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

July 20, 2011

Mr. Michael J. Pacilio
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 - FOURTH INSERVICE INSPECTION INTERVAL RELIEF REQUESTS I4R-02, I4R-03, I4R-04, I4R-05, AND I4R-06 (TAC NOS. ME4519, ME4520, ME4521, ME4522 AND ME4523)

Dear Mr. Pacilio:

By letter dated August 10, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102290162), supplemented by letters dated October 8, 2010, (ADAMS Accession No. ML102810630), October 29, 2010 (ADAMS Accession No. ML103020445), January 25, 2011 (ADAMS Accession No. ML110250663), and May 11, 2011 (ADAMS Accession No. ML111310192), Exelon Generation Company, LLC (Exelon, the licensee) submitted a set of requests for relief from, and the use of alternatives to, certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI requirements for Three Mile Island Nuclear Station, Unit 1 (TMI-1). The requests were all associated with the fourth Inservice Inspection (ISI) interval at TMI-1, which began on April 20, 2011, and ends no later than April 19, 2022, including the one year extension allowed by paragraph IWA-2430(d)(1) of ASME Section XI. The requests were as follows:

Request Number	Title
I4R-01	Request for Relief for Expanded Applicability for use of ASME Code Case N-513-2, Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 and 3 Piping
I4R-02	Request for Relief for Alternate Risk-Informed Selection and Examination Criteria for Examination Category B-F, B-J, C-F-1, and C-F-2 Pressure Retaining Piping Welds
I4R-03	Request for Relief for Inservice Inspection Impracticality of Pressure Testing the Reactor Pressure Vessel Head Flange Connection Lines
I4R-04	Request for Relief for ISI Snubbers Included in the Technical Specifications Snubber Visual Examination and Functional Testing Program
I4R-05	Request for Relief From Qualification Requirements of ASME Section XI, Appendix VIII, Supplement 11, for Examination of Structural Weld Overlays (SWOLs)
I4R-06	Request for Relief for Alternative Requirements due to Applicability of ASME Code Case N-649, Alternative Requirements for IWE-5240 Visual Examination

By letter dated October 29, 2010, Exelon withdrew request I4R-01 because ASME Code Case N-513-3 had been approved for use in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, Revision 16, eliminating the need for the request.

For request numbers I4R-02, I4R-04, I4R-05, and I4R-06, the licensee requested to use a proposed alternative, on the basis that the alternative provides an acceptable level of quality and safety, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Paragraph 50.55a(a)(3)(i). For request number I4R-03, the licensee requested relief on the basis that the code requirement is impractical, pursuant to 10 CFR 50.55a(g)(5)(iii).

The NRC staff has reviewed request numbers I4R-02, I4R-04, I4R-05, and I4R-06, and concludes, as set forth in the enclosed safety evaluation, that Exelon has demonstrated that the proposed alternatives provide an acceptable level of quality and safety. Therefore, request numbers I4R-02, I4R-04, I4R-05, and I4R-06 are authorized pursuant to 10 CFR 50.55a(a)(3)(i), for the fourth 10-year interval ISI program at TMI-1.

Further, the NRC staff has reviewed request number I4R-03, and concludes, as set forth in the enclosed safety evaluation, that Exelon has demonstrated that it is impractical to comply with the specified ASME Code requirement and that the proposed alternative testing will provide reasonable assurance of leak tightness of the subject components. Therefore, relief request number I4R-03 is granted pursuant to 10 CFR 50.55a(g)(6)(i), for the fourth 10-year interval ISI program at TMI-1.

If you have any questions, please contact the TMI-1 Project Manager, Mr. Peter J. Bamford, at 301-415-2833.

Sincerely,

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure:
As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED ALTERNATIVES AND RELIEF REQUEST REGARDING FOURTH INSERVICE INSPECTION INTERVAL, REQUEST NOS. I4R-02, I4R-03, I4R-04, I4R-05, AND I4R-06

EXELON GENERATION COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

DOCKET NO. 50-289

1.0 INTRODUCTION

By letter dated August 10, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102290162), supplemented by letters dated October 8, 2010, (ADAMS Accession No. ML102810630), October 29, 2010 (ADAMS Accession No. ML103020445), January 25, 2011 (ADAMS Accession No. ML110250663), and May 11, 2011 (ADAMS Accession No. ML111310192), Exelon Generation Company, LLC (Exelon, the licensee) submitted a set of requests for relief from, and the use of alternatives to, certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," requirements for Three Mile Island Nuclear Station, Unit 1 (TMI-1). The requests were all associated with the fourth Inservice Inspection (ISI) interval at TMI-1, which began on April 20, 2011, and ends no later than April 19, 2022, including the one year extension allowed by paragraph IWA-2430(d)(1) of ASME Section XI. The U.S. Nuclear Regulatory Commission (NRC, or Commission) staff reviewed and evaluated request numbers I4R-02, I4R-04, I4R-05, and I4R-06 pursuant to the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i). The staff reviewed and evaluated I4R-03 pursuant to the provisions of 10 CFR 50.55a(g)(6)(i).

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval, and subsequent intervals, comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable ASME Section XI Code of Record for the fourth 10-year ISI interval at TMI-1 is the 2004 Edition, no Addenda.

The ISI of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to

10 CFR 50.55a(g)(6)(i). Further, 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used when authorized by the NRC, if the applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety.

3.0 TECHNICAL EVALUATION

3.1 Request for Alternative I4R-02

The TMI-1 Risk-Informed (RI)-ISI program for the third 10-year ISI interval was submitted to the NRC by letters dated October 1, 2002, and July 7, 2003 (ADAMS Accession Nos. ML022830211, and ML031970464, respectively). The licensee's RI-ISI program was developed in accordance with the methodology delineated in Electric Power Research Institute's (EPRI's) topical report (TR) EPRI TR-112657, Revision B-A, for the third 10-year ISI interval. The EPRI-TR was previously reviewed and approved by the NRC staff (ADAMS Accession No. ML013470102). The NRC staff authorized TMI-1 to implement this RI-ISI program for the third 10-year interval by letter dated November 12, 2003 (ADAMS Accession No. ML032930264).

The licensee's August 10, 2010, submittal requested authorization to continue to implement the proposed RI-ISI program for TMI-1 for the fourth 10-year ISI interval, which started April 20, 2011. The licensee stated that the proposed fourth interval RI-ISI Program will be the same program methodology as authorized for the third inspection interval, and will continue to be a living program.

Pursuant to 10 CFR 50.55a(g), a certain percentage of ASME Code Category B-F, B-J, C-F-1, and C-F-2 pressure retaining piping welds must receive ISI during each 10-year ISI interval. The ASME Code requires 100 percent of all B-F welds and 25 percent of all B-J welds greater than one inch nominal pipe size be selected for volumetric or surface examination, or both, on the basis of existing stress analyses. For Categories C-F-1 and C-F-2 piping welds, 7.5 percent of non-exempt welds are selected for volumetric or surface examination, or both.

The licensee has proposed to use a RI-ISI program for ASME Code Class 1 and Class 2 piping (Examination Categories B-F, B-J, C-F-1, and C-F-2 piping welds) based on the EPRI TR, as an alternative to the ASME Code, Section XI requirements. All risk-informed applications are assessed against Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis." RG 1.174 states that a probabilistic risk assessment (PRA) used in risk-informed licensing action should be performed in a manner that is consistent with accepted practices. In Regulatory Information Summary (RIS) 2007-06, "Regulatory Guide 1.200 Implementation," (ADAMS Accession No. ML070650428), the NRC staff clarified that, for all risk-informed applications received after December 2007, the NRC staff will use RG 1.200, Revision 1, to determine whether the technical adequacy of the PRA used to support a submittal is consistent with accepted practices. Also, as discussed in RIS 2007-06, for applications received after December 2009 (later extended to April 2010), the NRC expects licensees to address scope elements of RG 1.200, Revision 2 for risk-informed license applications. The licensee's application, dated August 10, 2010, is based on RG 1.200, Revision 2.

3.1.1 ASME Code Components Affected

Code Class: 1 and 2

Examination Category: B-F, B-J, C-F-1, and C-F-2

Item Number: B5.10, B5.40, B5.50,
B9.11, B9.21, B9.22, B9.31, B9.32, B9.40,
C5.11, C5.21, C5.30, C5.41, C5.51, C5.70, and C5.81

Description: Alternate Risk-Informed Selection and Examination Criteria for Examination Category B-F, B-J, C-F-1, and C-F-2 Pressure Retaining Piping Welds

Component Number: Pressure Retaining Piping

3.1.2 Proposed Alternative

The licensee stated that the RI-ISI program plan for TMI-1 includes the two enhancements noted below and is currently approved for the TMI-1 third inspection interval. The fourth interval is proposed to be a continuation of the current application, and will continue to be a living program. No changes to the evaluation methodology as currently implemented under EPRI TR-112657, Revision B-A, are required as part of this interval update. According to the licensee, the following two enhancements will continue to be implemented.

