1989 re-racking.)

33. (RVF, RNS) The level of control and oversight for SFP evolutions has increased over time. As documented in the FRAP report and the Root Cause Investigation report, control of SFP work during the 1970s through the mid-1980s at Unit 1 was characterized by a lack of effective procedural guidance for fuel rods, was not consistently performed by knowledgeable

individuals, and occurred with relatively informal coordination between departments. When Unit 1 conducted campaigns to remove radiological waste from the SFP in the late 1970s and the 1980s, the requirements to describe precisely the content of radwaste shipments were not stringent (that is, at the time when the Unit 1 rods were most likely to have been cut up and/or mistakenly "processed" for shipping as low level waste). However, these controls became progressively more stringent throughout the 1980s and 1990s.

34. (RNS) By the time Unit 3 began commercial operation in the mid 1980s, radwaste characterization requirements (and practices) were far more rigorous than those in place in 1979 because of new low level waste classification requirements in 10 C.F.R. Part 61. To meet the higher standards for radwaste characterization, Millstone had upgraded the effectiveness of SFP activity supervision and oversight. Weaknesses in Unit 1 SFP work controls that contributed to loss of the two fuel rods were at least partially addressed by the time Unit 3 began operation in the mid-1980s, and continued to diminish over time as enhancements were made. Additionally, Unit 3 established procedural guidance for SFP operations beginning in 1997.

Differences in Special Nuclear Material Control and Inventory

35. (RNS) SNM inventory and control activities at Millstone Station were defined in procedures that evolved over the life of the Station. These procedures were established prior to commercial operation of Unit 1 (March 1971) and procedures applicable to Unit 3 SNM control were initially implemented in December1984. These procedures have been through multiple revisions.

36. (RNS) Unit 1 Special Nuclear Material Inventory and Control procedures contained a number of weaknesses discussed in greater detail in the Root Cause Investigation Report. Three procedural flaws weakened the control and inventory process with regard to individual fuel rods:

- Unit 1 procedures addressed control and accountability of fuel assemblies, but did not specifically address individual fuel rods.
- Unit 1 inventories relied upon documentation of fuel movement on "Material Transfer Forms" and these forms were inconsistently used for individual fuel rod movements.
- Unit 1 procedures did not clearly define the basis against which physical inventories were to be compared or require verification that the basis used was correct.

37. (RNS) Historically, procedures at Unit 1 controlled and accounted for nuclear fuel on the basis of fuel assemblies. Individual fuel rods at Unit 1 were not specifically required (by procedure) to be designated as "Special Nuclear Material" until September 1990, although the Reactor Engineer had the authority to so designate them. These SNM control and inventory weaknesses impacted Unit 1's ability to discover loss of the two fuel rods once it had occurred, but did not cause the loss itself. (As discussed elsewhere, the loss of the rods was a product of their physical location in close proximity to irradiated LPRM hot sections, a lack of recognition that they were fuel rods, and the way in which subsequent "clean-up" evolutions were conducted.)

38. (RNS) In direct contrast, Unit 3 procedures have consistently required that individual fuel rods (where they exist) be designated as SNM. This began with the first Unit 3 SNM procedure issued in 1984. The single individual fuel rod at Unit 3 was so designated when removed from its parent fuel assembly in 1995, and has subsequently been tracked and inventoried as SNM.

39. (RNS) Unit 1 fuel inventories required physical "piece counts" and focused on verifying that rack locations that were expected to contain fuel assemblies actually did. However, Unit 1 procedures did not clearly define the basis against which physical inventories were to be compared and did not require verification that the basis used was correct. In practice, the basis

document for each inventory was a revision of the previous inventory map that incorporated information from Material Transfer Forms initiated since the last inventory.

40. (RNS) The Unit 1 procedures assumed that the previous inventory was accurate and that Material Transfer Forms were used for every fuel movement. There was no requirement to verify that the basis for the inventory was an accurate reflection of fuel that "should be on hand" (*i.e.*, fuel received less fuel properly removed throughout plant life). Again, this weakness did not cause the physical loss of the two fuel rods. However, had the inventory basis accurately reflected the fuel that "should have been on hand," and had the fuel actually present been compared to it, the loss of accountability would have been detected much sooner.

41. (RNS) The two Unit 1 rods were not controlled in a manner consistent with how other nuclear fuel was controlled. They were not stored in the fuel racks and were not consistently documented on Material Transfer Forms when moved. This eventually allowed them to become "invisible" to the Unit 1 fuel inventory and control process.

42. (RNS) In contrast, the Unit 3 rod was stored, controlled, and monitored in a manner consistent with the way in which Unit 3 stored, controlled, and monitored nuclear fuel assemblies. It was entered into fuel inventory records, placed in the FSB, stored in the Unit 3 fuel rack, and subsequently inventoried and accounted for.

43. (RNS) The presence of the single individual fuel rod in Unit 3 was correctly and accurately reflected in inventory records (unlike the case at Unit 1). Moreover, prior to the completion of the RCAT investigation, Unit 3 had defined the basis for fuel inventories (the "Inventory of Record"), validated the accuracy of that basis, and reconciled the physical fuel inventory with that validated basis. Those actions confirmed that Unit 3 has all spent fuel it should have and that fuel accountability records have retained their integrity.

44. (RNS) At the completion of the Root Cause Investigation, the RCAT concluded that Unit 3 did not have process weaknesses similar to those that contributed to the undetected loss of Unit 1 fuel rods. The RCAT based this conclusion upon the following facts:

- Unit 3 had defined the basis against which fuel inventories would be compared (the "Inventory of Record");
- Unit 3 confirmed that the basis for the most recent fuel inventory was complete and accurate, and corresponded to the fuel physically present;
- Unit 3 procedures required individual rods (when present) to be designated as "Special Nuclear Material" and controlled in a manner consistent with fuel assemblies, and Unit 3 had complied with those procedures with regard to the one fuel rod in inventory.

