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10 CFR Part 54

TMI-12-069
April 16, 2012

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Submittal of Inspection Plan for Reactor Internals

Reference: NUREG-1928, "Safety Evaluation Report Related to the License Renewal of Three Mile Island Nuclear Station, Unit 1," dated October 2009

Appendix A ("Long Term Commitments for License Renewal of TMI-1") of the referenced U.S. Nuclear Regulatory Commission Safety Evaluation Report contains commitments associated with the license renewal of the Three Mile Island Nuclear Station (TMI), Unit 1. Commitment No. 36 commits to the following:

> "The PWR Vessel Internals Program will commit to the following activities: 1. Participate in the industry programs for investigating and managing aging effects on reactor internals. 2. Evaluate and implement the results of the industry programs as applicable to the reactor internals. 3. Upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval."

The period of extended operation begins April 20, 2014. Accordingly, attached is the requested inspection plan which is being submitted not less than 24 months before entering the period of extended operation.

The "Inspection Plan for the Three Mile Island Unit 1 Reactor Vessel Internals" (Attachment 1) is based upon the above commitment and MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)," dated December 2011. MRP-227-A includes the United States Nuclear Regulatory Commission (NRC) Safety Evaluation Report accepting MRP-227 for use as an acceptable Aging Management Program (AMP) for PWR Reactor Vessel Internals. The NRC SER includes licensee specific actions which shall be addressed by licensees choosing to implement MRP-227-A. The inspection plan discussed below is complete. However, changes to the plan may result from

ongoing discussions between the Materials Reliability Program (MRP) and the NRC in resolving final MRP-227-A inspection and evaluation methodologies. The final evaluation methodologies are scheduled to be reviewed and accepted by the NRC in 2012 and will allow final definition of work scope and schedule for presentation to the NRC for the three Applicant/Licensee Action Items defined below. A brief summary of the ongoing actions is provided below with additional detail provided in Appendix D of the enclosed inspection plan:

1. Applicant/Licensee Action Item 2 (Table D-2), based upon Section 4.2.2 of the NRC Safety Evaluation Report (SER), requires a licensee to identify which Reactor Vessel Internals (RVI) components are within the scope of license renewal. If a licensee identifies additional components within the scope of license renewal that are not currently included in MRP-227-A then the licensee shall propose necessary inspection requirements beyond the requirements of MRP-227-A. Exelon has identified that the RVI vent valve locking device should be further reviewed with MRP-227-A methodology to determine the impact on the RVI Aging Management Program (AMP) and the enclosed plan. TMI is currently working with the Pressurized Water Reactor Owners Group (PWROG) to address the action item. Exelon will submit an update of the PWROG progress in evaluating this item and a schedule for showing when Exelon will submit the results of an evaluation by April 19, 2013.

2. Applicant/Licensee Action Item 6 (Table D-2), based upon Section 4.2.6 of the SER, requires a licensee to justify the acceptability of certain inaccessible components that Table 4-4 of MRP-227-A identifies as expansion components. The SER action requires that a licensee submit an analysis of the acceptability of these components for continued service or a schedule for replacement of the subject components with the NRC submittal documenting the intent to implement the requirements of MRP-227-A. TMI is currently working with the Pressurized Water Reactor Owners Group (PWROG) to address the action item. Exelon will submit an update of the PWROG progress in evaluating these components and a schedule for showing when Exelon will submit an evaluation for continued service or a schedule for replacement by April 19, 2013.

3. Applicant/Licensee Action Item 7 (Table D-2), based upon Section 4.2.7 of the SER, requires that the licensee develop plant-specific analyses to demonstrate that there is not a loss of functionality of the Incore Monitoring Instrumentation (IMI) guide tube assembly spiders and Control Rod Guide Tube (CRGT) spacer castings due to loss of fracture toughness. TMI is currently working with the PWROG to address the action item. Exelon will submit an update of the PWROG progress in evaluating these components and a schedule for showing when Exelon will submit an evaluation for continued service or a schedule for replacement by April 19, 2013.

