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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2
RECONCILIATION OF REGULATORY REQUIREMENTS

Dominion Nuclear Connecticut, Inc. (DNC) has recently become aware of a conflict with the current regulatory structure of 10 CFR 50.68. Specifically, 10 CFR 50.68 contains requirements that can impact activities that are separately regulated and permissible under 10 CFR 72. On this basis, DNC hereby submits as Enclosure 1, pursuant to 10 CFR 50.12, a request for a limited exemption from the requirements of 10 CFR 50.68(b)(1). Similar exemptions have been granted by the Nuclear Regulatory Commission (NRC) for at least two other reactor licensees. Enclosure 2 provides information relating to an environmental assessment and finding of no significant impact. Commitments made in this submittal are listed in Enclosure 3. DNC is requesting NRC conclude its review of this matter no later than January 15, 2005.

If you have any questions or require additional information, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

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Enclosures

Commitments made in this letter: See Enclosure 3

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Enclosure 1

RECONCILIATION OF REGULATORY REQUIREMENTS

Millstone Power Station Unit 2
Dominion Nuclear Connecticut, Inc. (DNC)

I. BACKGROUND

Dominion Nuclear Connecticut, Inc (DNC) is constructing an independent spent fuel storage installation (ISFSI) as allowed under 10 CFR 72, Subpart K. This facility is expected to be operational at Millstone Power Station (MPS) by early 2005. Once in place, spent fuel from the Millstone Unit No. 2 (MPS2) spent fuel pool (SFP) will be transferred to this storage facility. The Transnuclear (TN) NUHOMS®-32PT storage system has been selected for use at the Millstone ISFSI. The TN NUHOMS®-32PT cask system with the Dry Shielded Canister (DSC) is designed to hold 32 spent fuel assemblies for ISFSI deployment, commonly referred to as the NUHOMS®-32PT DSC (References 1, 2), and is listed in 10 CFR 72.214 as Certificate of Compliance (CoC) 1004. ISFSI implementation involves the temporary placement of a DSC in the cask handling area of the MPS2 SFP. The cask handling area is a separate area of the MPS2 SFP that can be isolated from the SFP proper. Upon placement of the unsealed DSC in the cask handling area, fuel assemblies are transferred/moved underwater from the permanently installed storage racks located within the SFP to the DSC. Once the DSC is filled to capacity, it is sealed and drained prior to transfer to the ISFSI.

10 CFR 50.68 provides NRC requirements related to criticality prevention during fuel handling activities. 10 CFR 50.68(b)(1) specifically requires that “Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water.” 10 CFR 50.68(b)(4) further stipulates, “If credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.”

The NRC separately established criticality prevention standards under 10 CFR 72.124(a) and (b), to be applied to fuel handling activities supporting implementation of an ISFSI. 10 CFR 72.124(a) requires that spent fuel handling, packaging, transfer, and storage systems must be designed to be maintained subcritical and to ensure that, before criticality may occur, at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety. The design of handling, packaging, transfer, and storage systems must include margins of safety for the nuclear criticality parameters that are commensurate with the uncertainties in the data and methods used in calculations and demonstrate safety for the handling, packaging, transfer and storage conditions and in the nature of the immediate environment under accident conditions. 10 CFR 72.124(b) requires when practicable, the design of an ISFSI or MRS must be based on favorable geometry, permanently fixed neutron absorbing materials (known as poisons), or both. Where solid neutron absorbing materials are used, the design must provide for positive means of verifying their continued efficacy. For dry spent fuel storage systems, the continued efficacy may be confirmed by a demonstration or analysis before use, showing that significant degradation of the neutron absorbing materials cannot occur over the life of the facility.

While differing in approach, the underlying intent of these separate regulatory requirements is the same; the prevention of unplanned criticality events through a diverse combination of; design features, analysis to demonstrate margins against uncertainties, and administrative controls to manage unlikely events that could challenge criticality safety.

II. REQUEST

Pursuant to 10 CFR 50.12(a), "Specific Exemption," DNC hereby requests a limited exemption from the requirements of 10 CFR 50.68(b)(1) relative to demonstrating that keff will be maintained less than 1.0 under unborated conditions postulated to occur during fuel handling activities associated with loading, unloading, and handling of the components of the TN NUHOMS®-32PT storage system at MPS2. This exemption is justified based on the substantial criticality prevention features incorporated within the design of the TN NUHOMS®-32PT storage system, the requirement for soluble boron to prevent criticality included in the Technical Specifications for the cask system, the conservative nature of the criticality analysis performed in support of licensing this storage system, and the low likelihood of a boron dilution event occurring during anticipated fuel loading and handling operations. In addition, DNC proposes, in Enclosure 3, specific supplemental actions to address aspects of fuel loading and storage utilizing the NRC-certified storage system.

III. REGULATORY REQUIREMENTS

A. 10 CFR 50.68(b) provides specific requirements related to prevention of criticality during fuel handling activities.

   1. 10 CFR 50.68(b)(1) specifically states, "Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water."

   2. 10 CFR 50.68(b)(4) further stipulates, "If credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water."

As allowed by Part 72, the approved criticality analysis of the NUHOMS®-32PT DSC (Reference 2, Appendix M) is based upon credit for soluble boron concentration to maintain k-effective (keff) less than 0.95. Supplemental analyses to demonstrate keff is maintained less than 1.0 under unborated conditions are not required under Part 72.

IV. JUSTIFICATION

10 CFR 50.12(a) allows licensees to request exemptions and the Commission to grant exemptions from the requirements of the regulations where such exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Exemptions are only granted when special circumstances are present. DNC asserts that the following special circumstances exist in support of this application.