Differences in Oversight

45. (RNS) The level and sophistication of management and oversight of nuclear activities has evolved over the past three decades throughout the nuclear industry. Quality Assurance organizations did not generally exist at nuclear generating plants when Unit 1 began commercial operation in 1971. On-site fuel inventories were expected to remain relatively small with government-approved facilities accepting irradiated fuel for re-processing, and the industry did not expect plants to require the ability to store large amounts of irradiated fuel for extended periods of time, much less spent fuel generated over the entire plant operating life.

46. (RNS) Oversight of fuel inventory and control in place at Unit 1 when the two rods were lost in 1979 was nowhere near as intrusive, rigorous, or comprehensive as that in place at Unit 3 in 2001. As part of its investigation, the RCAT reviewed all 32 internal audits of Unit 1 SNM inventory and control conducted between 1971 and 2001, as well as the internal audits of Unit 3 conducted after 1994. The RCAT concluded that the Unit 1 audits prior to 1987 were unlikely to identify the vulnerabilities that contributed to the loss of Unit 1 fuel rods. In contrast, the RCAT found that, starting in 1997, SNM audits were of high quality and appeared to add substantial

value. Both audit depth and breadth were conspicuously greater than in previous audits, and included much greater consideration of regulatory requirements, substantially more review of "objective evidence" that field activities were properly conducted and reported, and assessment of how effectively past deficiencies had been addressed.

Differences in Fuel Inventory Reconciliation Results

47. (RNS) The only conclusive proof that fuel accountability has been maintained is a rigorous comparison of fuel on hand to the fuel that "should be on hand." Without a basis of comparison known to be accurate (the Inventory of Record), comparison of fuel on hand to documentation is inconclusive. Thus, an Inventory of Record is necessary to the ability to prove that physical fuel accountability has been maintained.

48. (RNS) An Inventory of Record, in and of itself, does not remove the potential for fuel accountability (and control) to be lost; but its appropriate use accomplishes two things:

- It proves that physical accountability has been maintained;
- It detects instances of physical accountability loss (if any) that happened since the previous reconciliation.

Establishment and use of an Inventory of Record could not have prevented the loss of two fuel rods at Unit 1. However, it could have facilitated earlier detection.

49. (RNS) Unit 1 had not reconciled fuel against a defined inventory of record between initial operation and recognition of the event. In contrast, after the event at Unit 1, Unit 3 fuel was reconciled in October 2001 against a defined Inventory of Record, conclusively proving that Unit 3 has retained physical control of all Unit 3 irradiated fuel.

Differences in Responsiveness to Identified Problems

50. (HLT, RNS) Millstone Station (including Unit 1) had a historical weakness in taking effective action to correct identified problems. This history is well documented in public records

associated with a lengthy 1996 station-wide shutdown. However, the Unit 3 response to the Unit 1 event differs significantly from historical performance as demonstrated by a number of specific examples:

- The station "bounded the problem" shortly after the two Unit 1 fuel rods were discovered to be missing and as the FRAP team was being formed. Reactor Engineers determined the potential for similar unidentified losses at Unit 3 was minimal, based on review of Spent Fuel Pool Maps, History of Movement records, and records of past evolutions involving individual fuel rods. This provided a high level of confidence for Unit 3, pending completion of the FRAP and the associated Root Cause Investigation.
- Reactor Engineers began taking corrective action for specific issues identified by the RCAT on the basis of preliminary investigation information rather than waiting for investigation completion. Specific examples of actions include defining the "Inventory of Record" for Unit 3 fuel, validating the accuracy of the "Inventory of Record", and reconciling Unit 3 fuel with the "Inventory of Record."
- Upon completion of the investigation in October, 2001, Millstone Station committed to implement all additional corrective actions recommended by the RCAT.

Summary Conclusion — Differences Between Unit 1 Issue and Unit 3 Controls Relevant to Regional Fuel Storage

51. (RNS) The Unit 1 event was an undetected loss of accountability of two fuel rods. Fuel assemblies were neither lost nor vulnerable to a similar loss. The two rods were most likely lost because they were stored in proximity to irradiated LPRMs, not recognized as fuel rods, and most likely mistakenly included in one or more waste shipments. Unit 3 rods are not similarly vulnerable to a loss of rods because:

- The individual Unit 3 fuel rod is clearly identified as fuel through placement in a special container.
- The individual Unit 3 fuel rod is stored in proximity to fuel (in fuel racks) and not in proximity to irradiated waste.
- Unit 3 does not have irradiated hardware that is physically similar to PWR fuel rods.

- Unit 3 SFP controls and oversight today are substantially greater than at Unit 1 over twenty years ago when Unit 1 lost accountability of the two rods.

52. (RNS) The Unit 1 loss was not detected in a timely manner because the SNM inventory practices did not require a full comparison of material on hand with an accurate "Inventory of Record." Unit 3 rods are not similarly vulnerable to a failure to detect a loss because:

- The one Unit 3 rod is entered into the SNM accountability process and is periodically inventoried.
- The periodic Unit 3 inventories compare fuel physically on hand with a defined "Inventory of Record" that lists what "should be" on hand. This "Inventory of Record" was validated in October 2001 and procedures have been implemented with requirements for periodic future validation.

On the basis of the above demonstrated facts, there is no significant relationship between the loss of two fuel rods from Millstone Unit 1 and current operations at Unit 3.

Willingness and Capability to Implement Administrative Controls

53. (HLT) As discussed above, the RCAT determined that the root cause of the Unit 1 fuel rod event was an over-reliance on the Unit 1 Reactor Engineer that masked certain other conditions. The behaviors and conditions that were weaknesses at that time at Unit 1 were specifically identified by the RCAT and differences between these conditions and what exists today at Millstone Unit 3 are fully discussed above. However, in deference to the ASLB's discussion of the issue for review in its decision to reopen Contention 4, we have also considered whether there are any implications in the Unit 1 event on the willingness and capability of DNC to implement Unit 3 administrative controls.