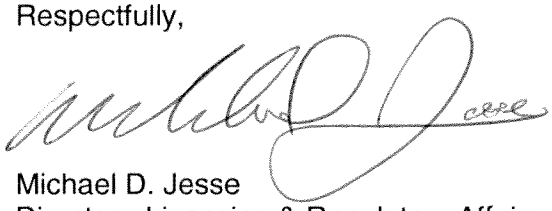
Attachment 2 contains three new commitments that correspond to the open actions described above. Exelon considers that license renewal commitment No. 36 is satisfied by virtue of the Attachment 1 inspection plan and the new commitments made in Attachment 2. There are no other regulatory commitments contained in this letter.

Section 2.4 of MRP-227-A identifies certain general assumptions for plant operation that are based on core design, operation as a base load plant, and design changes that could have an impact on the reactor vessel internals. MRP-229, "Materials Reliability Program: Functionality Analysis for B&W Representative PWR Internals," Revision 3, was a base document used in

development of MRP-227-A. MRP-229 identified that the effect of power uprates has not been considered in the functionality analysis. The impact of any future power uprates on this RVI Inspection Plan will be addressed, as appropriate, in the LAR application to implement the proposed uprate.

If you have any questions concerning this letter, please contact Tom Loomis at (610) 765-5510.

Respectfully,



Michael D. Jesse
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1) Inspection Plan for the Three Mile Island Unit 1 Reactor Vessel Internals
2) Summary of Commitments

cc: Regional Administrator, Region I, USNRC
USNRC Senior Resident Inspector, TMI
USNRC Project Manager, [TMI] USNRC

Attachment 1

Inspection Plan for the Three Mile Island Unit 1 Reactor Vessel Internals

ANP-2952
Revision 001
March 2012

Inspection Plan for the Three Mile Island Unit 1 Reactor Vessel Internals

(AREVA document 77-2952-001)

By
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Nature of Changes

Revision	Date	Section	Changes
000	November 2010		Original Release
001	March 2012		Incorporate the elements of the NRC SER for MRP-227, and changes made to MRP-227-A. Details below.
		General	Word searched and added "-A" to most occurrences of MRP-227. Historical reference to the originally submitted MRP-227 were left without the "-A".
		TOC	Updated to reflect other changes in the document.
		LOAA	List of Acronyms and Abbreviations changed to reflect other changes in the document.
		1.0	Added XI.M16A of NUREG-1801 Rev. 2 for the program comparison as this is required by the SER for MRP-227-A. Minor wording changes.
		2.0	Changed "current" to "original" as the current license expiration date is now 2034. Changed AMP to "aging management review" to correctly reflect the subject. Added discussion of TLAA in the TMI-1 LRA for completeness. Changed Table 2-1 to reflect the LR commitment in Appendix A of the LRA (UFSAR Supplement) rather than Appendix B. Revised MRP-227 history to include issuance of the SER and submittal of MRP-227-A. Modified paragraph about Appendix A, now App E, to better reflect what's in App E. Added MRP-231 and MRP-189 as references. Used MRP-227-A intended functions of the internals. Changed title of figure from B&W internals to TMI-1 internals.
		4.1	Reworded slightly. Brought some info from 4.2 to 4.1 and combined these sections. Deleted info about the reactor vessel inspections in the ASME code, this is not pertinent to the internals inspections. All TMI-1 recategorizations have been incorporated (or eliminated) in MRP-227-A, this section has been deleted in its entirety. Renumbered sections as some sections were deleted. Added discussion of fabrication records search to meet Applicant/Licensee Action Item #4. Deleted the discussion of aging effects for the UCB and LCB bolts and bolt locking devices. This was a TMI re-categorization but has been incorporated into MRP-227-A and thus is no longer a re-categorization.
		4.2	Note this used to be 4.3. Added sentence that was in 4.3.2 as it seemed out of place there. Revised to say current guidance is in MRP-227-A, rather than saying it culminated in the submittal of MRP-227. Under Mandatory and Needed: reworded to reflect current status of MRP-227-A. Changed most recent TMI-1 fuel cycle from cycle 18 to cycle 19. Updated reference to the cycle 19 report. Info provided by Exelon. Added assumptions from MRP-190 and MRP-229 to those from MRP-227 to complete Applicant/Licensee Action Item #1.
		4.3	Note this used to be 4.4. Simplified discussion, deleted redundant information.
		5.0	This entire section was re-written to include a typical License Renewal 10-element program comparison as requested by the NRC SER for MRP-227-A and comparison to NUREG-1801, Revision 2.
		6.0	Updated summary to reflect the other changes throughout this document.
		7.0	Updated References
		Appendices	Moved Appendix A to Appendix E. The TMI-1 Primary components, Expansion components, and Examination Acceptance/Expansion Criteria are now Appendices A, B and C.

