December 30, 2005

Mr. David A. Christian
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SUBJECT: MILLSTONE POWER STATION, UNIT NO. 3 - ISSUANCE OF AMENDMENT RE: LEAD TEST ASSEMBLY (TAC NO. MC5424)

Dear Mr. Christian:

The Commission has issued the enclosed Amendment No. 228 to Facility Operating License No. NPF-49 for the Millstone Power Station, Unit No. 3, in response to your application dated December 16, 2004, as supplemented October 5, 2005. The amendment revises the current fuel rod average licensing basis burnup limit for one lead test assembly containing advanced zirconium-based alloys to a limit not exceeding 71,000 megawatt-days per metric ton of uranium.

A copy of the related Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

/RA/

Victor Nerses, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-423

Enclosures: 1. Amendment No. 228 to NPF-49
2. Safety Evaluation

cc w/encls: See next page

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DOMINION NUCLEAR CONNECTICUT, INC., ET AL.

DOCKET NO. 50-423

MILLSTONE POWER STATION, UNIT NO. 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 228
License No. NPF-49

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Dominion Nuclear Connecticut, Inc. dated December 16, 2004, as supplemented on October 5, 2005, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the requested change to the design basis, as described in the attached Safety Evaluation dated December 30, 2005, is approved.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Darrell J. Roberts, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: December 30, 2005

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 228

TO FACILITY OPERATING LICENSE NO. NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.

MILLSTONE POWER STATION, UNIT NO. 3

DOCKET NO. 50-423

1.0 INTRODUCTION

By letter dated December 16, 2004, as supplemented by letter dated October 5, 2005, Dominion Nuclear Connecticut, Inc. (DNC, the licensee) requested a license amendment for Millstone Power Station, Unit 3 (MP3). The proposed change would revise the fuel rod average licensing basis burnup limit for one lead test assembly (LTA) to a limit not exceeding 71,000 megawatt-days per metric ton of uranium (MWD/MTU). Specifically, the proposed changes would permit DNC to irradiate an LTA containing advanced zirconium-based alloys during MP3 Cycle 12 to an end-of-life fuel rod average burnup of 71,000 MWD/MTU. The licensee stated that irradiation of this LTA in such a manner will provide data on fuel and material performance that will support industry goals of extending the current fuel burnup limits and address Nuclear Regulatory Commission (NRC or the Commission) questions related to fuel performance at higher burnup levels. The October 5, 2005, supplement contained clarifying information, did not expand the scope of the requested amendment, and did not change the NRC staff's proposed finding of no significant hazards considerations.

2.0 REGULATORY EVALUATION

There is no specific Technical Specification (TS) or license condition for MP3 that limits fuel burnup; however, by letter dated February 11, 2004, the NRC issued an exemption that allowed the use of a limited number of Optimized ZIRLO fuel assemblies in the MP3 core. This Exemption specifically stated that the burnup for these assemblies would not exceed 62,000 MWD/MTU. This burnup limit, therefore, became part of the licensing basis for MP3. A license amendment is required to process changes to plant-specific licensing bases when NRC staff approval is required and no other specific approval mechanism exists.

3.0 TECHNICAL EVALUATION

3.1 Mechanical Design

The licensee performed mechanical design analyses of the LTAs using the approved fuel rod design methodologies including WCAP-12488-A, entitled "Westinghouse Fuel Criteria Evaluation Process," and WCAP-12610-P-A, entitled "VANTAGE+ Fuel Assembly Reference Core Report." The design analyses included material properties, cladding corrosion, rod growth, rod internal pressure, and clad fatigue. These methodologies have been used to perform similar evaluations for other high burnup LTAs. The licensee found that the Optimized ZIRLO cladding had better corrosion performance than the approved ZIRLO cladding, and met the fuel rod oxidation limit of 100 microns. Using the approved methodologies, the licensee determined that the high burnup LTA met all the mechanical design limits for MP3 in Cycle 12.

Based on the previous LTA irradiation performance and acceptable analyses, the NRC staff concludes that the mechanical design of the high burnup LTA is acceptable to a peak rod average of 71,000 MWD/MTU for MP3 during Cycle 12.

3.2 Core Design

In the past, the NRC staff had two criteria for LTA programs, i.e., the number of LTAs should be limited, and the core locations of LTAs should be non-limiting (not in the highest power regions). Recently, however, the staff endorsed the concept of locating LTAs next to the highest power regions for simulating typical reactor operations. The high burnup LTA will be located in a non-limiting location for safe operation.