1. In lieu of the evaluation and sample expansion requirements in Section 3.6.6.2, "RI-ISI Selected Examinations" of EPRI TR-112657, TMI-1 will utilize the requirements of Paragraph-2430, "Additional Examinations" contained in ASME Code Case N-578-1, "Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method B, Section XI, Division 1." The alternative criteria for additional examinations contained in ASME Code Case N-578-1 provide a more refined methodology for implementing necessary additional examinations.

2. To supplement the requirements listed in Table 4-1, "Summary of Degradation-Specific Inspection Requirements and Examination Methods" of EPRI TR-112657, TMI-1 will utilize the provisions listed in Table 1, Examination Category R-A, "Risk-Informed Piping Examinations" contained in ASME Code Case N-578-1. To implement Note 10 of this table, paragraphs and figures from the 2004 Edition, no Addenda of ASME Section XI (TMI-1 Code of Record for the fourth interval) will be utilized which parallel those referenced in the code case. Table 1 of ASME Code Case N-578-1 will be used as it provides a detailed breakdown for examination method and categorization of parts to be examined.

In addition to this risk-informed evaluation, selection, and examination procedure, all ASME Section XI piping components, regardless of risk classification, will continue to receive ASME Code-required pressure testing as part of the current ASME Section XI program. Visual Test (VT)-2 visual examinations are scheduled in accordance with the TMI-1 pressure testing program, which remains unaffected by the RI-ISI program.

The licensee stated that the RI-ISI program in the present relief request is a maintenance of the RI-ISI methodology which was approved by the NRC for the third ISI interval. According to the licensee, since the fourth ISI interval request utilizes an identical RI-ISI methodology as was

previously approved, it will provide an acceptable level of quality and safety and should be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

3.1.3 NRC Staff Evaluation

The licensee has proposed to use a RI-ISI program that was developed using the RI-ISI methodology described in EPRI TR-112657 as an alternative to the ASME Code, Section XI requirements. The NRC staff's safety evaluation approving the methodology described in the EPRI-TR, concluded that the methodology conforms to guidance provided in RGs 1.174 and RG 1.178, Revision 1, "An Approach for Plant-Specific Risk-Informed Decision Making for Inservice Inspection of Piping," and that no significant risk increase should be expected from the changes to the ISI program resulting from applying the methodology.

The TMI-1 RI-ISI program for the third 10-year ISI interval was authorized by the NRC staff. In its safety evaluation, the staff concluded that the original RI-ISI program is consistent with the staff-approved RI-ISI process and methodology delineated in the EPRI-TR. The staff also concluded that the ISI program retains the fundamental requirements of the ASME Code, such as inspection methods, acceptance criteria, pressure testing, corrective measures, documentation requirements and quality control requirements. In response to the provisions of Regulatory Guide 1.200, Revision 2, for the fourth ISI interval, the licensee justified basing their RI-ISI analyses only on internal events PRAs by stating that fire, seismic, and external events are insignificant to the application's RI-ISI program.

Inservice inspection examines welds in order to identify and, if necessary, repair flaws. Piping failures will not cause fire events. Fire events may challenge piping integrity by causing transients that must be mitigated, but such challenges are expected to be less frequent and not significantly different than challenges caused by the random occurrence of internal initiating events. Seismic and other external events such as high winds, tornados, and floods subject piping systems to increased, and, for severe events, catastrophic loads. The staff evaluated the affect of seismic loads on piping in NUREG-1903, "Seismic Considerations for the Transition Break Size for Sites East of the Rockies." The NUREG concludes that, for most sites, only large flaws (e.g., greater than 30 percent of the piping wall thickness for a flaw approximately 145 degrees around the piping circumference) could cause piping to fail after seismic events that may be more frequent than about 10^{-5}/year. Seismic and other increased load events are too infrequent to cause flaw growth and therefore some other degradation mechanism is needed to grow flaws to such large sizes. The RI-ISI process already re-directs inspections to piping with degradation mechanism that could cause flaw growth and with the greatest impact on risk. Conversely, catastrophic loads will fail piping with or without flaws that might have been removed as a result of inspections and therefore including these catastrophic loads could misdirect the selection of locations. Therefore, the staff finds that fire, seismic, and external events have been adequately addressed in the development of the TMI-1 RI-ISI program.

In a request for additional information (RAI), the licensee was asked to:

- Provide an estimate of the potential change in risk between the RI-ISI program proposed for implementation in the fourth interval, and the ASME Section XI requirements which existed prior to the implementation of the first RI-ISI program.

- Provide the date of the last PRA reevaluation and provide the baseline Core Damage Frequency (CDF) and the baseline Large Early Release Frequency (LERF) for the

current PRA. In addition, explain how any modifications to the plant since the date of the last reevaluation and revision may impact the RI-ISI program.

In response, by letter dated January 25, 2011, the licensee stated that the increase in risk for TMI-1 from the ASME Section XI requirements to the fourth interval RI-ISI program was 1.15E-07 for CDF and 6.41E-09 for LERF. These values are within RG 1.174 acceptance criteria of 1.00E-06 and 1.00E-7, respectively.

The licensee stated that the RI-ISI program for the fourth 10-year ISI interval incorporated TMI-1 PRA Model 2009 (TM1080). This is the latest revision of the plant PRA model, and has a baseline CDF of 1.2E-05/yr and a baseline LERF of 1.5E-06/yr. The latest RI-ISI evaluation, Revision 3 dated September 2010, is the current version developed as part of the new fourth interval RI-ISI program. No additional updates have been made.

The staff has reviewed and evaluated the licensee's proposed RI-ISI program, including those portions related to the applicable methodology and processes, based on guidance and acceptance criteria provided in the EPRI-TR and in RG 1.174, RG 1.178, and in Standard Review Plan (SRP) Chapter 3.9.8 (ADAMS Accession No. ML032510135). An acceptable RI-ISI program plan is expected to meet the five key principles discussed in RG 1.178, SRP 3.9.8 and EPRI-TR, as stated below:

1) The proposed change meets the current regulations unless it is explicitly related to a requested exemption or rule change.
2) The proposed change is consistent with the defense-in-depth philosophy.
3) The proposed change maintains sufficient safety margins.
4) When proposed changes result in an increase in CDF and/or LERF, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
5) The impact of the proposed change should be monitored by using performance measurement strategies.

The first principle is met in this relief request because an alternative ISI program may be authorized pursuant to 10 CFR 50.55a(3)(i) and therefore, an exemption request is not required.

The second and third principles require assurance that the alternative program is consistent with the defense-in-depth philosophy and that sufficient safety margins are maintained, respectively. The methodology used to develop the fourth 10-year RI-ISI program interval is unchanged from the methodology approved for use in the third 10-year RI-ISI program interval. Assurance that the second and third principles are met is based on the application of the approved methodology and not on the particular inspection locations selected. Therefore, the second and third principles are met.

The fourth principle requires that any increase in CDF and risk are small and consistent with the Commission's Safety Goal Policy Statement. The change in risk is dependent on the number and location of inspections in the proposed ISI program compared to the number and location of inspections that would be inspected using the requirements of ASME Section XI. The fourth principle also requires demonstration of the technical adequacy of the PRA.

For the fourth 10-year interval, the licensee states, that the change in CDF is 1.15E-07 and the change in LERF is 6.41E-09. These values meet the RG 1.174 acceptance guidance for change in CDF of less than 1.00E-06/yr and change in LERF of less than 1.00E-07/yr and are

therefore, small and consistent with the Commission's policy statement. Based on the previously described fire, seismic, and external events evaluations, the licensee's PRA maintenance and update process, and the self-assessment results described in the application, the NRC concludes that the licensee has demonstrated the technical adequacy of the PRA, sufficient to support this RI-ISI application.

Given the above considerations concerning the increase in risk and the technical adequacy of the PRA, the staff finds that the licensee's analysis provides assurance that the fourth key principle is met and, thus, will not cause the NRC safety goals to be exceeded.

The fifth principle of risk-informed decision making requires that the impact of the proposed change be monitored by using performance measurement strategies. In the submittal dated August 10, 2010, the licensee states that the RI-ISI program is a living program. In the submittal, the licensee also states that the site PRA model is updated throughout the interval, and the impact on the RI-ISI program is assessed and the program is updated as necessary. Additionally, for the fourth interval, the licensee states in the submittal that the TMI-1 PRA Model applicable to the RI-ISI update (TM1080) was revised and issued in June 2009.