V. SPECIAL CIRCUMSTANCES

> *10 CFR 50.12(a)(2)(ii) Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule,...*

Application of the 10 CFR 50.68(b)(1) and (b)(4) criticality prevention standard to the storage and handling of fuel assemblies retained in the permanently installed racks located within the SFP is appropriate, and no exemption is requested in that regard. However, the application of 10 CFR 50.68(b)(1) criticality prevention standards to DSC loading operations conducted in connection with a 10 CFR Part 72 license is not necessary to achieve the underlying purpose of the rule, given the design characteristics of and safety analyses for the NUHOMS®-32PT Cask System as well as the associated procedural controls, including TS requirements applicable to the System, which are designed to preclude conditions for accidental criticality.

The NRC has granted similar exemptions to Diablo Canyon Power Plant (Reference 9) and Sequoyah Nuclear Plant (Reference 10). Therein, the staff accepted that the underlying intent of 10 CFR 50.68(b)(1) is met if it can be demonstrated that an accidental criticality event is unlikely to occur.

The staff also accepted that an inadvertent criticality accident is unlikely to occur if the following five criteria are met:

1. *The cask [DSC] criticality analyses are based on the following conservative assumptions:*

    a) *All fuel assemblies in the DSC are unirradiated and at the highest permissible enrichment,*
    b) *Only 75 percent of the Boron-10 in the Boral panel inserts is credited,*
    c) *No credit is taken for fuel-related burnable absorbers, and*
    d) *The DSC is assumed to be flooded with moderator at the temperature and density corresponding to optimum moderation."*

2. *The licensee's ISFSI TS requires the soluble boron concentration to be equal to or greater than the level assumed in the criticality analysis and surveillance requirements necessitate the periodic verification of the concentration both prior to and during loading and unloading operations.*

3. *Radiation monitors, as required by GDC 63, "Monitoring Fuel and Waste Storage," are provided in fuel storage and handling areas to detect excessive radiation levels and to initiate appropriate safety actions.*

4. *The quantity of other forms of special nuclear material, such as sources, detectors, etc., to be stored in the DSC will not increase the effective multiplication factor above the limit calculated in the criticality analysis.*

5. *Sufficient time exists for plant personnel to identify and terminate a boron dilution event prior to achieving a critical boron concentration in the DSC. To demonstrate that it can safely identify and terminate a boron dilution event, the licensee must provide the following:*

   a) *A plant-specific criticality analysis to identify the critical boron in the DSC based on the highest reactivity loading pattern.*
   b) *A plant-specific boron dilution analysis to identify all potential dilution pathways, their flowrates, and the time necessary to reach a critical boron concentration.*
   c) *A description of all alarms and indications available to promptly alert operators of a boron dilution event.*
   d) *A description of plant controls that will be implemented to minimize the potential for a boron dilution event.*
   e) *A summary of operator training and procedures that will be used to ensure that operators can quickly identify and terminate a boron dilution event."*

The following information provides assurance that the above criteria will be met when using the Transnuclear NUHOMS®-32PT spent fuel storage system at MPS2.

<u>*Criterion 1*</u>

The DSC criticality analyses are based on the following conservative assumptions:

a) *All fuel assemblies in the DSC are unirradiated and at the highest permissible enrichment,*
b) *Only 75 percent of the Boron-10 in the Boral panel inserts is credited,*
c) *No credit is taken for fuel-related burnable absorbers, and*
d) *The DSC is assumed to be flooded with moderator at the temperature and density corresponding to optimum moderation.*

Amendment No. 5 to CoC No. 1004 for the TN Standardized NUHOMS® System, effective January 7, 2004, added the 32PT DSC to the list of DSC's authorized for use in the Standardized NUHOMS® System for dry storage of spent fuel. The design criteria for the NUHOMS® System require that the fuel loaded in the DSC remain subcritical under normal and accident conditions as defined in 10 CFR Part 72. The requirements presented in the standard review plan (SRP) for dry cask storage system (NUREG-1536, "Standard Review Plan for Dry Cask Storage System") were followed for the criticality analyses.

NUREG-1536 provides the following acceptance criteria for the criticality evaluation consistent with the requirements of Criterion 1:

> "Criticality safety of the cask system should not rely on use of the following credits:
>
> a. burnup of the fuel
> b. fuel-related burnable neutron absorbers
> c. more than 75 percent for fixed neutron absorbers[a] when subject to standard acceptance tests.
>
> [a]For greater credit allowance, special, comprehensive fabrication tests capable of verifying the presence and uniformity of the neutron absorber are needed."

The criticality analyses performed for the 32PT DSC are described in Section 6 of Appendix M of the Final Safety Analysis Report (FSAR) Revision 8 for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel. As required, the criticality analyses assume the fuel is unirradiated, no credit for fuel-related burnable neutron absorbers is taken, and less than full credit for the fixed neutron absorber within the fuel basket. The criticality analyses assume 90 percent assumed credit for the fixed neutron poison in the basket is taken. The use of 90 percent, versus 75 percent assumed credit for the fixed neutron poison in the basket under the criterion is justified based on fabrication tests verifying the presence and uniformity of the neutron absorber as outlined in Section 6 of Appendix M of the Standardized NUHOMS® FSAR. These analyses have been performed to establish the maximum allowed fuel enrichments for which the Technical Specification-specified soluble concentration will maintain keff below an upper subcritical limit (USL) which is less than or equal to 0.95 under conditions of optimum moderation.