Revision	Date	Section	Changes
			Word searched the document for "Appendix" and revised references as needed.
		App A	The previous App A has been moved to App E.
		App B	Previous App B is now App A. Revised Appendix number and title; this is now the TMI-1 Primary Components rather than a reprint of the MRP-227-A Primary Components. Made the changes in MRP-227-A Deleted the items that were not applicable to TMI-1
		App C	Previous App C is now App B. Revised Appendix number and the title; this is now the TMI-1 Expansion Components rather than a reprint of the MRP-227-A Expansion Components Made the changes in MRP-227-A Deleted the items that were not applicable to TMI-1
		App D	Previous App D is now App C. Revised Appendix number and the title; this is now the TMI-1 Examination Acceptance and Expansion Criteria rather than a reprint of the MRP-227-A Examination Acceptance and Expansion Criteria Table Made the changes in MRP-227-A There are no TMI-1 specific changes.
		App E	Previous App E was a discussion of TMI-1 Specific re-categorizations. MRP-227-A has incorporated all of the TMI-1 re-categorizations, and this appendix is no longer necessary. It has been deleted.
		New App D	Added new appendix D to document the disposition of the Topical Report Conditions and Applicant/Licensee Action Items from the NRC SER contained in MRP-227-A.
		App E	The previous Appendix A is now Appendix E. Revised introduction to reflect what was requested by the NRC SER for MRP-227-A. Deleted the GALL comparison (the last three columns in Rev. 0). Made the location and disposition their own columns.

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List of Acronyms and Abbreviations

AMP – Aging Management Program

AMR – Aging Management Review

ASME – American Society of Mechanical Engineers

B&PV – Boiler and Pressure Vessel

B&W – Babcock and Wilcox

B&WOG – B&W Owner's Group

CAP – Corrective Action Program

CASS – Cast Austenitic Stainless Steel

CFR – Code of Federal Regulations

CLB – Current Licensing Basis

CRGT – Control Rod Guide Tube

CSA – Core Support Assembly

CSS – Core Support Shield

EPRI – Electric Power Research Institute

Exelon – Exelon Nuclear

FD – Flow Distributor

FMECA – Failure, Modes, Effects, and Criticality Analysis

FSER – Final Safety Evaluation Report

GALL – Generic Aging Lessons Learned (NUREG-1801)

GLRP – Generic License Renewal Program

I&E Guidelines – Inspection and Evaluation Guidelines (MRP-227-A)

IASCC – Irradiation-Assisted Stress Corrosion Cracking

IE – Irradiation Embrittlement

IMI – Incore Monitoring Instrumentation

ISI – In-Service Inspection

JOBB – Joint Owners' Baffle Bolt (Program)