In keeping with the RI-ISI program being a living program, the licensee stated by letter dated January 25, 2011, that the program has been updated to allow adjustments in the welds selected for examination to account for limited examination coverage, plant modifications, PRA model revisions and implementation of an augmented inspection program for Alloy 600 components. Thus, the NRC staff concludes that the TMI-1 RI-ISI program is a living program and that the proposed alternative is being monitored by using performance management strategies.

Based on the above discussion, the NRC staff concludes that the five key principles of risk-informed decision making are ensured by the licensee's proposed fourth 10-year RI-ISI program, and that the proposed alternative is acceptable.

3.2 Relief Request I4R-03

Relief Request I4R-03 relates to the Reactor Pressure Vessel Head Flange Connection Lines, which are ASME Code Class 2 piping. In accordance with ASME Section XI, Table IWC-2500-1, Category C-H, Item Number C7.10, all Class 2 pressure retaining components shall be subject to a system leakage test with a VT-2 examination, in accordance with Paragraph IWC-5220. This pressure test is to be conducted once each inspection period.

The licensee provided the following basis for requesting relief:

> The two Reactor Pressure Vessel Head Flange Connection Lines are separated from the reactor pressure boundary by one passive membrane, an O-ring located on the reactor pressure vessel closure head flange. A second O-ring is located on the opposite side of the tap in the vessel flange. This line runs from the flange to a normally closed 1" isolation valve and is not pressurized during normal plant operation.
>
> The configuration of this system precludes manual testing while the vessel head is removed. The configuration of the vessel tap, combined with the small size of the tap and the high test pressure requirement (approx 2155 psig), prevents the tap from being temporarily plugged. When the reactor pressure vessel closure

head is installed, an adequate pressure test cannot be performed due to the fact that the inner O-ring is designed to withstand pressure in one direction only. Due to the groove that the O-ring sits in and the clip assembly, pressurization in the opposite direction into the recessed cavity and retainer clips would likely damage the O-ring.

Pressure testing of this line during the System Leakage Test is precluded because the line will only be pressurized in the event of a failure of the inner O-ring. Purposely failing the inner O-ring to perform the ASME Section XI required test would require purchasing a new set of O-rings, additional time and radiation exposure to detension the reactor pressure vessel head, installation of the new O-rings, and then reset and retension of the reactor pressure vessel head.

3.2.1 Licensee's Proposed Alternative (as stated)

The licensee proposes the following alternative:

A VT-2 visual examination on the ISI Class 2 portion of the Reactor Pressure Vessel Head Flange Connection Lines will be performed once each inspection period when the reactor pressure vessel head is off and the fuel transfer canal is filled above the vessel flange. The static head developed with the connection lines filled with water will allow for the detection of any gross leakage in the lines. This examination will be performed on the accessible, exposed portion of the lines out to the closed isolation Class 2 boundary valves once each inspection period as per the frequency specified by Table IWC-2500-1.

3.2.2 NRC Staff Evaluation

Operational testing of the reactor vessel head flange connection lines is precluded because the line would only be pressurized in the event of a failure of the inner O-ring. The NRC staff agrees that it is unreasonable to purposely fail the inner O-ring, conduct the required pressure test and then purchase a new set of O-rings, incur additional time and radiation exposure to detension the reactor pressure vessel head, install new O-rings, and then reset and retension of the reactor pressure vessel head in order to conduct the required test. Alternatively, to perform the system leakage test in accordance with the ASME Code requirements would require extensive re-design and modification to the reactor head flange and/or the associated leakoff piping. In either case, it would impose a burden on the licensee.

The licensee has proposed to perform a VT-2 visual examination of the reactor vessel head flange connection lines, once each inspection period, when the fuel transfer canal is filled above the vessel flange, flooding the connection lines with water. The NRC staff agrees that this alternative is sufficient to detect any gross inservice flaws, if present, in the subject piping. Therefore, the NRC staff finds that the proposed testing provides reasonable assurance of leak tightness.

As set forth above, the NRC staff concludes that the licensee provided sufficient technical basis to find that compliance with the current requirements would cause an unnecessary burden on the licensee without a compensating increase in the level of quality and safety. It would be impractical for the licensee to comply with the requirement. The proposed alternative testing provides reasonable assurance of leak tightness of the subject components. Therefore, granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life

or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed upon the facility. No additional requirements, beyond what is described in the licensee's application, have been imposed by the NRC staff in granting this relief request.

3.3 Request for Alternative I4R-04

The licensee has proposed alternative requirements regarding all TMI-1 safety-related ASME Code Class 1, 2 and 3 snubbers. Specifically, the ASME Code, Section XI, Article IWF-5000, provides inservice inspection requirements for snubbers. Paragraphs IWF-5200(a) and IWF-5300(a) require that snubber preservice and inservice examinations be performed in accordance with the ASME/American National Standards Institute (ANSI) Code for Operation and Maintenance of Nuclear Power Plants, Part 4 (OM-4), 1987 Edition, with OMa-1988 Addenda, using the VT-3 visual examination method described in IWA-2213. Paragraphs IWF-5200(b) and IWF-5300(b) require that snubber preservice and inservice tests be performed in accordance with OM-4. Paragraphs IWF-5200(c) and IWF-5300(c) require that integral and non-integral attachments for snubbers, including lugs, bolting, pins, and clamps, be examined in accordance with the requirements of Subsection IWF. The licensee proposes to use TMI-1 TS, Section 4.17, "Shock Suppressors (Snubbers)," to perform visual examinations and functional testing of ASME Code Class 1, 2 and 3 snubbers in lieu of meeting the ASME Code, Section XI requirements described above.

3.3.1 Licensee's Basis for Proposed Alternative

In the application dated August 10, 2010, the licensee provided a basis for its proposed alternative. TMI-1 TS, Section 4.17, "Shock Suppressors (Snubbers)," contains specifically developed and approved visual inspection and functional testing requirements for the snubbers at TMI. The TS, Section 4.17 requirements, differ from the OM-4 requirements for visual examination, scheduling, re-examinations, and functional testing requirements.

The TMI-1 TSs specify two different plans for snubber functional testing:

1.) Functionally test 10% of a type of snubber with an additional 10% tested for each functional testing failure, or

2.) Functionally test a sample size and determine sample acceptance or rejection using TS figure 4.17-1

OM-4 specifies three functional test plans. OM-4 was completely revised in the 1988 Addenda to incorporate three snubber functional testing sampling plans, identified as the 10% testing sample plan, the 37 testing sample plan and the 55 testing sample plan. The 10% testing sample plan differs from the TMI-1, TS plan in that it only requires an additional 5% of snubbers to be tested for each functional test failure. The TMI-1 TS plan requires an additional 10% of the snubbers to be tested for each functional test failure. This results in an increase in the overall level of plant quality and safety when using the TSs.

According to the licensee's letter, dated January 25, 2011, the reactor coolant pump (RCP) snubbers are excluded from TS, Section 4.17. The RCP snubber testing procedure verifies freedom of motion (snubber break away force and drag force), piston lock-up velocity (activation range), and piston velocity after lockup. The testing frequency is to perform testing on at least two snubbers at least once every other outage rotating such that the same snubber is not

selected in any two consecutive tests unless it failed a previous functional test. If a snubber fails, TMI-1 Procedure 1303-9.11 requires testing of all of the remaining untested RCP snubbers.

In the application dated August 10, 2010, the licensee stated that the TS snubber visual examination frequency is based on an operating cycle of 24 months and is similar to the visual examination frequency defined in OM-4. The TMI-1 TS visual inspection frequency for the situation with no unacceptable snubbers is 24 months, and for one unacceptable snubber is 16 months. The OM-4 visual inspection frequency for the situation with no unacceptable snubbers is 18 months, and for one acceptable snubber is 12 months. The OM-4 requirements do not account for 24 month fuel cycles. The OM-4 and TMI-1 TS contains identical visual inspection periods when two or more snubbers are considered unacceptable.

Additionally, the TS requirements do not specifically address preservice visual examination of snubbers. The licensee states that they will perform a preservice visual examination of snubbers following maintenance activities.

The licensee requests the use of TS, Section 4.17, "Shock Suppressors (Snubbers)," for visual examination, scheduling, re-examinations, and functional testing requirements. Snubber preservice and inservice visual examinations will be conducted using the VT-3 visual examination method described in IWA-2213 of ASME Section XI. Repair/replacement activities performed on snubbers shall be in accordance with Article IWA-4000 of ASME Section XI. Snubbers installed, corrected, or modified by repair/replacement activities shall be preservice examined and preservice tested in accordance with the applicable TS requirements prior to return to service.