Criterion 2

The licensee's ISFSI TS requires the soluble boron concentration to be equal to or greater than the level assumed in the criticality analysis and surveillance requirements necessitate the periodic verification of the concentration both prior to and during loading and unloading operations.

A condition of CoC 1004 indicates that DSCs authorized by the CoC are approved for use by holders of 10 CFR Part 50 licenses for nuclear power reactors at reactor sites under the general license issued pursuant to 10 CFR Part 72.210 subject to the conditions specified by 10 CFR 72.212 and the attached Technical Specifications (meaning Technical Specifications attached to the CoC).

The Technical Specifications applicable to the 32PT DSC (attached to CoC 1004) contain the following requirements:

Limit/Specification:

> "The DSC cavity shall be filled only with water having a boron concentration equal to, or greater than 2500 ppm."

Surveillance:

> "Written procedures shall be used to independently determine (two samples analyzed by different individuals) the boron concentration in the water used to fill the DSC cavity.
>
> 1. Within 4 hours before insertion of the first fuel assembly into the DSC, the dissolved boron concentration in water in the spent fuel pool, and in the water that will be introduced in the DSC cavity, shall be independently determined (two samples chemically analyzed by two individuals).
>
> 2. Within 4 hours before flooding the DSC cavity for unloading the fuel assemblies, the dissolved boron concentration in water in the spent pool, and in the water that will be introduced into the DSC cavity, shall be independently determined (two samples analyzed chemically by two individuals).
>
> 3. The dissolved boron concentration in the water shall be reconfirmed at intervals not to exceed 48 hours until such time as the DSC is removed from the spent fuel pool or the fuel has been removed from the DSC."

Bases:

> "The required boron concentration is based on the criticality analysis presented in Appendix M of this FSAR for loading of the DSC with unirradiated fuel, maximum enrichment, and optimum moderation conditions."

<u>*Criterion 3*</u>

Radiation monitors, as required by GDC 63, "Monitoring Fuel and Waste Storage," are provided in fuel storage and handling areas to detect excessive radiation levels and to initiate appropriate safety actions.

Millstone Unit 2 FSAR (Reference 5) sections Appendix 1A, 9.5.2.1, 7.5.6 and 9.9.8.2.1 describe compliance with GDC 63. As described in FSAR section 9.9.8.2.1, a radiation monitoring system is located next to the spent fuel pool. The radiation monitoring system consists of four-gamma sensitive detector assemblies spaced about the spent fuel pool area with local indication plus visual and audible alarms. These four area radiation monitors also provide indication and alarm in the Main Control Room. These area radiation monitors will alert the operators to excessive radiation levels in the spent fuel pool area. The operators and Health Physics personnel would investigate the reasons for the high radiation levels and initiate appropriate safety actions.

Criterion 4

The quantity of other forms of special nuclear material, such as sources, detectors, etc., to be stored in the cask will not increase the effective multiplication factor above the limit calculated in the criticality analysis.

The allowable contents of the 32PT DSC are specified in the CoC 1004 Technical Specifications. These contents have been addressed in the criticality analyses performed in support of licensing this storage system. Burnable poison rod assemblies are not authorized to be stored with CE 14X14 type assemblies in the 32PT DSC.

Criterion 5

Sufficient time exists for plant personnel to identify and terminate a boron dilution event prior to achieving a critical boron concentration in the DSC. To demonstrate that it can safely identify and terminate a boron dilution event, the licensee must provide the following:

a) A plant-specific criticality analysis to identify the critical boron in the DSC based on the highest reactivity loading pattern.
b) A plant-specific boron dilution analysis to identify all potential dilution pathways, their flowrates, and the time necessary to reach a critical boron concentration.
c) A description of all alarms and indications available to promptly alert operators of a boron dilution event.
d) A description of plant controls that will be implemented to minimize the potential for a boron dilution event.
e) A summary of operator training and procedures that will be used to ensure that operators can quickly identify and terminate a boron dilution event.

Criterion 5a

As described below, two scenarios are analyzed to determine the most limiting reactivity condition for MPS2 fuel (CE14x14 fuel type) to be stored in the NUHOMS 32PT DSC. One scenario for the existing approved CoC 1004, and a second scenario for the proposed Amendment of CoC 1004.

Boron Concentrations for Keff < 0.95

The 32PT storage system has been evaluated for the CE 14X14 type fuel used at MPS2. The 32PT system has the option of placing poison rod assemblies (PRAs) in the guide tubes of the fuel assemblies to be stored to allow storage of fuel assemblies of higher initial enrichment. This provides a method for maintaining the appropriate subcritical margin (keff $\leq$ 0.95) with increasing initial enrichment at the Technical Specification specified minimum soluble boron concentration. These criticality analyses and results are described in Section 6 of Appendix M of the Final Safety Analysis Report (FSAR) Revision 8 for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel. As indicated previously the minimum soluble boron concentration specified in the Technical Specifications (Amendment 7 of CoC 1004) for loading a 32PT DSC is 2500 ppm. This allows storage of fuel of initial enrichment of up to 3.8 wt. % U-235 with no PRAs, fuel of initial enrichment of up to 4.6 wt. % U-235 with 4 PRAs, and fuel of initial enrichment of up to 5.0 wt. % U-235 with 8 PRAs while still maintaining the required subcritical margin to ensure keff is maintained $\leq$ 0.95.