LCB – Lower Core Barrel

LR – License Renewal

LRA – License Renewal Application

LRAAI – License Renewal Applicant Action Item

LTS – Lower Thermal Shield

MRP – Materials Reliability Program

MUR – Measurement Uncertainty Recapture

NDE – Non-Destructive Examination

NRC – Nuclear Regulatory Commission

OE – Operating Experience

PWR – Pressurized Water Reactor

PWROG – Pressurized Water Reactor Owners Group

QA – Quality Assurance

QATR – Quality Assurance Topical Report

RFO – Refueling Outage

RV – Reactor Vessel

SCC – Stress Corrosion Cracking

SER – Safety Evaluation Report

TLAA – Time-Limited Aging Analysis

TE – Thermal Embrittlement

TMI-1 – Three Mile Island Unit 1

UCB – Upper Core Barrel

UFSAR – Updated Final Safety Analysis Report

U.S. – United States

UT – Ultrasonic Testing (Nondestructive Examination Technique)

UTS – Upper Thermal Shield

VT-3 – Visual Examination

1.0 INTRODUCTION

The purpose of this report is to document the Three Mile Island Unit 1 (TMI-1) Reactor Vessel (RV) Internals Inspection Plan for submittal to the United States (U.S.) Nuclear Regulatory Commission (NRC). This report provides a description of the TMI-1 RV Internals Inspection Plan as it relates to the management of aging effects consistent with previous commitments. The TMI-1 RV Internals Inspection Plan is based on MRP-227-A "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines"[1].

The Reactor Vessel Internals Inspection Plan is a part of the TMI-1 Reactor Vessel Internals Aging Management Program (AMP). The overall program consists of not only the RV Internals inspections described in this document, but includes other TMI-1 and Industry Programs and Activities as discussed in Section 4.0 of this inspection plan. Section 5.0 of this plan compares the TMI-1 AMP to the 10-element program in Section XI.M16A of NUREG-1801, Revision 2 "Generic Aging Lessons Learned (GALL)" report[2] as required by Applicant/Licensee Action Item #8 of the NRC Safety Evaluation Report (SER) for MRP-227. Although this comparison is made to the NUREG-1801, Revision 2 program as required by the SER, TMI-1 remains committed to NUREG-1801, Revision 1 as addressed in their License Renewal (LR) Application (LRA) and SER.

This TMI-1 RV Internals Inspection Plan contains a discussion of the background of the Babcock and Wilcox (B&W)-designed plant RV Internals programs, first sponsored by the utilities through the B&W Owner's Group (B&WOG) and later by the PWR Owners group (PWROG), and submitted to the NRC through the Electric Power Research Institute (EPRI) PWR Materials Reliability Program (MRP). The TMI-1 RV Internals Inspection Plan also contains a discussion of operational experience, and relevant TMI-1 and industry programs and activities.

The TMI-1 RV Internals AMP will include this TMI-1 RV Internals Inspection Plan and will demonstrate that the program adequately manages the effects of aging for RV Internals components and establishes the basis for providing reasonable assurance that the RV Internals components remain functional through the TMI-1 LR period of extended operation.

2.0 BACKGROUND

2.1 TMI-1 License Renewal Background

By letter dated January 8, 2008, AmerGen Energy Company, LLC submitted the LRA for TMI-1 in accordance with Title 10, Part 54, of the Code of Federal Regulations (10 CFR 54).[3] Through the LRA, AmerGen Energy Company, LLC (Exelon Nuclear, herein Exelon) requested the NRC renew the operating license for TMI-1 (license number DPR-50) for a period of 20 years beyond the original expiration of midnight April 19, 2014. The renewed license was issued by the NRC on October 22, 2009.[4] The SER NUREG-1928[5] documented the technical review of the TMI-1 LRA by the NRC Staff.