3.3.2 NRC Staff Evaluation

ASME Section XI, Table IWA-1600-1, "Referenced Standards and Specifications," notes that OM-4 shall be per the 1987 Edition with the OMa-1988 Addenda. OM-4 specifies the requirements for visual examination (paragraph 2.3) and functional testing (paragraph 3.2). The licensee proposes to use the TMI-1 TS, Section 4.17 for inservice visual examination and functional testing of snubbers. A visual inspection is the observation of the condition of the installed snubbers to identify those that are damaged, degraded, or inoperable as caused by physical means, leakage, corrosion, or environmental exposure. To verify that a snubber can operate within specific performance limits, the licensee performs functional testing that typically involves removing the snubber and testing it on a specially designed stand or bench. The performance of visual examinations is a separate process that complements the functional testing program and provides additional confidence in snubber operability.

The licensee requested an alternative to the requirements of the ASME Code, Section XI, paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b). The licensee proposed that the inservice visual examinations and functional testing of ASME Code Class 1, 2 and 3 snubbers be performed in accordance with the requirements of the TMI-1 TS, Section 4.17 in lieu of meeting the requirements in the ASME Code, Section XI, paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b).

The ASME Code, Section XI, paragraphs IWF-5200(a) and IWF-5300(a) require that snubber preservice and inservice examinations be performed in accordance with OM-4, using the VT-3 visual examination method described in IWA-2213. Paragraphs IWF-5200(b) and IWF-5300(b) require that snubber preservice and inservice tests be performed in accordance with OM-4.

The licensee did not ask for relief from the paragraphs IWF-5200(c) and IWF-5300(c) of Article IWF-5000 requirements. Paragraphs IWF-5200(c) and IWF-5300(c) require that integral and non-integral attachments for snubbers, including lugs, bolting, pins, and clamps, be examined in accordance with subsection IWF. In its January 25, 2011, response to an RAI from the NRC, the licensee stated that the examination of snubber integral and non-integral attachments will be performed as required by the ASME Boiler and Pressure Vessel (BPV) Code, Section XI, 2004 Edition, no Addenda, Subsection IWF, as part of the TMI-1 ISI Program. Examination of snubber welded attachments will be performed in accordance with the ASME Code, Section XI, 2004 Edition, No Addenda, Subsections IWB, IWC, and IWD welded attachment examination requirements. The licensee stated that this ensures compliance with ASME IWF-5200(c) and IWF-5300(c).

TMI-1 TS, Section 4.17 defines inservice examination requirements and inservice operability testing requirements similar to those provided by OM-4. These criteria are compared and summarized in the following table and followed by a detailed review:

	Criteria	ASME/ANSI OM Part 4 – 1987 through OMa-1988 Addenda	Three Mile Island Unit 1 TS Section 4.17
Inservice Examination			
1	Visual Examination	Paragraph 2.3.1.1, Visual Examination, provides visual examination acceptance criteria.	TS 4.17.1(d), provides visual inspection (examination) acceptance criteria.
2	Visual Examination Interval Frequency	Paragraph 2.3.2.2 provides visual examination interval frequency.	The Table in TS 4.17.1(b) provides snubber visual inspection (examination) interval frequency.
3	Method of Visual Examination	IWF-5200(a) and IWF-5300(a) require use of the VT-3 visual examination method described in IWA-2213.	The licensee states in their alternative request that visual examinations shall be performed using VT-3 visual examination certified personnel.
4	Subsequent Examination Intervals	Paragraph 2.3.2 provides guidance for subsequent inservice examination intervals.	The table in TS 4.17.1(b) provides subsequent visual inspection intervals.
5	Inservice Examination Failure Evaluation	Paragraph 2.3.4 provides details about the snubber inservice examination failure evaluation.	TS 4.17.1(b) provides details related to inservice examination failure evaluation.
Inservice Operability Test			
1	Inservice Operability Test Requirements	Paragraph 3.2.1.1, Operability Test, provides details about snubber operability test requirements either with an in-place or bench test.	TS 4.17.1(f) provides details about snubber inservice operability test requirements. The licensee states in their relief request that snubbers will be tested either in-place or with a bench test.
2	Snubber Sample Size	Paragraph 3.2.3 states that each defined test plan group shall use either: a "10% sampling plan"; a "37 testing sample plan;" or a "55 testing sample plan" during each refueling outage.	TS 4.17.1(e), provides a snubber sample plan.

3	Additional Sampling	(a) Paragraph 3.2.3.1(b) provides additional sampling requirements for a "10% sampling plan." (b) & (c) Paragraph 3.2.3.2(b) provides additional sampling requirements for a "37 testing sample plan," and "55 testing sample plan."	(a) TS 4.17.1(e)(1) provides additional sampling requirements for "10% sampling plan." (b) TS 4.17.1(e)(2) provides additional sampling plan requirements for a "37 testing sample plan." (c) TMI-1 is not using the "55 testing sample plan."
4	Inservice Operability Failure Evaluation	Paragraph 3.2.4.1 provides snubber inservice operability failure evaluation.	TS 4.17.1(g) provides details about inservice operability failure evaluations.
5	Test Failure Mode Groups	Paragraph 3.2.4.2 requires that unacceptable snubber(s) shall be categorized into failure mode group(s).	TS 4.17 does not specifically address "Failure Mode Groups." TS 4.17.1(g) provides details for an engineering evaluation of each functional test failure to determine the cause of the failure and other affected snubbers.
6	Corrective Actions for 10% Testing Sample Plan Or 37 Testing Sample Plan	Paragraphs 3.2.5.1 and 3.2.5.2 state that unacceptable snubbers shall be repaired, modified, or replaced.	TS 4.17.1(h) states that snubbers which fail the visual inspection or the functional test acceptance criteria shall be repaired or replaced.

Inservice Examination Requirements

1. Visual Examination

OM-4, Paragraph 2.3.1.1, requires snubber visual examinations to identify impaired functional ability due to physical damage, leakage, corrosion, or degradation. TS 4.17.1(d), requires that visual inspections shall verify: (1) that there are no visible indication of damage or impaired operability; and (2) attachments to the foundation or supporting structure are secure. Snubbers which appear inoperable as a result of visual inspections may be determined to be operable provided that: (1) the cause for rejection is clearly established and remedied for the snubbers and all other susceptible snubbers; and (2) the affected snubbers are functionally tested in the as-found condition and determined to be operable per TS 4.17.1(f). The licensee stated in their RAI response dated January 25, 2011, that examination of snubber integral and non-integral attachments will be performed as required by the ASME BPV Code, Section XI, 2004 Edition, no Addenda, Subsection IWF, as part of the TMI-1 ISI Program. Examination of snubber welded attachments will be performed in accordance with the ASME Code, Section XI, 2004 Edition, no Addenda, Subsections IWB, IWC, and IWD welded attachment examination requirements (e.g., Examination Categories B-K, C-C, and D-A). TS 4.17.1(d) snubber visual examination requirements are considered to be equivalent to snubber visual examination requirements of

OM-4, Paragraph 2.3.1.1. Therefore, this alternative provides an acceptable level of quality and safety and is acceptable.

2. Visual Examination Interval Frequency

The table in TS 4.17.1(b) provides snubber visual inspection interval frequency requirements which are different than the OM-4 visual inspection interval requirements. The table in TS 4.17.1(b) is less conservative than the table provided in OM-4, Section 2.3.2.2 when no or one unacceptable snubbers are found. When no unacceptable snubbers are found, the table in TS 4.17.1(b) has a 6-month longer subsequent visual inspection period than the table in OM-4, Section 2.3.2.2, and when one unacceptable snubber is found, the table in TS 4.17.1(b) has a 4-month longer subsequent visual inspection period than the table in OM-4, Section 2.3.2.2. The subsequent visual examinations in OM-4 were developed before a 24-month outage interval, such as is the case for TMI-1, was standard. Additionally, the ASME OM Code, 2004 Edition, Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints in Light-Water Reactor Nuclear Power Plants," which has been approved by the NRC,[1] contains a more liberal examination schedule in comparison to OM-4 or TS 4.17.1(b). The longer intervals for no and one snubber reflected in the TMI-1 TS still provide a reasonable monitoring frequency. Further, since the actions for more than one snubber inoperable are equivalent to the interval specified in OM-4, systematic or widespread failures are dispositioned in a similar manner. Therefore, while slightly less conservative than OM-4, the alternative provides an acceptable level of quality and safety and is acceptable.

3. Method of Visual Examination

ASME Section XI, paragraphs IWF-5200(a) and IWF-5300(a) require that preservice and inservice examination be performed in accordance with OM-4, using the VT-3 visual examination method described in IWA-2213. IWA-2213 states that, "VT-3 examinations are conducted to determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearance, settings, and physical displacements; and to detect discontinuities and imperfections, such as loss of integrity at bolts and welded connections, loose or missing parts, debris, corrosion, wear, or erosion. VT-3 includes examinations for conditions that could affect operability or functional adequacy of snubbers and constant load and spring type supports."