Proposed Amendment 9 to the NUHOMS CoC 1004 submitted April 21, 2004, provides analyses to support variable minimum required soluble boron concentrations as a function of the initial enrichment of the fuel to be stored. This amendment would allow the minimum required spent fuel pool boron concentration for DSC loading to vary with the initial enrichment of the fuel to be stored in the DSC. The currently licensed 32PT system requires a minimum of 2500 ppm of soluble boron for initial enrichments of up to 3.8 wt. % U-235 (assuming no PRAs are used). Proposed Amendment 9 would allow the required soluble boron limit to be reduced in discrete steps corresponding to the initial enrichment, from a maximum limit of 2500 ppm for initial enrichments less than or equal to 3.90 wt. % U-235 to 1800 ppm limit for initial enrichments less than or equal to 3.35 wt. % U-235 (also assuming no PRAs are used). These boron concentration values ensure that keff is maintained $\leq$ 0.95. It would be DNC's intent to implement this amendment when approved as the spent fuel pool is normally maintained at a lower boron concentration than the 2500 ppm currently required by the CoC 1004 Technical Specifications and the initial enrichment of the fuel available for loading is less than the current limit of 3.8 wt. % U-235 which corresponds to the 2500 ppm.

The criticality and boron dilution evaluation provided herein bounds both the boron concentrations required for the existing Amendment 7 and the proposed Amendment 9. As will be shown, the limiting condition for the boron dilution event is for a 32PT DSC loaded with fuel that requires 2500 ppm of soluble boron to maintain keff $\leq$ 0.95 on a 95/95 basis.

Boron Concentrations for Keff of 1.0

Additional criticality analyses have been performed by TN to determine a critical soluble boron concentration for the CE 14X14 fuel type. These analyses were performed using the same methodology and assumptions as those used in the previous calculations.

In order to accommodate the requirements proposed in Amendment 9 of CoC 1004, the additional analyses performed by TN determined critical boron concentrations for the 32PT system assuming fuel of 3.35 wt. % U-235 and 3.90 wt. % U-235 for use in evaluating a potential dilution event during DSC loading. As indicated above, these analyses were performed using the same methodology as those described in Section 6 of Appendix M of the Final Safety Analysis Report (FSAR) Revision 8 for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel.

These analyses determined the reduction in soluble boron concentration required to result in an increase of 0.05 in the USL for the conditions under which the Technical Specification minimum required soluble boron concentration of 2500 ppm (corresponding to 3.90 wt. % fuel) or 1800 ppm (corresponding to 3.35 wt. % fuel) had been established. These calculations were performed assuming initial enrichments of 3.35 wt. % U-235 and 3.90 wt. % U-235 consistent with the proposed Amendment 9 limits, which also bound the current Amendment 7, 3.80 wt. % U-235 limit.

The calculations show that to remain below a keff of USL + 0.05, a 32PT DSC loaded with fresh 3.35 wt. % U-235 enriched fuel would require a soluble boron concentration of 1200 ppm. For the case of fresh 3.90 wt. % U-235 enriched fuel, a soluble boron concentration of 1700 ppm is required. These calculations assume an optimum moderation scenario in the canister, which is highly conservative.

In summary, a 32PT DSC filled with 3.90 wt. % U-235 Millstone 2 (CE 14x14) fresh fuel, with no PRAs, under optimum moderation conditions would require $\geq$ 2500 ppm to maintain keff $\leq$ 0.95, and would require $\leq$ 1700 ppm for keff to reach critical. A 32PT DSC filled with 3.35 wt. % U-235 Millstone 2 (CE 14x14) fresh fuel, with no PRAs, under optimum moderation conditions would require $\geq$ 1800 ppm to maintain keff $\leq$ 0.95, and would require $\leq$ 1200 ppm for keff to reach critical. The use of PRAs to allow higher enrichments does not alter these boron concentration values.

These analyses provide boron concentration endpoints for use in evaluating a boron dilution event occurring when a loaded 32PT DSC is located in the MPS2 spent fuel pool. As will be shown later, the limiting condition for the boron dilution event is the event starting with a required boron concentration of 2500 ppm, and a critical boron concentration of 1700 ppm.

Criterion 5b

Boron Dilution Analysis

The objective of the boron dilution analysis presented in this submittal is to confirm that design features, instrumentation and administrative procedures allow sufficient time to detect and mitigate a boron dilution in the SFP before the boron concentration is reduced to a level which allows criticality of the fuel per the NUHOMS®-32PT DSC criticality analysis.

MPS2 has previously submitted a boron dilution analysis for the MPS2 SFP (Reference 3) to allow soluble boron credit in the MPS2 SFP. The boron dilution analysis previously submitted to the NRC analyzed the potential dilution sources, alarms and administrative features that would be used to detect and mitigate a boron dilution event. In the previous boron dilution analysis (Reference 3) it was shown that a maximum possible dilution flow rate of 200 gpm of unborated water would reduce the boron concentration in the MPS2 SFP from 1700 ppm to 600 ppm in 19 hours.

The dilution analysis presented here is quite similar to the boron dilution analysis previously submitted to the NRC. The systems that were previously analyzed for an inadvertent dilution of the pool remain present and have been considered. The major difference in the boron dilution analysis presented in this submittal is that the starting boron concentration for the dilution is 2500 ppm, and the boron concentration by which the event needs to be terminated is 1700 ppm. As will be shown below, the maximum possible dilution flow rate of 200 gpm of unborated water would reduce the boron concentration in the MPS2 SFP from 2500 ppm to 1700 ppm in 9.5 hours.