Section 3.1 of TMI-1's LRA[6] discusses the RV Internals aging management review (AMR) for LR. The components that are subject to AMR have been identified in accordance with the requirements of 10 CFR 54.4. The AMPs selected to manage aging effects for the RV Internals are identified in Section 3.1.2.1.3 and Table 3.1.2-3 of the LRA and include time-limited aging analyses (TLAAs) and Water Chemistry. A description of the water chemistry program is provided in Appendix B of the LRA; while the TLAAs are described in Section 4 and Appendix A of the LRA. In the TMI-1 LRA, Exelon committed to (1) participate in industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

Section 3.1.3 of NUREG-1928[5] concludes that Exelon has provided sufficient information to demonstrate that the effects of aging for the RV Internals components, within the scope of LR and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the current licensing basis (CLB) for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Section 4.9 of NUREG-1928[5] identifies that the TLAAs from the LRA were reviewed. The SER concludes the identified TLAAs associated with RV Internals for TMI-1 comply with the requirements of 10 CFR 54.21(c).

The three TLAAs for the RV internals in the TMI-1 LRA include low cycle fatigue, high cycle fatigue, and neutron embrittlement. Low cycle fatigue is managed by the Fatigue Monitoring Program (LRA Section 4.3.4). High cycle fatigue (flow induced vibration) is projected through the period of extended operation (LRA Section 4.3.5). Neutron embrittlement is managed by the PWR Vessel Internals Program and neutron embrittlement is one of the aging effects evaluated in MRP-227-A (see Section 3.2.6 of MRP-227-A).

Section 6 of NUREG-1928[5] concludes the staff determined that the requirements of 10 CFR 54.29(a) were met by the TMI-1 LRA.

Table 2-1 demonstrates how the TMI-1 RV Internals LR commitments have been fulfilled.

Table 2-1: TMI-1 RV Internals LRA Commitment Resolutions

Commitment reference location	Commitment/Action Items	Fulfilled, as described in reference location
TMI-1 LRA[6], Appendix A, License Renewal Commitment 36 (page A-52)	TMI-1 commits to the following activities for the PWR Vessel Internals program: • Participate in the industry programs for investigating and managing aging effects on reactor internals. • Evaluate and implement the results of the industry programs as applicable to the reactor internals. • Upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	Exelon currently participates and will continue to participate in the industry programs for investigating and managing aging effects on reactor internals during TMI-1 current and extended license periods. The second and third bullets are being fulfilled by the development and submittal of this TMI-1 RV Internals Inspection Plan (based on MRP-227-A,) to the NRC for review and approval.

2.2 TMI-1 RV Internals AMR/Industry Program Background

In the TMI-1 LRA, Exelon committed to submitting an inspection plan for the RV Internals components; this document is that inspection plan.

The initial industry work performed, which supports the TMI-1 RV Internals Inspection Plan, included an AMR documented in BAW-2248[7] that was directed by the B&WOG Generic License Renewal Program (GLRP). The NRC final safety evaluation report (FSER) of BAW-2248 was attached to the NRC's letter to the B&WOG dated December 9, 1999.[8] The NRC's letter and FSER are included in the updated BAW-2248A report.[9] Per the NRC FSER, the BAW-2248 approach was found acceptable.

As presented in BAW-2248A, Table 4-1, a combination of existing inspections and additional work to be identified by the "RV Internals Aging Management Program" was credited for aging management of the B&W operating plant RV Internals, including the TMI-1 RV Internals.

The additional industry work on the aging of the RV Internals, begun by the submittal of BAW-2248 for B&W plants resulted in the submittal of "PWR Internals Inspection and Evaluation Guidelines," MRP-227, Rev. 0 in January of 2009 for NRC review.[10] The NRC issued a Safety Evaluation[11] accepting MRP-227 with certain conditions and applicant action items. MRP-227-A was then completed in December 2011 with the changes requested by the NRC SER. MRP-227-A[1] is considered the industry program for TMI-1 RV Internals. Components recommended for augmented examinations are categorized as "Primary", "Expansion", or "Existing Programs". Components not recommended for augmented examinations are categorized as "No Additional Measures". The industry program is intended to provide a consistent approach to the aging management of PWR RV Internals components across the PWR fleet. For additional information about MRP-227-A, see Section 4.2.2 of this report.