TS 4.17.1(d), requires that visual inspections shall verify: (1) that there are no visible indication of damage or impaired operability; and (2) attachments to the foundation or supporting structure are secure.

The licensee stated in their request that the snubber preservice and inservice visual examination will be conducted using the VT-3 visual examination method described in IWA-2213. Therefore, the scope of the TMI-1 TS, Section 4.17, visual inspection requirements are equivalent to the OM-4, VT-3 examination requirements. As such, the licensee's method of snubber visual inspection provides an acceptable level of quality and safety, and is acceptable.

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1. This approval can be found in 10 CFR 50.55a(b)(3) which endorses the 2004 Edition of the ASME Code for Operation and Maintenance of Nuclear Power Plants. This code edition contains the referenced ISTD subsection.

4. Subsequent Examination Intervals

OM-4, Paragraph 2.3.2 provides the subsequent examination interval based on the number of unaccepted snubbers discovered. TS 4.17.1(b) establishes subsequent snubber visual inspection intervals based on the number of unacceptable snubbers discovered, in lieu of OM-4 Section 2.3.2.2 requirements. TS 4-17-1(b) note "**" states the following:

> The inspection interval for each type of snubber shall not be lengthened more than one step at a time unless a generic problem has been identified and corrected; in that event the inspection interval may be lengthened one step the first time and two steps thereafter if no inoperable snubbers of that type are found.

OM-4 states that the subsequent examination for any given failure mode group shall not be lengthened more than one increment at a time. The TS, Section 4.17 note results in a less conservative subsequent examination schedule than the guidance provided in OM-4; however, it is more conservative than the requirements provided in ASME OM Code, Subsection ISTD. Subsection ISTD contains a visual examination schedule with much longer examination intervals than OM-4 or TMI-1 TS, Section 4.17.1(b). Subsection ISTD has been approved for use by the NRC. Therefore, the subsequent examination intervals contained in TS 4.17.1b provide an acceptable level of quality and safety and are acceptable.

5. Inservice Examination Failure Evaluation

OM-4, Paragraph 2.3.4.1, requires that snubbers not meeting examination criteria be evaluated to determine the cause of unacceptability. OM-4, Paragraph 2.3.4.2 notes that snubbers that are found to be unacceptable may be tested in accordance with the requirements of Paragraph 3.2. TS 4.17.1(b) notes that snubbers which appear inoperable as a result of visual inspections shall be classified as unacceptable and may be reclassified acceptable for the purpose of establishing the next visual inspection interval, provided that: (1) the cause of the rejection is clearly established and remedied for that particular snubber and for other snubbers, irrespective of type, that may be generically susceptible; and (2) the affected snubber is functionally tested in the as-found condition and determined operable per TS 4.17.1(f). The NRC staff finds that the TS requirements are equivalent to the requirements of OM-4. Therefore, the inservice examination failure evaluation requirements described in the TSs provide an acceptable level of quality and safety and are acceptable.

Inservice Operability Testing Requirements

1. Inservice Operability Test

OM-4, Paragraph 3.2.1.1, requires that snubber operational readiness tests verify the activation, release rate, and breakaway force or drag force of the tested snubbers by either an in-place or bench test. TS 4.17.1(f) notes that the snubber functional test is to verify: (1) snubber activation (restraining action or lockup) is achieved within the specified velocity range in both tension and compression; (2) snubber release rate (bleed) is achieved in both tension and compression, within the specified range; and (3) fasteners for attachment of the snubber to the component and to the snubber anchorage are secure. TS 4.17.1(d)(1) notes that snubbers shall be functionally tested in-place or in a bench test. Additionally, the licensee stated in a letter dated May 11, 2011, that TMI-1 does not have any snubbers specifically required not to displace under continuous load. The NRC staff finds that the TS requirements are comparable

to the snubber operability test requirements of OM-4, Paragraph 3.2.1.1. Therefore, the TS test requirements provide an acceptable level of quality and safety and are acceptable.

2. Snubber Sample Size

OM-4, Paragraph 3.2.3 requires either a 10% testing sampling plan, a "37 testing sample plan," or a "55 testing sample plan." TS 4.17.1e, "Functional Tests," notes that snubbers shall be functionally tested using the following sample plans: (1) TS 4.17.1e(1): at least 10% of the total population of each type snubber and 10% additional testing for each testing failure; or (2) TS 4.17.1(e)(2): a representative sample of each type of snubber in accordance with TS Figure 4.17-1. The TS 4.17.1(e)(1) and 4.17.1(e)(2) plans are similar to the 10% and 37 testing sample plans, as specified in OM-4. By letter dated January 25, 2011, the licensee stated that they currently uses the TS 4.17.1(e)(1) "10% sample plan" and do not intend to use the TS 4.17.1(e)(2) "37 testing sample plan." Based on the similarity of the TMI-1 TS requirements to the OM-4 requirements, the number of snubbers tested during outages is considered to be equivalent. Therefore, the TS requirements for snubber sample size provide an acceptable level of quality and safety, and are acceptable.

3. Additional Sampling

(a) For the "10% testing sample plan"

OM-4, Paragraph 3.2.3.1(b), requires that an additional sample size must be at least one-half the size of the initial sample size of the "defined test plan group" of snubbers. That is, for a 10% sample program, an additional 5% of the same type of snubber in the overall population would need to be tested. TS 4.17.1(e)(1) requires that for each snubber of the type that does not meet the functional test acceptance criteria of TS 4.17.1(f), an additional 10% of that snubber type shall be functionally tested. Therefore, the TS 4.17.1(e)(1) requirements for 10% additional sampling when using the 10% testing sample plan, exceed the OM-4 requirements. Therefore, they provide an acceptable level of quality and safety, and are acceptable.

(b) For the "37 testing sample plan"

OM-4, Paragraph 3.2.3.2(b) notes that for any snubber(s) determined to be unacceptable as a result of testing, an additional random sample of at least one-half the size of initial sample lot shall be tested until the total number tested (N) is equal to the initial sample size multiplied by the factor 1+ C/2, where C is total number of snubbers found to be unacceptable. The testing of additional samples is also required for snubbers determined to be unacceptable in any additional test. For the "37 testing sample plan," initial and any additional testing shall be in accordance with Figure C1 of the Appendix C of OM-4. The "37 testing sample plan," has an "accept" and a "reject" line (Figure C1). The "accept" line is governed by an equation, N =37(1 + C/2), and "reject" line is governed by N = 37(-1 + C/2). Points are plotted only at the end of the testing of the sample lots. If the point plotted ever falls above the "reject" line, all snubbers of that group must be tested. The acceptance and rejection criteria of TS 4.17.1(e)(2) and Figure 4.17-1 are equivalent to the requirements of OM-4 and therefore provide an acceptable level of quality and safety with respect to additional sampling, and are acceptable.

4. Inservice Operability Failure Evaluation

OM-4, Paragraph 3.2.4.1 requires that snubbers not meeting the operability testing acceptance criteria in Paragraph 3.2.1 shall be evaluated to determine the cause of the failure. TS 4.17.1(g),

"Functional Test Failure Analysis," notes that an engineering evaluation shall be made of each failure to meet the functional test acceptance criteria to determine the cause of the failure. The results of this evaluation shall be used, if applicable, in selecting snubbers to be tested in an effort to determine the operability of other snubbers, irrespective of type, which may be subject to the same failure mode. The TS requirements related to inservice operability failure evaluation are equivalent to the OM-4 requirements. Therefore, the TS requirements provide an acceptable level of quality and safety and are acceptable.

5. Test Failure Mode Groups

OM-4, Paragraph 3.2.4.2 requires that unacceptable snubber(s) be categorized into failure mode group(s). A test failure mode group shall include all unacceptable snubbers that have a given failure mode, and all other snubbers subject to the same failure mode. TS, Section 4.17 does not specifically address, "Failure Mode Groups." However, TS 4.17.1(g) requires an engineering evaluation of each functional test failure to determine the cause of the failure. In its letter dated January 25, 2011, the licensee states that, "If any snubber selected for functional testing either fails to lock-up or fails to move, i.e., frozen-in-place, the cause will be evaluated and if caused by a manufacturer or design deficiency, all snubbers of the same type subject to the same defect shall be functionally tested. This testing requirement shall be independent of the requirements stated in Specification 4.17.1(e)(1) for snubbers not meeting the functional test acceptance criteria." For failure modes other than a manufactured or design deficiency, TS 4.17.1(g) ensures that snubbers subject to the same failure mode are selected for continued testing. The NRC staff finds that the proposed alternative is comparable to the OM-4 requirements. Therefore, the proposed alternative provides an acceptable level of quality and safety and is acceptable.