Potential Dilution Sources

DNC has reviewed and identified potential sources that could dilute the MPS2 SFP. The identified dilution sources were used in the dilution analysis. The analysis provided here is a summary of the analysis performed in Reference 8.

Plant systems representing credible bounding dilution sources and maximum flow rates are:

Potential Dilution Sources	**Maximum Flow Rate**
-Primary Make-Up Water (PMW) System, open valve directly to SFP	200 gpm
-Auxiliary Feedwater makeup to the SFP open valve directly to SFP	100 gpm
-Reactor Building Closed Component Cooling Water (RBCCW) leak to SFP cooling due to heat exchanger tube rupture	142 gpm
-PMW pipe leak to SFP	< 93 gpm
-Auxiliary Steam and Condensate Return piping leak	75.4 gpm
-Fire Protection System piping leak	93 gpm
-Domestic Water pipe leak to SFP	< 93 gpm
-Turbine Building Closed Cooling Water pipe leak to SFP	< 93 gpm
-Roof Drains	discussed separately later

Dilution Event

The dilution analysis (Reference 8) used the above established flow rates and includes the following assumptions:

1. Boron concentration starts at the minimum ISFSI TS value of 2500 ppm.

2. The initial volume of the spent fuel pool is 297,000 gallons, which includes the attached fuel transfer canal volume. Conservatively neglected is the Cask Loading Pit volume.

3. The starting level of the pool is set at the SFP level corresponding to the SFP low level alarm. This is conservatively below the nominal operating level.

4. Spill paths that would reduce dilution water entering the pool (i.e., floor drains) are not credited as mitigating factors.

5. Dilution times are based on a feed and bleed operation with instantaneous complete mixing. The assumption of instantaneous mixing, with one exception, is conservative since the possible unborated water sources entering the Spent Fuel Pool (SFP) are far away from the fuel in the DSC. The fuel in the DSC is located at the bottom of the cask handling pit, and the cask handling pit is connected to the SFP through a gate opening. Also the operation of spent fuel pool cooling system provides substantial mixing to the water in the SFP. The one exception to the use of instantaneous mixing as conservative is if the dilution causes water to enter directly into the cask handling area. As discussed in Commitment 2, procedural controls are planned to ensure that unborated water into the SFP or cask handling area during normal cask operations does not cause an excessive dilution. As discussed in this document, the potential sources of dilution to the SFP have been identified. To ensure that the assumption of uniform mixing remains conservative from an inadvertent dilution, appropriate controls or measures to minimize the possibility of direct dilution of the cask handling area of the SFP will be established prior to DSC loading. (Commitment 6).

6. The SFP high-level alarm is considered the first alarm for operator's response.

Dilution Analysis Results

The limiting boron dilution failure occurs when Primary Make-up Water (PMW) is added to the SFP at 200 gpm. The value of 200 gpm is the maximum flow rate of the system. PMW is used to add water to raise SFP level through a manual evolution performed by Operations and is procedurally controlled.

With an initial MPS2 SFP boron concentration of 2500 ppm, and a 200 gpm dilution flow rate, a feed and bleed dilution to the spent fuel would require 114,000 gallons of water to reduce the boron concentration to 1700 ppm. At a 200 gpm dilution flowrate, this would take 9.5 hours to add 114,000 gallons of water to the MPS2 SFP. The 2500 ppm boron concentration assures that the fuel within the NUHOMS 32PT DSC will have a keff $\leq$ 0.95 on a 95/95 basis, assuming compliance with the 32PT DSC TS for enrichment and PRAs. The 1700 ppm boron concentration corresponds to the boron concentration at which criticality of the fuel could occur within the NUHOMS 32PT DSC. This value is exceptionally conservative since it does not credit fuel burnup, but rather assumes fresh fuel at the maximum enrichment permitted by TS is contained within the DSC.

Because there is a pending NUHOMS CoC 1004 proposed Amendment 9, an additional boron dilution case was examined. The proposed Amendment 9 would allow the required soluble boron to be reduced in discrete steps corresponding to the initial enrichment, from a maximum of 2500 ppm for initial enrichments less than or equal to 3.90 wt. % U-235 (assuming no PRAs are used) to 1800 ppm for initial enrichments less than or equal to 3.35 wt. % U-235 (assuming no PRAs are used). This additional boron dilution analysis is summarized next.

With an initial MPS2 SFP boron concentration of 1800 ppm and a 200 gpm dilution flow rate, a feed and bleed dilution to the spent fuel pool would require the addition of 120,423 gallons of water to reduce the boron concentration to 1200 ppm. At a 200 gpm dilution flowrate, this would take 10 hours. The 1800 ppm boron concentration assures that the fuel within the NUHOMS®-32PT DSC will have a keff $\leq$ 0.95 on a 95/95 basis, assuming compliance with the 32PT DSC TS for enrichment and PRAs. The 1200 ppm boron concentration corresponds to the boron concentration at which criticality could occur within the NUHOMS®-32PT DSC. This value is exceptionally conservative since it does not credit fuel burnup, but rather assumes fresh fuel at the maximum enrichment permitted by TS is contained within the DSC.

From the above, it can be seen that the shortest (limiting) boron dilution event is from the higher starting boron concentration of 2500 ppm. This analysis bounds both the existing CoC 1004 Amendment 7 and the proposed Amendment 9 for the 32PT DSC for MPS2 fuel.

Roof Drains

The roof drain piping around the SFP is such that the roof drains route from the roof to two separate drain headers.

