



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

March 26, 2015

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 - REACTOR COOLANT SYSTEM
ALLOY 600 INSPECTION PROGRAM FOR LICENSE RENEWAL
COMMITMENT NO. 14. (TAC NO. MF3433)

Dear Mr. Heacock:

By letter dated July 31, 2013, Dominion Nuclear Connecticut, Inc. (the licensee) submitted its response to a commitment related to renewal of the operating license for Millstone Unit 2 (MPS2). Specifically, the licensee committed to submit a revised aging management program description for the management of nickel-based alloy 600 components, no later than two years before MPS2 enters its period of extended operation. This is designated as license renewal commitment #14.

Specific requirements for inservice inspections (ISI) are identified in the MPS2 ISI Program. For the reactor internals, these include:

- Inservice inspections performed in accordance with Examination Categories 8-N-3 for the core support structures made accessible by removal of the reactor internals, and
- Augmented examinations were not required by ASME Section XI.

In addition to the ISI program, the monitoring and control of reactor coolant water chemistry ensures the long-term integrity and continued functionality of reactor vessel internals.

The NRC staff has reviewed the licensee's alloy 600 program as a plant-specific program. Based on that review, the NRC staff concludes that the program meets the NRC staff's requirements established for structures and/or components made of nickel alloy material, and meets the commitments made by the licensee.

The NRC staff also concludes that the licensee has demonstrated that the effects of aging will be adequately managed at MPS2. The aging management program will ensure that the intended functions will be maintained consistent with the MPS2 current licensing basis for the period of extended operation of MPS2, as required by 10 CFR 54.21(a)(3). This completes the NRC staff's review of the licensee response to the license renewal commitment # 14.

D. Heacock

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If you have any questions, please contact the Millstone Power Station Project Manager, Mohan Thadani, at (301) 415-1476.

Sincerely,

A handwritten signature in black ink, appearing to read "Mohan C. Thadani". The signature is written in a cursive style with a large initial "M".

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure: Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REACTOR COOLANT SYSTEM ALLOY 600 INSPECTION PROGRAM

DOMINION NUCLEAR CONNECTICUT, INC.

DOCKET NO. 50-336

MILLSTONE POWER STATION, UNIT 2

1.0 INTRODUCTION

By letter dated July 31, 2013, Dominion Nuclear Connecticut, Inc., the licensee, submitted its response to a commitment to support the renewal of the operating license for Millstone Unit 2 (MPS2) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13218A260). Specifically, the licensee committed to submit a revised aging management program description for the management of nickel-based alloy components no later than two years before MPS2 enters its period of extended operation. This is designated as license renewal commitment #14.

Specific requirements for inservice inspections are identified in the MPS2 Program. For the reactor internals, these include:

- Inservice inspections performed in accordance with Examination Categories 8-N-3 for the core support structures made accessible by removal of the reactor internals, and
- Augmented examinations were not required by ASME Section XI.

In addition to the ISI program, the monitoring and control of reactor coolant water chemistry ensures the long-term integrity and continued functionality of reactor vessel internals.

2.0 REGULATORY REQUIREMENTS

The NRC staff reviewed the Millstone license renewal application for compliance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." In October 2005, the NRC staff's safety evaluation report "Safety Evaluation Report Related to the License Renewal of the MPS2 and MPS3" was issued as NUREG-1838. This report is available in ADAMS under accession numbers ML053270483 and ML053290180.

In accordance with 10 CFR 54.21(a)(3), "For each structure and component identified in paragraph (a)(1) of this section, the licensee shall demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the period of extended operation."

As documented in NUREG-1838, the staff reviewed the information included in the License Renewal Application regarding the applicant's demonstration of the Reactor Coolant System Alloy 600 Inspection Program to ensure that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB throughout the period of extended operation.

At the time NUREG-1838 was being finalized, the industry was still developing a long term Alloy 600 management plan. The applicant committed to develop and submit the Reactor Coolant System Alloy 600 Inspection Program to the U.S. Nuclear Regulatory Commission (NRC) for staff review and approval 24 to 36 months prior to the period of extended operation. As documented in NUREG-1838, the staff concluded that this program attribute was acceptable.

By letter dated July 31, 2013, the licensee submitted a response to the above commitment by providing the details for MPS2 Alloy 600 Inspection Program as part of the license renewal process.

3.0 LICENSEE RESPONSE TO LICENSE CONDITION # 14

The licensee states that the aging management plan is consistent with the nickel alloy nozzles and penetrations aging management program described in Chapter XI of NUREG-1801, Rev 0 "Generic Aging Lessons Learned (GALL) Report" with two enhancements:

1. The program scope has been enhanced according to industry guidelines to include all Alloy 600/82/182 components in the primary system.
2. The inspection requirements have been updated to the requirements of ASME Section XI Code Cases N-722-1, N-729-1, and N-770-1.