6. Inservice Operability Testing Corrective Actions for the "10% testing sample plan" or the "37 testing sample plan"

OM-4, Paragraphs 3.2.5.1 and 3.2.5.2 require that unacceptable snubbers be adjusted, repaired, modified, or replaced. TS 4.17.1(h) notes that snubbers which fail the visual inspection or the functional test acceptance criteria shall be repaired or replaced. Replacement snubbers which have repairs which might affect functional test results shall be tested to meet the functional test criteria before installation. The TS corrective actions associated with unacceptable snubbers at TMI-1 are equivalent to the OM-4 requirements. Therefore, the TS corrective actions provide an acceptable level of quality and safety and are acceptable.

Additionally, the testing of the RCP snubbers fulfills the OM-4 requirements. The RCP snubber testing procedure verifies freedom of motion (snubber break away force and drag force), piston lock-up velocity (activation range), and piston velocity after lockup. The testing frequency method results in two of the four snubbers being tested every other refueling outage, resulting in a 25% testing rate, which is greater than the OM-4 required 10% testing rate. If one RCP snubber fails the functional test, then all other RCP snubbers will be tested.

Based on the above reviews regarding the comparison of the OM-4 and the TS Section 4.17 requirements, the NRC staff finds that snubber inservice visual examinations and functional testing, conducted in accordance with TMI-1 TS Section 4.17, provides reasonable assurance of snubber operability equivalent to that of the ASME Code, Section XI, Paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b). Therefore, the staff finds that the licensee's proposed alternative provides an acceptable level of quality and safety. It should be noted that in authorizing proposed alternative I4R-04, TMI-1 TS Section 4.17 becomes an approved

acceptable alternative to meeting the requirements of ASME Section XI for performing ISI and testing of snubbers. Any changes to these TS requirements during the fourth ISI interval must be reviewed and approved by the NRC staff for authorization, pursuant to 10 CFR 50.55a(a)(3), as well as pursuant to 10 CFR 50.90.

As set forth above, the NRC staff determined that the proposed alternative in I4R-04, provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i). Therefore, the NRC staff authorizes the proposed alternative noted above, at TMI-1, for all safety-related ASME Code Class 1, 2, and 3 snubbers, for the fourth 10-year ISI interval.

3.4 Request for Alternative I4R-05

This request relates to the qualification requirements of ASME Code, Section XI, Appendix VIII, Supplement 11, for Examination of Structural Weld Overlays (SWOLs) for the existing overlays described below, as well as any future NRC-approved overlays installed during the fourth ISI interval:

COMPONENT IDENTIFICATION				
WELD IDENTIFICATION	**ITEM #**	**SIZE**	**ADJACENT WELD**	**DESCRIPTION**
SR0010BM	B9.11	10"	NA	Pressurizer surge nozzle to pipe dissimilar metal weld at hot leg "A"
PR0021BM	B5.40	10"	NA	Pressurizer surge nozzle to safe end dissimilar metal weld at the pressurizer
DH0001BM	B9.11	12"	DH0498	Decay heat nozzle to safe end weld at hot leg "B". This location also includes the adjacent safe end to pipe weld.

These overlays are ASME Code Class 1, examination category B-F and B-J. The Code of Record for the fourth 10-year ISI interval at TMI-1 is the 2004 Edition, no Addenda of the ASME Code, Section XI. 10 CFR 50.55a(b)(2)(xxiv) requires that the ultrasonic (UT) examination must be performed using personnel, procedures, and equipment qualified in accordance with the 2001 Edition, no Addenda of the ASME Code, Section XI, Appendix VIII, Supplement 11, "Qualification Requirements For Full Structural Overlaid Wrought Austenitic Piping Welds" (Supplement 11). The specific paragraphs in Supplement 11 affected by this request for relief are: 1.1(b), 1.1(d)(1), 1.1(e)(1), 1.1(e)(2), 1.1(e)(2)(a)(1), 1.1(e)(2)(a)(2), 1.1(e)(2)(a)(3), 1.1(e)(2)(b)(1), 1.1(e)(2)(b)(2), 1.1(e)(2)(b)(3), 1.1(f)(1), 1.1(f)(3), 1.1(f)(4), 2.0[2], 2.1, 2.2(d), 2.3, 3.1, 3.2(a)[3], and 3.2(b).

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2. Appendix VIII, Supplement 11, Paragraph 2.0 is not addressed by the licensee in the text of Relief Request I4R-05. However, Relief Request I4R-05, Table 2, *Modifications to Appendix VIII, Supplement 11 (2001 Edition, No Addenda)* addresses the Performance Demonstration Initiative (PDI) modification of this paragraph. Therefore, the staff has evaluated this paragraph in this Safety Evaluation.

3. Appendix VIII, Supplement 11, Paragraph 3.2(a) is not addressed by the licensee in the text of the Relief Request, I4R-05. However, Relief Request I4R-05, Table 2, *Modifications to Appendix VIII, Supplement 11 (2001 Edition, No Addenda)* addresses the PDI modification of this paragraph. Therefore, the staff has evaluated this paragraph in this Safety Evaluation.

3.4.1 Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposes an alternative to the qualification requirements of Supplement 11 using the ultrasonic qualification program for weld overlay inspections developed and administered by EPRI for the Performance Demonstration Initiative (PDI) program.

3.4.2 Licensee's Basis for Proposed Alternative and Staff Evaluation

The U.S. nuclear utilities created the PDI program to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. To this end, PDI has developed a program for qualifying equipment, procedures, and personnel for examinations of weld overlays in accordance with ultrasonic test (UT) criteria of Supplement 11. Prior to the Supplement 11 program, EPRI maintained a performance demonstration program for weld overlay qualification under the Tri-party Agreement between the NRC, EPRI, and the Boiling Water Reactor Owners Group (BWROG), titled "Coordination Plan for NRC/EPRI/BWROG Training and Qualification Activities of NDE (Nondestructive Examination) Personnel," dated July 3, 1984 (ADAMS Legacy Library Accession No. 8407090122). Instead of having two programs with similar objectives, the NRC staff recognized the PDI program for weld overlay qualifications as an acceptable alternative to the Tri-party Agreement. This is documented in a letter from William H. Bateman to Michael Bratton, titled "Weld Overlay Performance Demonstration Administered by PDI as an Alternative for Generic Letter 88-01 Recommendations," dated January 15, 2002 (ADAMS Accession No. ML020160532). Further, the PDI program is routinely assessed by the NRC staff for consistency with the current ASME Code, as well as any proposed changes, to ensure that it continues to provide an acceptable level of quality and safety.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposes to utilize UT examination technique and personnel qualifications for the existing and future SWOLs using PDI demonstrated procedures in conjunction with PDI qualified examiners in lieu of the Supplement 11 requirements. The licensee states that the PDI qualification program provides an acceptable alternative to the requirements of Supplement 11 and provides an acceptable level of quality and safety.

The licensee's basis for the proposed alternative and the NRC staff evaluation of the differences identified in the PDI program with Supplement 11 are as follows:

Paragraph 1.1(b) of Supplement 11 states limitations to the maximum thickness for which a procedure may be qualified. The ASME Code states that, "The specimen set must include at least one specimen with an overlay thickness within minus 0.10-inch to plus 0.25-inch of the maximum nominal overlay thickness for which the procedure is applicable." The ASME Code requirement addresses the specimen thickness tolerance for a single specimen set, but is confusing when multiple specimen sets are used. The PDI proposed alternative states that, "the specimen set shall include specimens with overlays not thicker than 0.10-inch more than the minimum thickness, nor thinner than 0.25-inch of the maximum nominal overlay thickness for which the examination procedure is applicable." The proposed alternative provides clarification on the application of the tolerance. The tolerance is unchanged for a single specimen set; however, the proposed alternative clarifies the tolerance for multiple specimen sets by providing tolerances for both the minimum and maximum thicknesses. The proposed wording eliminates confusion while maintaining the intent of the overlay thickness tolerance. Therefore, the staff

finds that this PDI program alternative maintains the intent of the Supplement 11 requirements, and is acceptable

Paragraph 1.1(d)(1) of Supplement 11 requires that all base metal flaws be cracks. PDI determined that certain Supplement 11 requirements pertaining to location and size of cracks would be extremely difficult to achieve. For example, flaw implantation requires excavating a volume of base material to allow a pre-cracked coupon to be welded into this area. This process would add weld material to an area of the specimen that typically consists of only base material, and could potentially make ultrasonic examination more difficult and not representative of actual field conditions. In an effort to satisfy the requirements, PDI developed a process for fabricating flaws that exhibit crack-like reflective characteristics. Instead of all flaws being cracks, as required by Paragraph 1.1(d)(1), the PDI program for weld overlays contain at least 70% cracks with the remainder being fabricated flaws exhibiting crack-like reflective characteristics. The fabricated flaws are semi-elliptical with tip widths of less than 0.002-inches. The licensee provided further information describing a revision to the PDI program alternative to clarify when real cracks, as opposed to fabricated flaws, will be used; "PDI limits flaws in cases where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws." The NRC has reviewed the flaw fabrication process, compared the reflective characteristics between actual cracks and PDI-fabricated flaws, and found that the fabricated flaws for this application provide assurance that the PDI program meets the intent of the Supplement 11 requirement. Therefore, the staff finds that the proposed alternative to the Supplement 11 requirement is acceptable.