The 10" roof drain line travels along the south wall of the 38'-6" elevation. This 10" drain line is not seismically supported and any leakage from this line would drain onto the SFP building floor. This line interconnects six roof drains from the south portion of the auxiliary building roof. If the entire roof surface area of water drains into the pool, 25 inches of rainfall would be required to add 114,000 gallons to the pool. Since both a pipe leak and 25 inches of rain would be necessary, this unborated dilution source is not considered a credible threat to dilute the SFP soluble boron concentration from 2500 ppm to 1700 ppm.

The piping above the SFP is seismically supported and therefore should not be a potential dilution source of water into the SFP. However, should there be a leak in this piping header, the roof area supplying this drain piping is less than the non-seismic header. Therefore the required rainfall would be 25 inches or larger. Since both a pipe leak of this seismically supported piping and 25 inches of rain would be necessary, this unborated dilution source is not considered a credible threat to dilute the SFP soluble boron concentration from 2500 ppm to 1700 ppm.

Criterion 5c

Alarms and Indications

Should a boron dilution event occur and unborated water be added to the spent fuel pool, there is no automatic level control system for the spent fuel pool; therefore, the spent fuel pool will overflow on an uncontrolled water addition. An expected alarm for this event would be the spent fuel pool high level alarm in the control room. It will take about one hour for a 200 gpm water addition to cause the pool water level to go from the low level alarm setpoint to the high level alarm setpoint. Therefore, detection of the high level condition in the pool would be within one hour for a 200 gpm dilution rate. It would take an additional hour for the pool to overflow. Thus a total of two hours would be the longest time to overflow the pool at a 200 gpm dilution flow rate.

While other indications to the operators would be expected, such as pressure drops in systems leaking water to the SFP, or additional pumps starting due to low pressure because of water leaking to the SFP, or increased auxiliary building sump levels on a pool overflow, these are not credited here.

To ensure defense in depth regarding the detection of a boron dilution event, an additional administrative control will be established such that whenever a 32PT DSC is in the spent fuel pool and fuel is in the DSC, spent fuel pool water level will be visually verified to not be overflowing at three hour intervals. If a pool overflow condition occurred, the control room would be immediately notified (Commitment 1).

When DSC operations are in progress in the spent fuel pool, there should be a continuous presence of personnel supporting the loading/unloading operations of fuel. Therefore, the likelihood of a boron dilution event and pool level increase going unnoticed is not reasonable. However, the requirement to verify spent fuel pool level not overflowing at three hour intervals assures that even if the DSC is left unattended with fuel in the DSC, that a dilution event will be detected within three hours of the pool overflow.

Using the above approach, should a boron dilution event occur with a limiting value of 200 gpm of unborated water being added to the SFP, then the SFP water level would increase since there is no automatic level control system. The operators would receive a high spent fuel pool water level alarm in the control room. This alarm would be received within one hour even if SFP water level was at the minimum level at the start of the event. Alarm Response Procedures for this alarm would cause the operators to verify the high alarm condition, investigate the cause and terminate the level increase.

Should a DSC be present in the SFP, with fuel in the DSC, then the three hour visual check of the SFP not overflowing would be in progress. If for some reason the SFP high level alarm did not cause detection of the boron dilution event, then the three hour visual verification of spent fuel pool level not overflowing would detect the boron dilution event in progress. Since it would take two hours for the pool to overflow, assuming 200 gpm dilution flow and pool water level starting at the low water level, and at most three additional hours to visually detect the overflow, then at most a total of five hours could have elapsed since the start of the dilution. Since the total time to dilute the SFP from 2500 ppm to 1700 ppm is 9.5 hours, then an additional 4.5 hours is available to mitigate or terminate the event. This is more than sufficient time to mitigate or terminate the event. Dilutions that are smaller than 200 gpm will result in additional time to detect, mitigate and terminate the boron dilution event.

Criterion 5d

This section describes the plant controls that will be implemented to minimize the potential for a boron dilution event are provided here.

During normal operations associated with insertion and removal of the DSC from the SFP, small amounts of unborated water are used. This water will typically drain to the pool. DSC procedures will be modified to include a requirement that the spent fuel pool will be sampled for boron concentration after each interval of 500 gallons of unborated water has been added to the pool (Commitment 2).

During the time that a DSC is in the pool and fuel is in the DSC, procedural controls will be implemented to ensure that the transfer canal bulkhead gate will not be used to block the transfer canal opening to the pool (Commitment 3). This ensures consistency with the volume credited in the boron dilution analysis, and the added SFP water volume from the transfer canal will slow the boron concentration change for any boron dilution that does occur.

To ensure defense in depth regarding the detection of a boron dilution event, an additional administrative control will be established such that whenever a 32PT DSC is in the spent fuel pool and fuel is in the DSC, spent fuel pool water level will be visually verified to not be overflowing at three hour intervals. If a pool overflow condition occurred, the control room would be immediately notified (Commitment 1).

Criterion 5e

This section provides a summary of operator training and procedures that will be used to ensure operators can quickly identify and terminate a boron dilution event

The need to detect and mitigate a boron dilution event is currently addressed in the licensing basis for MPS2. Boron dilutions, should they occur, will raise the water level in the spent fuel pool, thus the SFP high level alarm response procedure specifies the required operator response actions for a boron dilution event. The operator response to the SFP high level alarm would be to verify visually the SFP level to determine the validity of the alarm, and if valid, terminate the water addition. This procedure specifies that the operators will determine that there are no water sources directly leaking into the pool, and if necessary, then verify that the connected systems are not leaking into the pool. There is a precaution to identify the existing licensing basis SFP boron concentration levels, which are currently a minimum of 1720 ppm to comply with TS LCO 3.9.17. An additional precaution will be added to this procedure to identify that if there is a DSC in the SFP with fuel in the DSC, such that additional boron concentration limits apply, then these limits will be specified in the procedure (Commitment 4).