54. (HLT, RNS) The Unit 1 loss of accountability with respect to two individual fuel rods was in reality the result of a combination of a number of unusual causal factors and historic circumstances. Specifically, the following factors and circumstances played a role:

- reactor design;

- historic reliance at Millstone Unit 1 on GE in fuel matters;
- the Unit 1 seawater intrusion event;
- a practice at Unit 1 for storage of loose fuel rods;
- a change in Federal policy regarding fuel reprocessing;
- fuel handling procedures in use at the time; and
- SFP cleanup practices.

These factors do not apply, individually or in combination, today at Millstone Unit 3 in the same way they applied historically at Unit 1.

55. (HLT, RNS) Reactor design characteristics that distinguish the Unit 1 circumstances from those at Unit 3 stem from the fact the Unit 1 is a Boiling Water Reactor ("BWR"). Unit 3 is a Pressurized Water Reactor ("PWR"). BWRs have LPRMs; PWRs do not. The LPRMs are highly radioactive; they must be cut into segments to fit into shipping containers for shipment to a low level waste disposal facility; they are similar in appearance to spent fuel rods; and their radioactive condition can mask other radioactive material in a shipping container. All of these factors could have contributed to the Unit 1 event.

56. (HLT) Unit 1 was one of the early nuclear power plants built in the United States. Unit 1 was purchased as a "turnkey" plant from GE and, as a result, Unit 1 relied extensively on GE for reactor fuel expertise. GE was widely viewed as the expert in fuel-related matters, somewhat diminishing Unit 1 ownership and oversight.

57. (HLT, RNS) Unit 1 experienced a seawater intrusion event during its first operating cycle. GE was tasked with evaluating the effects of the seawater (chloride) on the fuel rods and the fuel assembly hardware. In carrying out this investigation, GE reviewed the operating history of the core and selected fuel assembly MS 557 for disassembly and detailed inspection.

Early GE fuel assemblies were not designed with the expectation that they would be fully disassembled and then reassembled in the spent fuel pool. The center spacer capture rod was not designed to be replaced or reused. Thus, the chloride event and subsequent disassembly of MS 557 resulted in the need for loose rod storage in the Unit 1 SFP.

58. (HLT, RNS) The loose spent fuel rod holders (8-rod container) that were used, while having the right physical dimensions to be stored in the fuel racks in the SFP, did not have a bale handle. The GE-designed container had an eyehook that was used for movement in the SFP. The bale handle provided the connection for the fuel-handling crane to enable the operators to place fuel assemblies into the fuel storage racks. Without bale handles, placing the container in the fuel racks with the fuel-handling crane was difficult. This resulted in the practice that GE started at Unit 1 which was to leave the loose rods in the container tied to the side of the pool.

59. (HLT, RNS) GE also had individual fuel rods in the Unit 1 SFP as part of their Segmented Rod Test Program. Unit 1 was one of three BWR's selected for this program. As result, GE fuel handlers were at the Unit 1 SFP to load and unload individual rods into a test bundle that was placed back into the core for the next operating cycle. During these operations, the Unit 1 Reactor Engineers relied on GE for fuel movement and tracking.

60. (HLT) The original design for the Unit 1 SFP in 1970 was for the storage of one and one-half cores. At that time, the nuclear industry and the Atomic Energy Commission anticipated relatively small amounts of spent fuel being stored in the SFP at the reactor site. The spent fuel was to be transported to a licensed fuel reprocessing facility for the removal and reuse of the fissile material. However, the Federal Government decided not to support spent fuel reprocessing in 1978. This resulted in the need to significantly expand the storage capacity of SFPs, including Unit 1, over time. The impact of this policy change was greater on plants, like

Millstone Unit 1, that had already been built than it was for those still under construction, like Millstone Unit 3. Expansion of the storage capacity in the Unit 1 SFP ultimately required disposal of most of the radioactive waste that had been place in the SFP, including the LPRMs.

61. (HLT, RNS) The Unit 1 procedure at the time provided discretion for the RE to determine the level of documentation necessary to meet the SNM tracking and accounting requirements. Minor movements of fuel assemblies within the SFP were at the time not always documented (*e.g.*, if the assembly was promptly returned to its original location).

62. (HLT, RNS) The SNM control and accountability systems of the late 1960s and the early 1970s were not designed with the expectation of significant fuel reconstitution taking place in the SFPs. Fuel was not expected to leak, so there was expected to be little need to disassemble or track individual fuel rods. As a result, the level of detail of the Unit 1 SNM procedures for tracking the location and movement of fuel was based on whole fuel assemblies and not individual fuel rods. This, of course, is no longer true as previously discussed.

63. (HLT, RVF) Based on the information from the interviews, it was concluded that the turnover information which was provided in 1980 when the Unit 1 RE left the company was not adequate. The turnover was not sufficient to ensure that the follow-up actions were taken or that the rods would continue to be tracked on the SFP map. This turnover came in the middle of a major refueling outage while the incoming RE was assigned duties away from the SFP.

64. (HLT) In sum, specific historical factors and a combination of unusual circumstances at Unit 1 contributed directly to the events that resulted in the loss of accountability of the two spent fuel rods. These pre-existing causal factors made the plant vulnerable to the loss of accountability. In contrast, based on a review of the FRAP investigation team and RCAT efforts, there is no reason to suggest that the loss of the two rods was due to a lack of willingness or the

lack of capability to implement and follow the procedures or controls such as those that would be relied upon to prevent criticality accidents or to adequately control the movement of fuel.

65. (HLT) Likewise, there were a number of factors that delayed the discovery of the missing fuel rods. None of these was a lack of willingness to implement administrative controls.