Paragraph 1.1(e)(1) of Supplement 11 requires that at least 20-percent but not less than 40-percent of the flaws shall be oriented within plus or minus 20 degrees of the axial direction (of the piping test specimen). Flaws contained in the original base metal heat-affected zone satisfy this requirement; however, PDI excludes axial fabrication flaws in the weld overlay material. PDI has concluded that axial flaws in the overlay material are improbable because the overlay filler material is applied in the circumferential direction (parallel to the girth weld); therefore, fabrication anomalies would also be expected to have major dimensions in the circumferential direction. The NRC finds that this approach to implantation of fabrication flaws is reasonable for meeting the intent of the Supplement 11 requirement. Therefore, the staff concludes that PDI's exclusion of flaws oriented in the axial direction in the weld overlay material is acceptable.

Paragraph 1.1(e)(1) of Supplement 11 also requires that the rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws. PDI treats each flaw as an individual flaw and not as part of a system of closely spaced flaws. PDI controls the flaws going into a test specimen set such that the flaws are free of interfering reflections from adjacent flaws. In some cases, this permits flaws to be spaced closer than what is allowed for classification as a multiple set of flaws by IWA-3300, thus potentially making the performance demonstration more challenging than the existing requirement. Since this is a conservative requirement with respect to the ASME Code requirement, the staff concludes that PDI's application for closely spaced flaws is acceptable.

Paragraph 1.1(e)(2) of Supplement 11 requires that specimens be divided into base metal and overlay grading units. The PDI program adds clarification with the addition of the word "fabrication" and ensures that flaw identification will not be masked by other flaws with the addition of "Flaws shall not interfere with ultrasonic detection or characterization of other flaws." PDI's alternative provides clarification and assurance that the flaws are identified. Therefore, the staff finds that the PDI alternative to the Supplement 11 requirement is acceptable.

Paragraph 1.1(e)(2)(a)(1) of Supplement 11 requires that a base grading unit shall include at least 3 inches of the length of the overlaid weld, and the base grading unit includes the outer 25-percent of the overlaid weld and base metal on both sides. The PDI program reduced the criteria to 1 inch of the length of the overlaid weld and eliminates from the grading unit the need to include both sides of the weld. The proposed change permits the PDI program to continue using test specimens from the existing weld overlay program which have flaws on both sides of the welds. These test specimens have been used successfully for testing the proficiency of personnel for over 16 years. The weld overlay qualification is designed to be a near-side (relative to the weld) examination, and it is improbable that a candidate would detect a flaw on the opposite side of the weld due to the sound attenuation and re-direction caused by the weld microstructure. However, the presence of flaws on both sides of the original weld (outside the PDI grading unit) may actually provide a more challenging examination, as candidates must determine the relevancy of these flaws, if detected. For these reasons, the staff agrees that PDI's use of the 1 inch length of the overlaid weld base grading unit and elimination from the grading unit the need to include both sides of the weld, as described in the PDI program alternative, is an acceptable alternative to the Supplement 11 requirements. Therefore, the staff finds the proposed alternative acceptable.

Paragraph 1.1(e)(2)(a)(2) of Supplement 11 requires, when base metal cracking penetrates into the overlay material, that a portion of the base grading unit shall not be used as part of the overlay grading unit. The licensee proposes, and the NRC staff agrees, that the PDI program adjusts for the changes in Paragraph 1.1(e)(2)(a)(2) and conservatively states that when base metal flaws penetrate into the overlay material, no portion of it shall be used as part of the overlay fabrication grading unit. The staff notes that the PDI program also provided clarification by the addition of the term "flaws" for "cracks" and the addition of "fabrication" to "overlay grading unit." The staff concludes that the PDI program alternative provides clarification and conservatism, and therefore, is acceptable.

Paragraph 1.1(e)(2)(a)(3) of Supplement 11 requires that for unflawed base grading units, at least 1 inch of unflawed overlaid weld and base metal shall exist on either side of the base grading unit. This is to minimize the number of false identifications of extraneous reflectors. The PDI program stipulates that unflawed overlaid weld and base metal exists on all sides of the grading unit and flawed grading units must be free of interfering reflections from adjacent flaws which addresses the same concerns as the ASME Code. Hence, the staff concludes that PDI's application of the variable flaw-free area adjacent to the grading unit meets the intent of the Supplement 11 requirements and is, therefore, acceptable.

Paragraph 1.1(e)(2)(b)(1) of Supplement 11 requires that an overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 square inches. The overlay grading unit shall be rectangular, with minimum dimensions of 2 inches. The PDI program reduces the base metal-to-overlay interface to at least 1 inch (in lieu of a minimum of 2 inches) and eliminates the minimum rectangular dimension. This change is necessary to allow use of existing examination specimens that were fabricated in order to meet NRC Generic Letter 88-01 (Tri-party Agreement, July 1984). This change may be more challenging to meet than that of the ASME Code because of the variability associated with the shape of the grading unit. Therefore, the staff concludes that PDI's application of the grading unit is conservative, and is an acceptable alternative to the Supplement 11 requirements.

Paragraph 1.1(e)(2)(b)(2) of Supplement 11 requires that unflawed overlay grading units shall be surrounded by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch around its entire perimeter. The PDI program redefines the area by noting unflawed

overlay fabrication grading units shall be separated by at least 1 inch of unflawed material at both ends and sufficient area on both sides to preclude interfering reflections from adjacent flaws. The licensee purported and the staff agreed, that the relaxation in the required area on the sides of the specimens may provide a more challenging demonstration than required by ASME Code because of the possibility of having a parallel flaw on the opposite side of the weld, while still ensuring no interfering reflections. Therefore, the staff concludes that PDI's application is an acceptable alternative to the Supplement 11 requirements.

Paragraph 1.1(e)(2)(b)(3) of Supplement 11 requirements are retained in the PDI program. In addition, the PDI program requires that initial procedure qualification contain three times the number of flaws required for a personal qualification. To qualify new values of essential variables, the equivalent of at least one personal qualification is required. The NRC staff concludes that PDI's additions enhance the ASME Code requirements, and are therefore acceptable, because it provides for a more stringent qualification criteria.

Paragraph 1.1(f)(1) of Supplement 11 requirements are retained in the PDI program, with the clarification change of the term "flaws" for "cracks." In addition, the PDI program includes the requirements that sizing sets shall contain a distribution of flaw dimensions to verify sizing capabilities. The PDI program also requires that initial procedure qualification contain three times the number of flaws required for a personal qualification. To qualify new values of essential variables, the equivalent of at least one personal qualification is required. The staff concludes that PDI's additions enhance the ASME Code requirements and are therefore, acceptable, because it provides a more stringent qualification criteria.

Paragraphs 1.1(f)(3) and 1.1(f)(4) of Supplement 11 requirements are clarified by the PDI program by replacing the term "cracking" with "flaws" because of the use of alternative flaw mechanisms. The staff concludes that this clarification in the PDI program meets the intent of the ASME Code requirements, and is acceptable.

Paragraph 2.0 of Supplement 11 is silent on performance demonstrations for the weld metal and overlay fabrication. The PDI program addresses the two performance demonstrations by specifying that they may be performed separately. The PDI program adds clarity to the testing criteria without changing the requirement. Therefore, the staff concludes that PDI's clarification is an enhancement to ASME Code requirement, and is acceptable.

Paragraphs 2.1 and 2.2(d) of the Supplement 11 requirements are clarified by the PDI program by the addition of the terms "metal" and "fabrication." These terms were added to clarify the description of the grading units present in a specimen. "Metal" was added to "base" to read "base metal," and "fabrication" was added to "overlay" to read "overlay fabrication." The staff determined that the clarifications provide acceptable classification of the terms they are enhancing. Therefore, the staff concludes that the PDI program meets the intent of the ASME Code requirements, and is acceptable.