The licensee noted that this program was developed utilizing the Electric Power Research Institute (EPRI) MRP-126 "Generic Guidance for Alloy 600 Management" industry guidance document (the finalized version of MRP-44). In addition, the licensee explained that the Alloy 600 Inspection Program is a living document and will be revised periodically to reflect the latest plant configurations.

4.0 THE NRC STAFF EVALUATION

The plant-specific Alloy 600 Program manages cracking due to primary water stress corrosion cracking (PWSCC) for nickel alloy component locations. The overall goal of the program is to maintain plant safety and minimize the impact of PWSCC on plant availability through assessment, inspection, mitigation, and repair or replacement of susceptible components. The staff has verified that the licensee's program is based on the NRC guidance in the ASME MRP-126, "Generic Guidance for Alloy 600 Management."

Pursuant to 10 CFR 54.21(a)(3), the staff reviewed the information in the licensee's Alloy 600 Program to ensure that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The Standard Review Plan for License Renewal (SRP LR), NUREG-1800, Rev. 2, contains the NRC staff's generic evaluation of existing plant programs and documents the technical basis for determining where existing programs are adequate, without modification for the extended period of operation. Guidance for the aging management of nickel-alloy material components, in which Alloy 600 components fall, is provided in Section A.1 "Aging Management Review," of the SRP LR. The NRC staff reviewed the licensee's Alloy 600 Program, as documented in the licensee's submittal, against the aging management program elements found in Section A.1.2.3 of the SRP LR. The NRC staff notes that;

- (1) Scope of the Program –the licensee's Alloy 600 Program will manage cracking due to PWSCC for the following nickel alloy component locations:

Reactor Vessel Heads
RCS/Code Class 1 Piping and Vessel Nozzle Welds
Steam Generator

Additionally, in Attachment 3 of the Alloy 600 Program, the licensee provides specific details for each alloy 600 component, including description, PWSCC susceptibility, inspections, mitigation options, repair options and future plans.

The staff notes that these nickel alloy components are managed under several other programs such as 10 CFR 50.55a which specifies Section XI requirements of the ASME Boiler and Pressure Vessel Code, license renewal programs such as LR-AMP-005-BAC, Boric Acid Corrosion Program, and several Code Cases, such as N-722-1, N-729-1 and N-770-1. The licensee notes that the "scope of the program" will be updated as industry experience or mitigation techniques are utilized.

The NRC staff confirms that the "scope of the program" program element satisfies the criterion defined in SRP LR Section A.1.2.3.1. The NRC staff concludes that this program element is acceptable.

- (2) Preventive Actions - The plan is an inspection program and is designated condition monitoring. As such, the plan does not include preventive actions. The plan relies on the ISI Program: Systems, Components and Supports; the S/G structural integrity program; and the boric acid corrosion aging management programs (AMPs) for inspections. Preventative action is provided by the chemistry control for primary systems AMP.

Based on this review, the staff confirms that the "preventive actions" program element satisfies the guidance in SRP LR Section A.1.2.3.2. The staff finds this program element acceptable.

- (3) Parameters Monitored or Inspected – The plan monitors for indications of cracking due to PWSCC in Alloy 600 components in the MPS2 primary system.

The NRC staff notes that the licensee's Alloy 600 Program uses the appropriate volumetric, surface and visual nondestructive examination (NDE) techniques for detection of degradation of the components identified in the scope of the program as required by ASME Code and industry guidance.

Based on this review, the staff confirms that the "parameters monitored or inspected" program element satisfies the guidance in SRP LR Section A.1.2.3.3. Therefore, the staff finds this program element acceptable.

- (4) Detection of Aging Effects - The licensee's Alloy 600 Program uses the ASME Code Section XI inspection requirements for inservice inspection (ISI) and the NRC staff accepted industry guidance. The NRC has approved, in accordance with 10 CFR 50.55a, the specific techniques and frequencies for monitoring nickel alloy components, which are prescribed by ASME Code Section XI for those components examined in accordance with the ISI program. In addition, for other items included in the scope of the licensee's Alloy 600 Program, the methods and frequencies of examination are recommended in industry guidance. Each of these programs for the detection of aging effects has been analyzed by the NRC to provide adequate detection capability.

Based on this review, the NRC staff confirms that the licensee's commitment in the "detection of aging effects" program element satisfies the guidance in SRP LR Section A.1.2.3.4. The NRC staff concludes that this program element is acceptable.

- (5) Monitoring and Trending - The licensee's Alloy 600 Program relies on periodic inspections performed by the ISI program, the S/G structural integrity program, and the boric acid corrosion control program to detect and address degradation.

The ISI program directs Alloy 600 inspections according to the regulatory requirements of 10 CFR 50.55a and industry guidance including Code Cases N-722-1, N-729-1, and N-770-1.

Based on this review, the NRC staff confirms that the "monitoring and trending" program element satisfies the guidance in SRP LR Section A.1.2.3.5. The NRC staff finds this program element acceptable.