The licensee determined that the LTAs continued to meet the core design criteria, including nuclear and thermal-hydraulic analyses, as the resident fuel for the MP3, Cycle 10 core. The LTAs were placed in core locations that would not experience the most limiting power peaking during the Cycle 10 operation. The results indicated that the Optimized ZIRLO clad fuel rods met all the core design requirements and would perform satisfactorily like the previously-approved fuel rods. With only a limited number of Optimized ZIRLO high burnup rods in the core, the licensee determined that the variation in the radiological consequences was extremely small. Based on the non-limiting location, the licensee determined that the radiological consequences of postulated design-basis accidents (DBAs) involving the high burnup LTA were minimal. In addition, the licensee will perform cycle-specific reload evaluations including the high burnup LTA to ensure that the reload core design requirements using approved methodology are met for Cycle 12.

Based on the approved methodology and acceptable radiological consequences, the NRC staff concludes that the core design of the high burnup LTA is acceptable to a peak rod average of 71,000 MWD/MTU for MP3 during Cycle 12.

3.3 Non-Loss-of-Coolant (LOCA) Transients

Previously, the licensee performed non-LOCA transient safety analyses to assess the impact of the LTAs in Chapter 15 of the Updated Final Safety Analysis Report. Since the LTAs were geometrically identical to the current resident fuel and there were insignificant material changes from the approved ZIRLO to the Optimized ZIRLO, the MP3 transient safety analyses remained

bounding for all the LTAs. Based on the non-limiting location, the licensee determined that the radiological consequences of postulated DBAs involving the high burnup LTA were minimal. Additionally, the licensee will perform cycle-specific reload evaluations including the high burnup LTA to ensure that the acceptance criteria for the non-LOCA transients using approved methodology are met for Cycle 12.

Based on the acceptable bounding analyses and radiological consequences, the NRC staff concludes that the high burnup LTA will meet the acceptance criteria for the non-LOCA transients, and is thus acceptable to a peak rod average of 71,000 MWD/MTU for MP3 during Cycle 12.

3.4 LOCA Analysis

The licensee determined that the LTAs continued to meet the same emergency core cooling system (ECCS) design requirements as the resident fuel for the MP3, Cycle 10 core. The LTAs were placed in core locations that would not experience the most limiting power peaking during the Cycle 10 operation. The Optimized ZIRLO cladding had been tested for corrosion resistance, tensile and burst strength, and creep characteristics. The results indicated that the Optimized ZIRLO clad fuel rods met all the necessary ECCS regulations and would perform satisfactorily like the previously-approved fuel rods. Based on the non-limiting location, the licensee determined that the high burnup LTA continued to meet the ECCS requirements. Additionally, the licensee will perform cycle-specific reload evaluations including the high burnup LTA to ensure that the Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46 acceptance criteria using approved methodology are met for Cycle 12.

Based on the acceptable ECCS performance and the non-limiting location in MP3, the NRC staff concludes that the licensee has demonstrated that the high burnup LTA will perform adequately under LOCA conditions, and thus the LTA is acceptable to a peak rod average of 71,000 MWD/MTU for MP3 during Cycle 12.

3.5 Radiological DBAs

The NRC staff reviewed the regulatory and technical analyses, as related to the radiological consequences of DBAs, performed by the licensee in support of this proposed license amendment. The NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess these impacts. The staff performed independent calculations to confirm the conservatism of the licensee's analyses. However, the findings of this safety evaluation input are based on the descriptions of the licensee's analyses and other supporting information docketed by the licensee.

The licensee stated that Westinghouse Commercial Atomic Power-12610-P-A, "VANTAGE + Fuel Assembly Reference Core Report," dated April 1995, shows that even though there are variations in core inventories of isotopes due to extended burnup up to 71,000 MWD/MTU, there are no significant increases of isotopes that are major contributors to accident doses. With only a limited number of high burnup fuel rods in the entire core (one LTA assembly out of 193 total), any variation in the isotopic inventories will be very small. Therefore, the radiological consequences of DBAs that assume fuel rod failure and melting, such as the large-break LOCA accident or the control rod ejection accident, are not significantly impacted. Of the remaining DBAs, only the reactor coolant pump sheared shaft/locked rotor accident (LRA) and the fuel

handling accident (FHA) assume fuel gap activity release. The only event for which the gap activity release from a single LTA would potentially have a significant impact is the FHA, which assumed failure of all fuel rods in one assembly plus 50 additional fuel rods in another assembly. The impact of the LTA on the LRA source term is not considered to be significant because the licensee's current analysis assumed failure of 6 percent of the core fuel rods, whereas one LTA is approximately equivalent to 0.5 percent of the core.