66. (HLT, RNS) First, the RE who had direct knowledge of the physical location of the two rods departed and there was inadequate turnover with his successor. The first RE had been the key individual involved in the identification and tracking of these two rods in the SFP. Second, during the LPRM processing and cutting in 1979, the workers did not use visual aids, such as borescopes or reverse periscopes, to help identify that there was fuel present in the non-fuel location. The high radiation levels prohibited close inspection of the items being loaded into the liners for shipment off site at a later date. Third, once the rods were cut and/or stored with radioactive LPRM hot sections, they were essentially hidden from any of the normal actions that might identify them. Subsequent physical inspections would not look for fuel in a waste area. Also, Unit 1 did not recognize the loss of physical accountability of the two MS-557 fuel rods because it did not effectively maintain and periodically compare a single integrated, readily retrievable "Inventory of Record" with the physical fuel inventory.

67. (HLT) The licensee's response to the circumstances of the two missing fuel rods was comprehensive and thorough and demonstrates a complete willingness to implement and enhance SNM inventory controls. In addition, during the FRAP investigation, the ownership of Millstone was transferred from NU to DNC. The DNC executives, managers, and the staff engineers were fully supportive of the FRAP team's needs and knowledgeable of the progress of the effort. The FRAP Team Project Manager and the IRT representative briefed the DNC management team that reviewed the results of the FRAP Team. Likewise, DNC executives and

managers were available to support all actions needed to ensure that Millstone Station was fully addressing the regulatory requirements associated with the SFP.

Conclusion

68. (All) Nothing identified by the FRAP investigation or the RCAT suggests that there is any commonality between the event at Unit 1 regarding the two missing fuel rods and the fuel handling procedures used to implement Unit 3 License Amendment 189. Moreover, the procedures already in place and the corrective actions taken at Millstone fully account for tracking and accounting of both fuel assemblies and fuel rods that are stored in the Unit 3 spent fuel pool. In our opinion, these actions adequately address the issue of fuel handling and accountability for Unit 3.

The information presented above is true and correct to the best of my knowledge and belief.

Robert V. Fairbank, Jr.

Robert V. Fairbank, Jr.

District of Columbia

Sworn and subscribed to before me on this 14th day of March, 2002.

Notary Public

VALERIE T. BEVERLY
Notary Public, District of Columbia

My Commission Expires: _____

My Commission Expires April 14, 2006

The information presented above is true and correct to the best of my knowledge and belief.

Richard N. Swanson

Sworn and subscribed to before me on this 11th day of March, 2002.

Notary Public

My Commission Expires: My Commission Expires April 30, 2004

The information presented above is true and correct to the best of my knowledge and belief.

Hugh L. Thompson, Jr.

Sworn and subscribed to before me on this 12th day of March, 2002.

Notary Public

My Commission Expires: My Commission Expires April 30, 2004

ATTACHMENT A

PROFESSIONAL QUALIFICATIONS OF ROBERT V. FAIRBANK, JR.

Experience:

2000-Present — Fairbank Management Services

Engineering and Management Consultant

Client: Northeast Utilities

- Project Manager – Managed Fuel Rod Accountability Project to investigate the loss of accountability for two spent fuel rods at Millstone 1 Nuclear Power Plant. Directed a highly experienced team of professionals, made presentations to State and Federal Regulatory Agencies and community nuclear oversight committees.

1996-2000 — Commonwealth Edison Company

Project Manager - Regulatory Services, Downers Grove

- Established and led a multi-site, 250,000-manhour project converting to Improved Standard Technical Specifications and 24-month operating cycles. Prepared several risk-informed Technical Specification changes to extend allowed-outage-times and increase surveillance test intervals.

Acting Engineering Manager, Quad Cities Nuclear Power Station

- Responsible for the entire design basis of two 800 MWe nuclear power plants. Led several engineering functional areas totaling over 150 engineers. Led a multi-disciplined team in thoroughly assessing the station's readiness for restart following a voluntary shutdown.

Executive Assistant to the Site Vice President, Quad Cities Nuclear Power Station

- Assisted in developing and overseeing the station's strategic business plan. As a collateral duty acted as the Regulatory Assurance Manager responsible for compliance with the station's operating license and improving the station's safety performance. Led a multi-disciplined team in comprehensively evaluating the adequacy of compliance with station's design and licensing basis (10 CFR 50.54(f) response).

System Engineering Manager, LaSalle County Nuclear Power Station

- Responsible for providing engineering and technical support to two 1100 MWe power stations. Led failure analysis and root cause investigations and managed completion of corrective and preventive actions to resolve longstanding equipment problems.

- Improved department efficiency by implementing changes and focusing engineers on station safety, production and cost goals, and increasing plant performance monitoring and predictive maintenance to prevent emergent equipment problems.

1980-1996 — Boston Edison Company, Pilgrim Nuclear Power Station

Project Manager

- As a direct report to the Senior Vice President Nuclear, contributed to the development of long-term and annual operating plans, deregulation strategy and transition plan development. Led the Northeast Energy Alliance, a consortium of ten nuclear utilities. Appointed Vice Chairman, Northeast Chapter, American Nuclear Society.

Manager, Regulatory Assurance and Emergency Preparedness

- Responsible for the station's operating license, emergency preparedness, and environmental programs. Contributed to achieving the station's best-ever regulatory ratings and inspection results. Implemented Technical Specification improvements. Led the station's strategic improvement plan.

Manager Nuclear Engineering

- Responsible for the entire design basis of Pilgrim Nuclear Power Station. Directed several functional groups totaling 95 engineers providing engineering analyses, plant design changes, and project management services. Reduced generating costs and improved plant performance via design improvements. Developed non-modification solutions to plant problems and regulatory initiatives. Founded a utility benchmarking peer group (Single Unit Boiling Water Reactors), sharing cost and performance information. Appointed Executive Member, Nuclear Electric Insurance Limited, Engineering Advisory Committee.

Manager, Engineering Design

- Led 54 engineers and earned the highest regulatory ratings.