Other than the additional precaution specified above, no additional changes have been identified as necessary to the operator's procedures to address SFP boron dilution events during DSC loading and unloading operations. Procedure changes that will be needed for DSC loading and unloading activities have been identified as described in response to Criterion 5d.

To ensure that the operators are aware of the SFP boron concentration requirements associated with the NUHOMS®-32PT DSC, operator training will be conducted (Commitment 5). This operator training will ensure the operators are aware of the 32PT DSC TS SFP boron concentration requirements, and should a boron dilution occur, at what boron concentration criticality in the DSC could occur. The training will emphasize the importance of avoiding any inadvertent additions of unborated water to the SFP, responses to be taken for notification or alarms that may be indicative of a potential boron dilution event during DSC loading and fuel movement in the SFP, and identification of the potential for a boron dilution event during decontamination rinsing activities.

Conclusions:

The requested exemption applies only to an activity that was previously authorized under 10 CFR Part 72.

An evaluation was performed to determine the MPS2 SFP boron dilution event that results in the shortest time to criticality for fuel in the NUHOMS 32PT DSC. Starting boron concentrations of both 1800 and 2500 ppm were evaluated as the initial condition for the boron dilution event. Thus, the analysis presented here bounds both Amendment 7 and proposed Amendment 9 to CoC 1004. It was determined that the TS for the NUHOMS system requiring a boron concentration of 2500 ppm is the limiting initial condition. Criticality of the NUHOMS®-32PT DSC occurs at a boron concentration of 1700 ppm when using fresh 3.9 wt. % U-235 fresh (no PRA's) CE 14x14 MPS2 fuel. The corresponding TS required boron concentration is 2500 ppm to ensure keff $\leq$ 0.95 on a 95/95 basis. The most limiting dilution path occurs as the result of an open valve in the PMW system allowing 200 gpm of unborated water to flow directly to the SFP. Based on an initial boron concentration of 2500 ppm and a dilution flow of 200 gpm, the time to reach a boron concentration of 1700 ppm is approximately 9.5 hours.

Should a boron dilution event occur, with a bounding value of 200 gpm of unborated water being added to the SFP, the SFP level would increase since there is no automatic level control system. The operators would receive a high spent fuel pool water level alarm in the control room. This alarm would be received within one hour even if SFP water level was at the minimum level at the start of the event. Alarm Response Procedures for this alarm would cause the operators to verify the high alarm condition, investigate the cause and terminate the level increase.

Should a DSC be present in the SFP, with fuel in the DSC, then the three hour visual check of the SFP would be in progress to assure that the pool is not overflowing. If for some reason the SFP high level alarm did not detect the boron dilution event, then the three-hour visual verification of spent fuel pool level not overflowing would detect the boron dilution event in progress. Since it would take two hours for the pool to overflow, assuming a 200 gpm dilution flow and the pool water level starting at the low water level, and at most three additional hours to visually detect the overflow, then at most a total of five hours could have elapsed since the start of the dilution. Since the total time to dilute the SFP from 2500 ppm to 1700 ppm is 9.5 hours, then an additional 4.5 hours is available to mitigate or terminate the event. This is more than sufficient time to mitigate or terminate the event. Dilutions that are smaller than 200 gpm will result in additional time to detect, mitigate and terminate the boron dilution event.

The above evaluation is extremely conservative because the required boron concentrations to control reactivity in the NUHOMS 32PT DSC do not credit fuel burnup. If fuel burnup was credited, the required boron concentrations to maintain sub-criticality would be significantly lower, in all likelihood equal to 0 ppm.

VI. CONCLUSION

DNC has provided information pertaining to the boron concentration level necessary to preclude criticality in the NUHOMS®-32PT DSC, sources which could result in boron dilution, alarms and boron dilution times. Mitigating actions have also been identified, including revisions of procedures and training of personnel to ensure that a boron dilution event is recognized and terminated with sufficient margin to ensure criticality is precluded.

DNC has also provided information pertaining to the conservative assumptions used in the NUHOMS criticality analysis of the DSC. For the reasons stated above, DNC concludes that the proposed exemption does not present an undue risk to the health and safety of the public and is consistent with the common defense and security.

Special circumstances are also present in accordance with 10 CFR 50.12(a)(2)(ii) in that application of the regulation in this particular circumstance is not necessary to achieve its underlying purpose, including: (1) the administrative features and design characteristic of the dry fuel storage system that are in place to preclude criticality; (2) DNC's compliance with the criticality preventive requirements of 10 CFR 50.68(b) for spent fuel stored and handled in the SFP, rather than the criticality monitoring of 10 CFR 70.24; and (3) DNC's continued monitoring of radiation level in the area in accordance with GDC 63, "Monitoring fuel and waste storage."