The current design-basis FHA for MP3 uses the analysis assumptions specified in Regulatory Guide (RG) 1.183 for an alternative source term (AST). The requested fuel rod average burnup of 71,000 MWD/MTU will exceed the burnup range for fuel rod gap fission product inventory release fractions as specified in RG 1.183, Table 3. Footnote 11 to Table 3 states that the release fractions listed there have been determined to be acceptable for use with currently-approved light-water reactor fuel with a peak burnup of up to 62,000 MWD/MTU, with conditions on the linear heat generation rate for burnups exceeding 54,000 MWD/MTU. For the high burnup LTA only, the licensee proposes to use fuel rod gap release fractions for the standard source term as specified in RG 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," as adjusted for high-burnup fuel based on NUREG/CR-5009, "Assessment of the Use of Extended Burnup Fuel in Light Water Power Reactors." The gap fraction values applicable only to the high-burnup LTA are 12 percent for Iodine-131, 30 percent for Krypton-85, and 10 percent for other halogens and noble gases. The gap fraction values applicable to the remainder of the fuel are the same as in the current MP3 licensing basis FHA analysis of 8 percent for all halogens and 10 percent for all noble gases.

DNC stated that information previously submitted on March 31, 2000, by the Nuclear Energy Institute (NEI) to the NRC as a comment on Draft Regulatory Guide 1081 for AST analysis guidance provided data to show the fission product release to the gap as a function of burnup. The licensee stated in that letter that, the projected gap fractions at a burnup of 71,000 MWD/MTU would be bounded by the values taken from RG 1.25 and NUREG/CR-5009. Given that the comment letter did not include data above 64,000 MWD/MTU, that data does not directly show what the gap fraction would be at 71,000 MWD/MTU. The NRC staff did not adopt the position presented in the NEI comment letter in RG 1.183. However, the staff believes that the projection of the gap activity presented in the letter indicates that the higher gap fractions of RG 1.25 and NUREG/CR-5009 are reasonable for a single high-burnup LTA at 71,000 MWD/MTU. The staff does not find that this assumption is acceptable for any other use, such as a larger core loading of fuel with a burnup of 71,000 MWD/MTU, at MP3 or for any other plant.

The licensee acknowledges that the positions proposed in the NEI comment letter with regard to the relationship between fuel burnup and gap fraction are not fully supported by empirical data at this time. The licensee's overall program for high-burnup LTAs will provide additional data on the fission product release to the fuel gap at higher burnup levels, to help resolve the uncertainty in the gap fraction assumptions.

To offset the increased gap fraction for the LTA, the licensee proposed to calculate the LTA activity release assuming the lower analyzed LTA peaking factor of 1.15 in place of the current licensing basis assumption for the lead rod radial peaking factor of 1.70. The peaking factor of 1.70 was applied to the 50 other fuel rods assumed to be damaged in the FHA analysis. With

the combination of the higher gap fractions and the lower peaking factor for the LTA, the radiological consequences for the FHA involving the LTA are bounded by the current AST FHA analysis approved in support of Amendment No. 219 to Facility Operating License NPF-49, dated March 17, 2004.

The staff's acceptance of the licensee's request was based on the impact of the LTA on the current licensing basis AST FHA analysis found acceptable in Amendment No. 219. The full-scope AST amendment request dated May 24, 2004, referred to in the October 5, 2005, supplement, remains under review at this time. Approval of this amendment does not imply acceptance of the control room ventilation system modeling as proposed in the May 24, 2004, full-scope AST amendment request. The changes in the FHA dose analysis assumptions found acceptable to the NRC staff for this amendment request are: the failure of all the rods in the LTA plus 50 rods in other fuel assemblies, the LTA gap fraction values, and the LTA radial peaking factor value. All other FHA analysis assumptions are the same as in the current licensing basis analysis. The staff considered only the change in the dose as illustrated by the licensee to determine the validity of the licensee's statement in this LTA revised burnup limit amendment request claiming that the lower peaking factor of 1.15 for the LTA compensates for the higher assumed gap fractions. The staff has determined that the licensee has demonstrated that the radiological consequences of the FHA including the high-burnup LTA is bounded by the current licensing basis FHA dose analysis.

4.0 SUMMARY

As described above, the NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess the radiological impacts of irradiation of one LTA up to a burnup limit of 71,000 MWD/MTU at MP3. The staff finds that the licensee used analysis methods and assumptions consistent with the conservative regulatory requirements and guidance identified in this evaluation. The staff also compared the doses estimated by the licensee to the applicable criteria and finds, with reasonable assurance, that the licensee's estimates of the exclusion area boundary, low-population zone, and control room doses will continue to comply with these criteria. Therefore, the proposed revision in the fuel rod average burnup limit for one LTA is acceptable.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Connecticut State official was notified of the proposed issuance of the amendment. The State official concurred with the staff's decision.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (70 FR 5238). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental

impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: S. Wu
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Date: December 30, 2005

Millstone Power Station, Unit No. 3

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