Group Leader, Fluid Systems and Mechanical Components

- Responsible for design, procurement, fabrication, and installation of fluid systems and mechanical components. Provided daily mechanical engineering support to operations and maintenance.

Project Manager

- Directed Three Mile Island Lessons Learned and Equipment Qualification Projects. Appointed Primary Representative to the Boiling Water Reactor Owners Group.

1978 – 1980 — Bechtel Power Corporation

Control Systems Group Leader

1975 – 1978 — Westinghouse Electric Corporation

Project Engineer

1970 – 1975 — Bechtel Power Corporation

Control Systems Engineer

Education: MBA, University of Pittsburgh, Pittsburgh, PA
BSME, Northeastern University, Boston, MA

ATTACHMENT B

PROFESSIONAL QUALIFICATIONS OF RICHARD N. SWANSON

Overview: Mr. Swanson has thirty years of experience with organizations in capital-intensive technical industries. He has made key contributions in a number of dramatic performance turn-arounds, both as a consultant and senior line manager. Line management responsibilities have included engineering, nuclear safety assessment, regulatory strategy and compliance, risk assessment, performance oversight, quality assurance, project management, and construction. Programmatic responsibilities have included leading and coaching event investigation teams, designing and conducting independent program assessments, diagnosing organizational weaknesses, designing and mentoring self-assessments, managing projects (from one to over one hundred projects), analyzing and improving processes, developing and implementing organization-wide improvement strategies, and managing technical programs. Clients include companies engaged in power generation, chemical processing, engineering design, and manufacturing.

Experience: **President, Performance Management Initiatives, Inc.**

Clients:

American Electric Power Company (D.C. Cook)

Baltimore Gas & Electric Company (Transmission)

BNFL Fuel Solutions Corporation

Carolina Power & Light (Corporate Engineering; Robinson; Brunswick; Shearon Harris)

ComEd (LaSalle; Quad Cities; Byron; Braidwood; Dresden; Zion; Nuclear Services)

Consolidated Edison (Indian Point 2) (Corrective Action Department; Emergency Preparedness Department)

Consumers Energy Company (Palisades)

Florida Power Corporation (Crystal River (nuclear); Energy Supply Division (fossil))

Florida Power & Light (Saint Lucie)

General Electric Nuclear Energy Division (Quality Assurance; Nuclear Services)

HGP, Inc.

International Atomic Energy Agency

Lockheed Martin Utility Services (Portsmouth Gaseous Diffusion Plant)

Northeast Utilities (Millstone Unit 1; Millstone Station; Millstone Unit 3; Nuclear Oversight Organization)

PG&E National Energy Group (Operations Division)

PP&L Corporation (Susquehanna SES)

US Enrichment Corporation

Major achievements and experiences:

- *Event Investigation, Performance Assessment, and Investigation Management:*

  ◊ Led, coached, and supported numerous independent investigations of plant events, management performance, employee allegations (Millstone Station, PG&E-NEG Operations Division; Baltimore Gas & Electric Co. Transmission Dep't.; Susquehanna, Indian Point 2; BNFL Fuel Solutions Corporation; D C Cook; LaSalle; Salem; Hope Creek; Palisades; Big Rock Point; Pilgrim)

  ◊ Reviewed Performance Indicators used by management, provided recommendations for improvement (usually in conjunction with other assignments) (Susquehanna; D C Cook; LaSalle; St. Lucie; Millstone; Portsmouth Gaseous Diffusion Plant; Salem; Hope Creek; Palisades; Big Rock Point)

  ◊ Mentored plant evaluators re: Event Investigations and Root Cause Assessments (Millstone Station, D C Cook; LaSalle)

  ◊ Led independent team evaluation of Corrective Action Program readiness for Manual Chapter 0350 restart, provided recommendations for improvement, supported implementation of programmatic improvements (DC Cook)

  ◊ Mentored QA managers, lead auditors, and auditors re: Audit and Surveillance practices and reports (Portsmouth Gaseous Diffusion Plant; Millstone Nuclear Oversight; Palisades; Big Rock Point; Salem; Hope Creek)

  ◊ Advised self-assessment teams (Indian Point 2, St. Lucie, Palisades, Big Rock Point)

  ◊ Enhanced QA effectiveness, overhauled oversight assessment methods, integration, and planning as General Manager/Director of QA (Palisades; Big Rock Point; Salem; Hope Creek)

  ◊ Evaluated Quality Assurance department performance, oversight processes & interfaces (Susquehanna, GE Nuclear Energy Division; Portsmouth Gaseous Diffusion Plant; Millstone Station; St. Lucie; Palisades; Big Rock Point; Salem; Hope Creek; Turkey Point)

- ◊ Authored, implemented "Principles of Nuclear Oversight" (Crystal River; Palisades; Big Rock Point; Salem; Hope Creek)
- ◊ Defined, planned, implemented self-assessment programs, influenced measurable line performance improvement (Palisades; Big Rock Point; Salem; Hope Creek)
- ◊ Turned around QA Department performance while reducing complement 17% (Consumers Power)
- ◊ Former member of Power Ascension Executive Review Board (Pilgrim)
- ◊ Former member of Management Safety Review Committee (Palisades; Big Rock Point)