Paragraph 2.3 of Supplement 11 requires that, for depth sizing tests, 80-percent of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate. This requires detection and sizing tests to be performed separately. The PDI revised the weld overlay program to allow sizing to be conducted either in conjunction with, or separately from, the flaw detection test. If performed in conjunction with detection and the detected flaws do not meet the Supplement 11 range criteria, additional specimens will be presented to the candidate with the regions containing flaws identified. Each candidate will be required to determine the maximum depth of the flaw in each region. For separate sizing tests, the regions of interest will

also be identified and the maximum depth and length of each flaw in the region will similarly be determined. In addition, PDI stated that grading units are not applicable to sizing tests, and that each sizing region will be large enough to contain the target flaw, but small enough such that candidates will not attempt to size a different flaw. The staff has determined that the above clarification provides a basis for implementing sizing tests in a systematic, consistent manner that meets the intent of Supplement 11. Therefore, the staff concludes that PDI's method is acceptable.

Paragraph 3.1 of Supplement 11 requires that examination procedures, equipment and personnel (as a complete ultrasonic system) are qualified for detection or sizing of flaws, as applicable, when certain criteria are met. The PDI program allows procedure qualification to be performed separately from personnel and equipment qualification. Historical data indicate that, if ultrasonic detection or sizing procedures are thoroughly tested, personnel and equipment using those procedures have a higher probability of successfully passing a qualification test. In an effort to increase this passing rate, PDI has elected to perform procedure qualifications separately in order to assess and modify essential variables that may affect overall system capabilities. For a procedure to be qualified, the PDI program requires three times as many flaws to be detected (or sized) as shown in Supplement 11 for the entire ultrasonic system. The personnel and equipment are still required to meet the Supplement 11 requirement. Therefore, the PDI program criteria exceed the ASME Code requirements for personnel, procedures, and equipment qualifications. Based on this conservative difference, the staff concludes that the PDI program criteria are acceptable.

Paragraph 3.2(a) of Supplement 11 refers to term the "cracking" in the base metal and flaws within the same acceptance criteria. The PDI program changed the term from cracking to flaws for consistence in the acceptance criteria and uniformity within the proposed alternative. The staff concludes that PDI's change adds clarity and meets the intent of the ASME Code requirements, thus the change is acceptable.

Paragraph 3.2(b) of Supplement 11 requires that all extensions of base metal cracking into the overlay material by at least 0.10-inch are reported as being intrusions into the overlay material. The PDI program omits this criterion because of the difficulty in actually fabricating a flaw with a 0.10-inch minimum extension into the overlay, while still knowing the true state of the flaw dimensions. However, the PDI program requires that cracks be depth-sized to the tolerance specified in the ASME Code which is 0.125-inches. Since the ASME Code tolerance is close to the 0.10-inch value of Paragraph 3.2(b), any crack extending beyond 0.10-inch into the overlay material would be identified as such from the characterized dimensions. The staff has determined that reporting of an extension in the overlay material is redundant for performance demonstration testing because of the flaw sizing tolerance. Therefore, the staff concludes that PDI's omission of highlighting a crack extending beyond 0.10-inch into the overlay material is acceptable.

The NRC staff has reviewed the licensee's submittal and determined that, based on the preceding discussion, and in accordance with 10 CFR 50.55a(a)(3)(i), use of the PDI program alternative to select paragraphs in ASME Code, Section XI, Appendix VIII, Supplement 11 provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the alternative proposed in request I4R-05 is authorized for the fourth 10-year ISI interval at TMI-1.

3.5 Request for Alternative I4R-06

Pursuant to 10 CFR 50.55a(a)(3)(i), Exelon Generation Company LLC's letter dated August 10, 2010, requested to use Code Case N-649 as an alternative to the requirements of Paragraph IWE-5240 of the ASME Code, Section XI, for visual examination of the TMI-1 concrete containment with a metal steel liner that is inaccessible during a post-repair pressure test.

Section 50.55a of 10 CFR Part 50 incorporates, by reference, the 2004 Edition, no Addenda of Section XI of the ASME Code. Paragraph IWE-5240, of Subsection IWE of the ASME Code, requires a detailed visual examination (IWE-2310) to be performed on areas affected by repair/replacement activities.

In the alternative request, the licensee stated that the "Applicability Index for Section XI Cases," contained in the ASME Code, "Code Cases: Nuclear Components," states that ASME Code Case N-649 is applicable up to and including the 1998 Edition with the 2000 Addenda of ASME Section XI. The Edition/Addenda referenced in the Code Case text itself also ends at the 1998 Edition with the 2000 Addenda. The licensee also stated that the requirements of Paragraph IWE-5240 are identical in both the 1998 Edition with the 2000 Addenda and the 2004 Edition, no Addenda. TMI-1 has a concrete containment with a metal liner that is inaccessible during a post-repair pressure test. ASME Code Case N-649 was issued to allow this visual examination to be performed during or after the pressure test in recognition of the impracticality of performing the visual examinations of concrete containment liners during the post repair pressure test. The licensee also stated that ASME did not address this impracticality in the Code until the 2004 Edition with the 2006 Addenda of ASME Section XI was issued. Therefore, ASME Code Case N-649 is needed for the 2004 Edition, no Addenda of ASME Section XI, which is applicable to the TMI-1 fourth ISI interval.

In the alternative request, the licensee requested that the applicability of ASME Code Case N-649 be extended to the 2004 Edition, no Addenda for use in the plant's fourth 10-year ISI interval. NRC RG 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," lists ASME Code Case N-649 as acceptable for use with no conditions or limitations. The only issue being addressed by this alternative request is the "Applicability Index for Section XI Cases," and the use of Code Case N-649 in the TMI-1 fourth ISI interval.

The NRC staff reviewed the requirements of paragraph IWE-5240 in the 1998 Edition with the 2000 Addenda of ASME Section XI and the 2004 Edition, no Addenda and found that they are both identical. The NRC staff agrees with the licensee's assertion that TMI-1 has a concrete containment with a metal liner that is inaccessible during a post-repair pressure test. The staff also agrees that ASME Code Case N-649 was issued to allow this visual examination to be performed during or after the pressure test, in recognition of the impracticality of performing the visual examinations of concrete containment liners during the post-repair pressure test. The staff has previously identified ASME Code Case N-649 as acceptable for use with no conditions or limitations as stated in NRC Regulatory Guide 1.147, Revision 16, October 2010, (and Revision 15, as stated in the alternative request). Based on the consistency of the ASME Section XI code versions over the time period in question, the NRC staff concludes that the use of Code Case N-649 is acceptable and that the proposed alternative is therefore acceptable. The NRC staff finds that the proposed alternative provides an acceptable level of quality and safety and is therefore authorized in accordance with 10 CFR 50.55a(a)(3)(i).

4.0 CONCLUSION

The NRC staff reviewed and evaluated request numbers I4R-02, I4R-04, I4R-05, and I4R-06 pursuant to the provisions of 10 CFR 50.55a(a)(3)(i) and concludes that the proposed alternatives provide an acceptable level of quality and safety and are authorized for the fourth ISI interval at TMI-1. The staff reviewed and evaluated I4R-03 pursuant to the provisions of 10 CFR 50.55a(g)(6)(i) and grants relief for the fourth ISI interval at TMI-1, because it is impractical for the licensee to comply with the requirement and the proposed alternative inspection provides adequate assurance of leak tightness of the subject components. Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and approved, remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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Date: July 20, 2011

By letter dated October 29, 2010, Exelon withdrew request I4R-01 because ASME Code Case N-513-3 had been approved for use in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, Revision 16, eliminating the need for the request.

For request numbers I4R-02, I4R-04, I4R-05, and I4R-06, the licensee requested to use a proposed alternative, on the basis that the alternative provides an acceptable level of quality and safety, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Paragraph 50.55a(a)(3)(i). For request number I4R-03, the licensee requested relief on the basis that the code requirement is impractical, pursuant to 10 CFR 50.55a(g)(5)(iii).

The NRC staff has reviewed request numbers I4R-02, I4R-04, I4R-05, and I4R-06, and concludes, as set forth in the enclosed safety evaluation, that Exelon has demonstrated that the proposed alternatives provide an acceptable level of quality and safety. Therefore, request numbers I4R-02, I4R-04, I4R-05, and I4R-06 are authorized pursuant to 10 CFR 50.55a(a)(3)(i), for the fourth 10-year interval ISI program at TMI-1.

Further, the NRC staff has reviewed request number I4R-03, and concludes, as set forth in the enclosed safety evaluation, that Exelon has demonstrated that it is impractical to comply with the specified ASME Code requirement and that the proposed alternative testing will provide reasonable assurance of leak tightness of the subject components. Therefore, relief request number I4R-03 is granted pursuant to 10 CFR 50.55a(g)(6)(i), for the fourth 10-year interval ISI program at TMI-1.

If you have any questions, please contact the TMI-1 Project Manager, Mr. Peter J. Bamford, at 301-415-2833.

Sincerely,
/ra/
Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-289

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