VIII. REFERENCES

1. Transnuclear Incorporated, Amendment 7 of Certificate of Compliance No 1004, Standardized NUHOMS System.
2. Transnuclear Incorporated, Revision 8 of FSAR, for Standardized NUHOMS System.
3. J. A. Price letter to the U.S. NRC, "Millstone Power Station Unit No. 2, Technical Specification Change Request (TSCR) 2-10-01, Fuel Pool Requirements," dated November 6, 2001.
4. Diablo Canyon to the U.S. NRC, "Request for Exemption from 10 CFR 50.68 Criticality Accident Requirements," dated October 8, 2003.
5. Millstone Unit 2 Final Safety Analysis Report.
6. Pacific Gas and Electric Company letter DCL-03-150 to NRC dated November 25, 2003, "Response to NRC Request for Additional Information Regarding Potential Boron Dilution Events with a Loaded Multi-Purpose Canister in the DCPP Spent Fuel Pool (TAC No. L23399)"
7. U.S. NRC to J. A. Price, "Millstone Power Station, Unit No. 2 - Issuance Of Amendment RE: Spent Fuel Pool Requirements (TAC NO. MB3386)," dated April 1, 2003.
8. DNC Technical Evaluation M2-EV-04-0025, Revision 0, "Boron Dilution Analysis for TN32PT Cask in the Millstone 2 Spent Fuel Pool."
9. Federal Register Notice, Vol. 69, No. 24, February 5, 2004, p. 5591, Pacific Gas and Electric Company, Diablo Canyon Power Plant, Unit Nos. 1 and 2; Exemption
10. Federal Register Notice, Vol. 69, No. 113, June 14, 2004, p. 33075, Tennessee Valley Authority, Sequoyah Nuclear Plant, Unit Nos. 1 and 2; Exemption

Enclosure 2

Environmental Assessment Information

Millstone Power Station Unit 2
Dominion Nuclear Connecticut, Inc. (DNC)

Environmental Assessment Information

The following information is provided in support of an environmental assessment and finding of no significant impact for the proposed exemption.

Identification of the Proposed Action

Dominion Nuclear Connecticut, Inc (DNC) requests an exemption from the requirements of 10 CFR 50.68, "Criticality Accident Requirements," for storage and handling, in Millstone Power Station Unit 2 (MPS2) Spent Fuel Pool (SFP). The exemption relates to the contents of the Transnuclear NUHOMS®-32PT Cask System licensed under 10 CFR Part 72.

The Need for the Proposed Action

Specifically, 10 CFR 50.68(b)(1) sets forth the following requirement that must be met, in lieu of a monitoring system capable of detecting criticality events:

"Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water."

10 CFR 50.12(a) allows licensees to apply for exemptions and the Commission to grant exemptions from the requirements of the regulations where the exemptions are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and are not necessary to achieve the underlying purpose of the rule and other conditions are met.

DNC is requesting the proposed limited exemption from the requirement of 10 CFR 50.68(b)(1) due to a conflict in the regulations. Application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. A detailed discussion of the special circumstance is contained in Enclosure 1.

Environmental Impacts of the Proposed Action

All activities under consideration associated with the exemption occur within a radiological controlled area. DNC has determined that the requested exemption will not significantly increase the probability or consequences of accidents, that no changes are being made in the types or amounts of effluents that may be released off site, and that there is no significant increase in occupational or public radiation exposure as a result of the proposed activities. Therefore, there are no significant radiological environmental impacts associated with the proposed exemption.

With regards to potential non-radiological environmental impacts, DNC has determined that the proposed exemption has no potential to affect any historic sites. It does not affect non-radiological plant effluents and has no other environmental impact.

Therefore, there are no significant non-radiological environmental impacts associated with the requested exemption.

Environmental Impacts of the Alternatives to the Proposed Action

As an alternative to the requested exemption, the Commission could consider denial (i.e., the "no-action" alternative). Denial of the exemption would result in no change to the current environmental impacts. DNC considers the "no-action" alternative to impact DNC's ability to provide affordable, competitive, and reliable power since DNC power operations would be impacted in the near future.

Alternative Use of Resources

The requested exemption does not involve the use of any different resources than those previously considered in the Final Environmental Statement for the Millstone Nuclear Plant Unit 2, dated June 1973. Accordingly, the proposed action is not a major federal action significantly affecting the quality of the environment.

Enclosure 3

List of Regulatory Commitments

Millstone Power Station Unit 2
Dominion Nuclear Connecticut, Inc. (DNC)

The following commitments have been identified in this submittal and are incorporated into our commitment management program:

1. Whenever a 32PT Dry Shielded Canister (DSC) is in the spent fuel pool (SFP) and fuel is in the DSC, SFP water level will be visually verified to not be overflowing the top of the SFP at 3 hour intervals. If a pool overflow condition has occurred, the control room would be immediately notified.

2. DSC procedures will be modified to include a requirement that the spent fuel pool will be sampled for boron concentration after each interval of 500 gallons of unborated water has been added to the pool.

3. During the time that a DSC is in the pool and fuel is in the DSC, procedural controls will be implemented to ensure that the transfer canal bulkhead gate will not be used to block the transfer canal opening to the pool.

4. An additional precaution will be added to the SFP high level alarm response procedure to identify that if there is a DSC in the SFP, with fuel in the DSC, additional boron concentration limits apply, and these limits will be specified in the procedure.

5. To ensure that the operators are aware of the SFP boron concentration requirements associated with the NUHOMS®-32PT DSC, operator training will be conducted. This operator training will ensure the operators are aware of the 32PT DSC TS SFP boron concentration requirements, and should a boron dilution occur, at what boron concentration criticality of the DSC could occur. The training will emphasize the importance of avoiding any inadvertent additions of unborated water to the SFP, responses to be taken for notification or alarms that may be indicative of a potential boron dilution event during DSC loading and fuel movement in the SFP, and identification of the potential for a boron dilution event during decontamination rinsing activities.

6. Appropriate controls or measures to minimize the possibility of direct dilution of the cask handling area of the SFP will be established prior to DSC loading.