- *Project & Process Management:*
  - ◊ Construction Manager for second US Boiling Water Reactor Recirc Pipe replacement (Pilgrim)
  - ◊ Established and implemented capital budget management strategy (PSE&G; Boston Edison)
  - ◊ Achieved measurable improvements in project accountability and tightened project controls for project organizations (Hope Creek; Salem; Pilgrim)
  - ◊ Developed & implemented numerous engineering programs (e.g., Erosion/corrosion; Equipment Qualification; Appendix R/Fire Protection; Heavy Loads; Long-Term Equipment Layup; Safety Enhancement Program; Risk Assessment; Design Review Board) (Pilgrim; Salem; Hope Creek)
  - ◊ Project Manager/Project Engineer for various technical, critical path projects (e.g., Drywell Restoration following elevated temperatures; Feedwater Heater Replacement)
  - ◊ Process analysis (e.g., Work Control; Design Processes; Corrective Action Programs) (Pilgrim; Portsmouth Gaseous Diffusion Plant; Salem; Hope Creek; D C Cook; LaSalle; Millstone Station; St. Lucie; Crystal River; Indian Point 2)
  - ◊ Established regulatory affairs department, defined and implemented regulatory strategy and processes, repaired deteriorated relations with NRC (Pilgrim)
  - ◊ Extended consulting assignments re: restart strategy & processes, licensing department performance improvement, licensing department interfaces (D C Cook; Crystal River; Millstone Units 3 & 2; LaSalle; Pilgrim)
  - ◊ Advice, process development &/or management of regulatory agency team inspections (D C Cook; Quad Cities; Millstone 2 & 3; Crystal River; Portsmouth Gaseous Diffusion Plant; Palisades; Big Rock Point; Salem; Hope Creek; Pilgrim).

- ◊ Process development & support for regulatory inspection management, information management, and implementation plan for Independent Corrective Action Verification Program (inspection involving more than 15 NRC inspectors and 45 inspecting engineers for 25+ weeks per unit) (Millstone 2 & 3)

- *Other:*
  - ◊ Managed Engineering Department before, during and after plant was 'watch listed'; received four consecutive "SALP 1" NRC evaluations in engineering and tech support (Pilgrim)
  - ◊ Detailed review and advice re: major design information submittals required by 10CFR50.54(f) (Millstone 2; Millstone 3; Braidwood; Byron; Dresden; LaSalle; Quad Cities; Zion).
  - ◊ Emergency Director for NRC/FEMA-evaluated emergency exercise (Pilgrim)
  - ◊ Served eight years as commissioned officer in Ballistic Missile and Fast Attack nuclear submarines

Education and Licensure:

Babson College, Wellesley, Massachusetts; MBA, Finance
Northeastern University, Boston, Massachusetts; MS, Engineering Management & Operations Research
U.S. Naval Nuclear Power Program
U.S. Naval Academy, Annapolis, Maryland; BS, Operations Analysis
Licensed Professional Engineer (Mechanical)
Academy Certified Diplomate, American Academy of Certified Consultants and Experts

Presentations/Publications:

Safety Significance of Maintenance and Surveillance Programs, International Atomic Energy Agency, Argonne National Laboratory, Illinois, April, 2001.

An Operational Safety Vision for Nuclear Generating Plants, International Atomic Energy Agency, Argonne National Laboratory, Illinois, October, 2000; April, 2001.

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A Quality Assurance Operational Philosophy, American Nuclear Society Executive Conference on Self Assessment, San Diego, November, 1993.

Streamlining the Modification Process, Institute of Nuclear Power Operations Engineering Support Workshop, Atlanta, Georgia, February, 1992.

ATTACHMENT C

PROFESSIONAL QUALIFICATIONS OF HUGH L. THOMPSON, JR.

Overview: Mr. Thompson has over 30 year of nuclear safety experience, including senior level management in reactor licensing, inspection, spent fuel storage, low-level and high level waste regulatory oversight at the U.S. Nuclear Regulatory Commission. Prior to becoming an expert consultant on nuclear regulatory programs in 1999, Mr. Thompson was the Deputy Executive Director for Regulatory Programs at the NRC and directed the licensing, inspection, and rulemaking activities for operating reactors and material licensees. Mr. Thompson has also held the positions of the Director of the Office of Nuclear Material Safety and Safeguards, the Director of the Division of Licensing and the Director of the Division of Human Factors Safety for the Office of Nuclear Reactor Regulation. Since leaving the NRC, Mr. Thompson has provided executive level services and litigation support to law firms, nuclear facilities and DOE.

Experience:

Turner Harper & Associates — January 2001 to Present

Vice President

- Responsible for providing Executive Services and Litigation Support to law firms, nuclear facilities and U.S. government agencies. Provided safety oversight to the ongoing efforts to locate two missing fuel rods from Millstone Nuclear Power Station Unit 1. Supported the due diligence review of a major utility that was evaluating the regulatory performance and future risk at operating nuclear power plants. Provided expert consultation on the licensing requirements for the management and disposal of radioactive waste and the license termination requirements for the West Valley Demonstration Project. Team Leader for DOE Operational Readiness Review at Hanford, Washington.

Scientech, Inc. — February 1999 - January 2001

Senior Regulatory Advisor

- Responsible for providing Executive Services and Litigation Support to law firms, nuclear facilities, and government agencies. Assisted in researching and investigating information needed to address issues in arbitration concerning the prudence of actions taken during the operation of a three-unit nuclear power station in response to a proceeding initiated by minority owners. Analyzed depositions, testimony and reports presented by opposing witnesses and assisted client attorneys in preparing interrogatories and discovery requests. Assisted client attorneys during depositions and cross-examination of opposing technical experts. Provided expert testimony concerning the regulatory requirements and other factors that would have been

involved in the licensing of a very low-level waste disposal site in a NRC Agreement State. Provided expert consultation on the licensing requirements for a project being considered to process depleted uranium, the management and disposal of radioactive waste and the license termination requirements for the West Valley Demonstration Project.

January 1997 - December 1998 — U.S. Nuclear Regulatory Commission

Deputy Executive Director for Regulatory Programs

- Responsible for carrying out the day-to-day oversight of all NRC's regulatory programs, including the four NRC regional offices. These regulatory programs included the licensing, inspection, and enforcement of nuclear power reactors, research reactors, fuel cycle facilities, nuclear materials facilities, and the radioactive waste transportation storage and disposal programs. Accomplishments included streamlining the reactor licensing renewal process, refocusing the reactor inspection and evaluation program to be more risk-informed and performance-based, established the actions needed to addressed the Y2K computer issues, issued site cleanup regulations for license terminations, and supported expansion of the Agreement State Program.