- (6) Acceptance Criteria - The licensee's Alloy 600 Program uses the ASME Code Section XI inspection requirements of ISI. The NRC staff accepted the industry guidance. In general, the acceptance criteria of alloy 600 component inspection programs are based on the scope and reporting requirements established by the ASME Code as required by 10 CFR 50.55a. The NRC staff notes that ASME Section XI, IWB-3000 contains acceptance criteria appropriate for the reactor coolant pressure boundary components examined in accordance with Section XI. Also, ASME Section XI, IWA-5250 was verified to contain acceptable steps for evaluation and corrective measures for sources of leakage identified by visual examinations for leakage. These requirements ensure that alloy 600 components in the reactor coolant pressure boundary maintain their designed function under all required design conditions.

Based on this review, the NRC staff confirms that the "acceptance criteria" element satisfies the guidance in SRP LR Section A.1.2.3.6. The NRC staff finds this program element is acceptable.

- (7) Corrective Actions - The licensee notes in the Alloy 600 Program several repair alternatives that address corrective actions to address PWSCC aging effects of Ni-based alloys. Specifically, the licensee's Alloy 600 Program uses the repair and replacement requirements of ASME Code Section XI for ISI and the NRC staff accepted industry guidance. The NRC endorses the use of these repair and replacement activities through incorporation into the requirements of 10 CFR 50.55a.

The licensee credits four programs for managing the effect of cracking due to PWSCC. These four programs are ISI unresolved relevant indications, S/G eddy current tub degradation, boric acid corrosion control and primary system chemistry corrective actions.

Based on this review, the NRC staff confirms that the "corrective actions" program element satisfies the guidance in SRP LR Section A.1.2.3.7. The NRC staff concludes that this program element is acceptable.

- (8) Confirmation Process – The confirmation process for the licensee's Alloy 600 Program uses Site quality assurance procedures, review and approval processes, and administrative controls. These are implemented in accordance with the requirements of 10 CFR 50, Appendix B.

Based on this review, the staff confirms that the "confirmation process" program element satisfies the guidance in SRP LR Section A.1.2.3.8. The NRC staff concludes that this program element is acceptable.

- (9) Administrative Controls - The administrative controls for the licensee's Alloy 600 Program are reviewed, approved and maintained as controlled documents in accordance with the procedure control process and the QA program.

Based on this review, the NRC staff confirms that the "administrative controls" program element satisfies the guidance in SRP LR Section A.1.2.3.9. The NRC staff concludes that this program element is acceptable.

- (10) Operating Experience – The licensee's Alloy 600 Program provides industry experience regarding PWSCC and associated reactor coolant leakage incidents. Specifically, the licensee notes that the components have been replaced and mitigated at MPS2.

The program stated the MPS2 would follow industry efforts investigating the aging effects applicable to nickel-based alloys, identify the appropriate aging management activities, and implement the appropriate recommendations resulting from this guidance. Based on MPS and industry operating experience, the MPS2 RV head has been replaced and the pressurizer has been replaced. Full structural weld overlays and half nozzle repairs have also been made on the RCS piping. Further, the licensee notes that internal and industry operating experience subsequent to the mitigation activities indicated that the inspection methodologies employed by the Alloy 600 inspections program have been effective in identifying cracking due to PWSCC.

Based on this review, the NRC staff confirms that the "operating experience" program element satisfies the guidance in SRP LR Section A.1.2.3.10. The NRC staff concludes that this program element is acceptable.

In addition to the above, the NRC staff concludes that the requirements of 10 CFR 50.55a (including required code cases) are bounding with respect to the recommendations contained in the GALL report (irrespective of revision). Therefore the NRC staff concludes that adherence by the licensee to current regulatory requirements is sufficient to adequately manage the aging of the subject components

5.0 CONCLUSION

The NRC staff has reviewed the licensee's Alloy 600 Program as a plant-specific program and concludes that the NRC staff's requirements established for structures and/or components made of nickel alloy material are met by the commitments made by the licensee.

The NRC staff also concludes that the licensee has demonstrated that the effects of aging will be adequately managed at MPS2. The aging management program will ensure that the intended functions will be maintained consistent with the MPS2 CLB for the period of extended operation of MPS2, as required by 10 CFR 54.21(a)(3).

Principal Contributor: M. Audrain

Date: March 26, 2015

D. Heacock

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If you have any questions, please contact the Millstone Power Station Project Manager, Mohan Thadani, at (301) 415-1476.

Sincerely,

/RA/

Mohan C. Thadani, Senior Project Manger
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure:
As stated

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OFFICE	LPL1-1/PM	LPL1-1/LA	NRR/DE/EPNB*	LPL1-1/BC	LPL1-1/PM
NAME	MThadani	KGoldstein	MAudrain	BBeasley	MThadani
DATE	3/18/2015	3/17/2015	12/02/2014	3/25/2015	3/26/2015

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