February 1989 - January 1997

Deputy Executive Director for Nuclear Materials Safety, Safeguards, and Operations Support

- Responsible for carrying out the day-to-day oversight of all NRC's nuclear materials and waste management programs. This included the material programs that were located in each NRC region. These regulatory programs included the licensing, inspection, and enforcement of all fuel cycle facilities, nuclear materials facilities, and the radioactive waste transportation storage and disposal programs. Responsible for the oversight of the NRC Enforcement and Investigation Programs for both reactors and non-reactor licensees. Reviews and evaluations of NRC Agreement States Programs were conducted and followup actions taken when program weakness were identified. Also responsible for the planning and operation of the NRC information technology and computer systems and the operation and maintenance of the White Flint Office space.

February 1987 - February 1989

Director Office of Nuclear Materials Safety and Safeguards

- Responsible for carrying out the day-to-day oversight of all NRC's nuclear materials and waste management programs. This included the material program that was located in each NRC region. These regulatory programs included the licensing, inspection, and enforcement of all fuel cycle facilities, nuclear materials facilities, and the radioactive waste transportation storage and disposal programs. Managed the first major downsizing of the NMSS HLW staff, revised the nuclear medicine program to focus on performance based requirements, established NRC staff program to focus on the cleanup of contaminated sites, and developed the performance-based security requirements for fuel cycle facilitates with significant quantities of special nuclear material.

November 1985 - February 1987

Director, Division of PWR A Licensing, Office of Nuclear Reactor Regulation

- Responsible for the licensing and technical safety reviews and evaluations needed to support the licensing reviews for all Westinghouse-designed reactors. This included the project management activities, completion of the NRC Safety Evaluation Reports, Environmental Impact Statements and testimony when needed to support the licensing hearings. Issued 15 full power operating licenses to plants that had been required to backfit the Lesson Learned from the TMI 2 accident.

March 1985 - November 1985

Director, Division Licensing, Office of Nuclear Reactor Regulation

- Responsible for managing the licensing process of all commercial power and non power reactors, including the safety and environmental evaluations. Directed and supervised the processing of all technical specification changes and other licensing amendments needed to support changes at operating reactors. This responsibility also included ensuring that testimony needed to support NRC's licensing decisions was consistent with agency guidance and sufficient to sat the operating licensing hearings was when required.

December 1981 - March 1985

Director, Division of Human Factors Safety, Office of Nuclear Reactor Regulation

- Directed and managed all human factors efforts in NRC that were being take in response to the accident at Three Mile Island. These activities include control room design reviews, operator qualification and training requirements, simulator requirements, operating and emergency procedure upgrades, and licensee management qualification requirements. Also developed the human factors research needs for the NRC.

September 1980 - December 1981

Director, Planning and Program Analysis Staff, Office of Nuclear Reactor Regulation

- Responsibilities included long range and short range program planning, budget formulation, overview of the NRR Technical Assistance programs and program reviews. As needed established priories and schedules when competing resource demands arose.

September 1975 - September 1980

Technical Assistant, Office of the Commission and Office of Nuclear Reactor Regulation

- Responsible for reviewing and recommending positions on technical and policy issues that were being developed and proposed to address safety concerns and events. Provided expert advice on the formulation of broad Commission programs policies and budget matters.

Atomic Energy Commission — October 1972 - September 1975

Environmental Project Manager, Office of Nuclear Reactor Regulation

- Project management responsibilities for the preparation of draft and final Environmental Impact Statements (FES) for the initial licensing and the continued operation of nuclear power reactors. Provided expert testimony as required on the contents of the FES.

Alabama Power Company — September 1970 - October 1972

Senior Nuclear Engineer

- Responsibilities included preparing responses to AEC licensing questions for the Farley Nuclear Power plant operating license. Assisted in setting up the initial employee training program for Farley.

United States Navy — June 1965 - July 1970

Officer

- Responsibilities included completing nuclear power school and submarine school. Assigned to a fast attack submarine and was responsible for the operations and maintenance of the main propulsion equipment and the weapons systems. Responsible for the security required for the protection of nuclear weapons and the crew training to handle nuclear weapons.

Publications:

- Numerous NRC documents including Environmental Impact Statements, expert testimony in licensing hearings, NRC Testimony before Congressional Committees or Subcommittees including DOE's High Level Waste Program, NRC Oversight of DOE, and Y2K Readiness of Operating Nuclear Power Reactors. (1973- 1998)

- Thompson, H.L. et. al., Independent Technical Review of Proposed Drilling Activities for Operable Unit 7-10 Staged Interim Action (Alternate Pit 9 Project), for the U.S. Department of Energy, October 1999

Affiliations/Memberships:

- Member DC Bar

Training:

- Federal Executive Institute Charlottesville, VA.
- US Navy Nuclear Power School
- US Navy Submarine School

Honors:

- NRC AWARD FOR EXCELLENCE IN EEO 1985
- Meritorious Senior Executive Award 1987
- NRC Distinguished Service Award 1991
- Distinguished Senior Executive Award 1991
- Meritorious Senior Executive Award 1996
- President's Council on Y2K Conversion – Outstanding Service 1998
- DOE CERTIFICATE OF APPRECIATION – PIT 9 PROJECT - 1999

Education:

- U.S. Naval Academy, BS
  Naval Science

- Georgia Institute of Technology, MS
  Nuclear Engineering

- George Washington University, JD
  Law

D

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
Dominion Nuclear Connecticut, Inc.	)	Docket No. 50–423–LA–3
	)	
(Millstone Nuclear Power Station, Unit No. 3)	)	

AFFIDAVIT OF JOSEPH J. PARILLO

I, Joseph J. Parillo, being duly sworn, state as follows:

1. I am a nuclear engineer employed by Dominion Nuclear Connecticut, Inc. ("DNC"). I am currently a Senior Engineer in the Reactor Analysis Section at Millstone Power Station (Millstone).

2. I previously testified in this proceeding on the three contentions raised by the Connecticut Coalition Against Millstone and the Long Island Coalition Against Millstone (Intervenors) and admitted by the Atomic Safety and Licensing Board (Licensing Board), including Contention 4. My testimony on Contention 4 was in an affidavit included in the filing made by Northeast Nuclear Energy Company ("NNECO") on June 30, 2000.

3. My professional qualifications and experience were described in my prior affidavit in Paragraphs 3 and 4. In addition, I included a statement of professional qualifications as Attachment A to that affidavit. As described there, I hold a Bachelor of Science degree in Nuclear Engineering from Rensselaer Polytechnic Institute, which I received in 1976. I have been employed by Northeast Utilities and DNC since that time, and have worked principally in

the areas of reactor engineering, reactor core design, fuel storage, and nuclear criticality analyses. I am also familiar with the process used to manage fuel movements at Millstone, including movements into and out of the spent fuel pools.

4. The purpose of this affidavit is to respond to a question from Judge Kelber regarding the applicability to Millstone Unit 3 of NRC Regulatory Issue Summary ("RIS") 2001-12, "Nonconservatism in Pressurized Water Reactor Spent Fuel Storage Pool Reactivity Equivalencing Calculations," dated May 18, 2001.

5. I am familiar with RIS 2001-12, and more particularly with the Oak Ridge National Laboratory ("ORNL") report referenced therein (NUREG/CR-6683 (ORNL/TM-2000/230), "A Critical Review of the Practice of Equating the Reactivity of Spent Fuel to Fresh Fuel in Burnup Credit Criticality Safety Analyses for PWR Spent Fuel Pool Storage," September 2000). I specifically reviewed the ORNL report and evaluated it for applicability to Millstone Unit 3. This evaluation took place in February through May 2001. I also discussed this matter with the NRC Staff in April 2001. The results of our evaluation were documented through the Millstone Corrective Action Program.

6. The ORNL report discusses certain nonconservatisms in a practice known as "reactivity equivalencing" used in nuclear criticality calculations related to Spent Fuel Pool ("SFP") storage configurations. "Reactivity equivalencing" involves equating the reactivity of a spent fuel assembly with a particular initial enrichment and burnup combination, to a fresh fuel assembly (*i.e.*, zero burnup) of a different initial enrichment. This "fictitious" equivalent fresh fuel assembly is used in the criticality calculations to simplify the calculation. The ORNL report shows nonconservatism in this technique when used in two types of circumstances: (1) for

certain geometric configurations of spent fuel assembly storage, such as 2-out-of-4 "checkerboarding" and certain 3-out-of-4 storage configurations; and (2) where soluble boron credit is applied, either under normal or assumed accident conditions. The use of an equivalent enrichment in these circumstances can affect the results of the criticality calculation, if an equivalent enrichment is used in conditions which are inconsistent with how the equivalent enrichment was developed.

7. For Millstone Unit 3, the ORNL report as it relates to geometric configurations does not apply. The Millstone Unit 3 SFP licensing basis analyses do not analyze spent fuel in any of the geometric configurations that the ORNL report is concerned about. Millstone Unit 3 spent fuel is not analyzed in a checkerboard configuration. Millstone Unit 3 does store fuel in a 3-out-of-4 configuration in SFP Region 1, but the limiting case analyzes storage of 5.0 weight-percent (w/o) U-235 fresh fuel in the 3-out-of-4 configuration, with the fourth location empty and blocked. The ORNL report issue does not apply to calculations involving fresh fuel, where reactivity equivalencing is not used.

8. For Millstone Unit 3, the ORNL report issue does apply to the extent DNC relies on soluble boron credit. As discussed in my June 2000 affidavit, Paragraph 21, Unit 3 does not rely on soluble boron credit for normal conditions. The Unit 3 SFP licensing basis criticality analyses for accident conditions require a minimum 425 ppm soluble boron for the limiting accident condition (a dropped or misplaced 5.0 w/o U-235 fresh fuel assembly in Region 3 of the SFP). As a result, the Technical Specifications were rounded up to 800 ppm for the Technical Specification boron surveillance.

9. With respect to the reactivity equivalencing nonconservatism, we evaluated the limiting Region 3 calculation and concluded that the 425 ppm of soluble boron needed for accident conditions is still valid. There is substantial margin to the value of 425 ppm soluble boron needed for accident conditions. Our evaluation shows the available margin to 425 ppm is more than enough to cover the reactivity equivalencing nonconservatism described in the ORNL report. The majority of this margin is available because the criticality case that generated the 425 ppm soluble boron requirement was for a Region 3 3-out-of-4 storage configuration that we considered in the design process, but decided later not to license. The limiting accident condition for the 4-out-of-4 Region 3 storage configuration that was licensed has substantial margin to the 425 ppm accident condition soluble boron value. Note that for Regions 1 and 2 of the Unit 3 SFP, the licensing basis calculations include even more margin because significantly less soluble boron is necessary in Region 2 for accident conditions, and no soluble boron is needed in Region 1 for accident conditions.

10. In conclusion, we have reviewed the ORNL report and concluded that the 425 ppm soluble boron calculated bounding value for accident conditions would still be adequate, and the 800 ppm Technical Specification soluble boron surveillance limit would still be sufficiently conservative. In addition, as discussed by Robert McDonald in his affidavit included in the June 30, 2000 NNECO filing in this proceeding, Paragraph 11, Millstone procedures establish an even more conservative administrative limit of 2,600 ppm soluble boron.

11. The foregoing statements are true and correct to the best of my knowledge and belief.

Joseph J. Parillo

Sworn and subscribed to before me on this 13 day of March, 2002.

Notary Public

My Commission expires:

WM. E. BROWN
NOTARY PUBLIC
MY COMMISSION EXPIRES MAR. 31, 2006