An AMR for LR was performed and the results are documented in Table 3.1.2-3 of the TMI-1 LRA. A comparison of the results of the TMI-1 LRA AMR and the results of the industry activity are provided in Appendix E of this report.

Initial augmented examinations for aging degradation mechanisms not yet completed are currently scheduled to be completed no later than the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B&PV) Code Section XI, 10-year In-service (ISI) inspection. A relief request for the 10-year ISI for TMI-1 RV Internals, previously scheduled for the Fall 2011 outage, was submitted on October 29, 2009 to allow certain ASME Code inspections, including the visual examinations of category B-N-2 and B-N-3 RV Internals, to be deferred to the Fall 2015 outage.[12] By letter dated September 21, 2010 containing the safety evaluation for this

request, the NRC authorized the deferral of the visual examination of the RV Internals until the Fall 2015 outage.[13][14]

2.3 TMI-1 RV Internals AMP Intent

The TMI-1 RV Internals AMP, which will include the TMI-1 RV Internals Inspection Plan described in this document after review and approval by the NRC, utilizes a combination of prevention and condition monitoring. Where applicable, credit is taken for existing programs (e.g., primary water chemistry program and ASME B&PV Code Section XI inspection program). The TMI-1 RV Internals Inspection Plan incorporates the requirements for augmented inspections provided by industry guidelines in MRP-227-A. Augmented inspections are in addition to the requirements of ASME B&PV Code Section XI[15]; the augmented inspections do not reduce, alter, or otherwise affect current ASME B&PV Code Section XI inspections at TMI-1.

Aging degradation mechanisms that impact the RV Internals have been identified in MRP-227-A. MRP-227-A provides augmented examination requirements for detection of the effects of aging degradation mechanisms as listed in Table 2-2.

Table 2-2 RV Internals Aging Degradation Mechanisms and Their Aging Effects

Aging Degradation Mechanism	Aging Effect
Stress Corrosion Cracking (SCC)	Cracking
Irradiation-Assisted Stress Corrosion Cracking (IASCC)	Cracking
Wear	Loss of Material
Fatigue	Cracking
Thermal Aging Embrittlement	Loss of Ductility and Toughness, Unstable Crack Extension
Irradiation Embrittlement (IE)	Loss of Ductility and Toughness, Unstable Crack Extension
Void Swelling and Irradiation Growth	Dimension Change, Distortion, and Cracking
Thermal and Irradiation-Enhanced Stress Relaxation or Irradiation Enhanced Creep	Loss of Mechanical Closure Integrity leading to Cracking

Section 5.0 of this report compares the TMI-1 RV Internals AMP (including this inspection plan) to the ten elements in AMP XI.M16A of NUREG-1801, Revision 2. The TMI-1 RV Internals AMP incorporates programs and activities that are credited for managing the aging effects produced by the mechanisms listed in Table 2-2. TMI-1 RV Internals components within the scope of the LRA and NUREG-1928 have been considered in this TMI-1 RV Internals Inspection Plan.

Appendix D to this inspection plan identifies the TMI-1 response to each of the Topical Report Conditions and Applicant/Licensee Action Items in the NRC Safety Evaluation for MRP-227 Rev 0. While disposition to several items are included in this plan, disposition of certain Applicant/Licensee Action Items will subsequently be addressed as listed in Appendix D.

A comparison of the results of the TMI-1 LRA AMR (LRA Table 3.1.2-3) and the results of the industry activity (MRP-227-A and supporting documents MRP-189[16] and MRP-231[17]) is provided in Appendix E of this report. As discussed in response to Applicant/Licensee Action Item #2 in Appendix D, the only component identified in the LRA that is not included in the MRP-227-A development is the vent valve locking device. A review of this component using the MRP-227-A development methodology will be performed and will be submitted to the NRC upon completion.

2.4 TMI-1 RV Internals Background

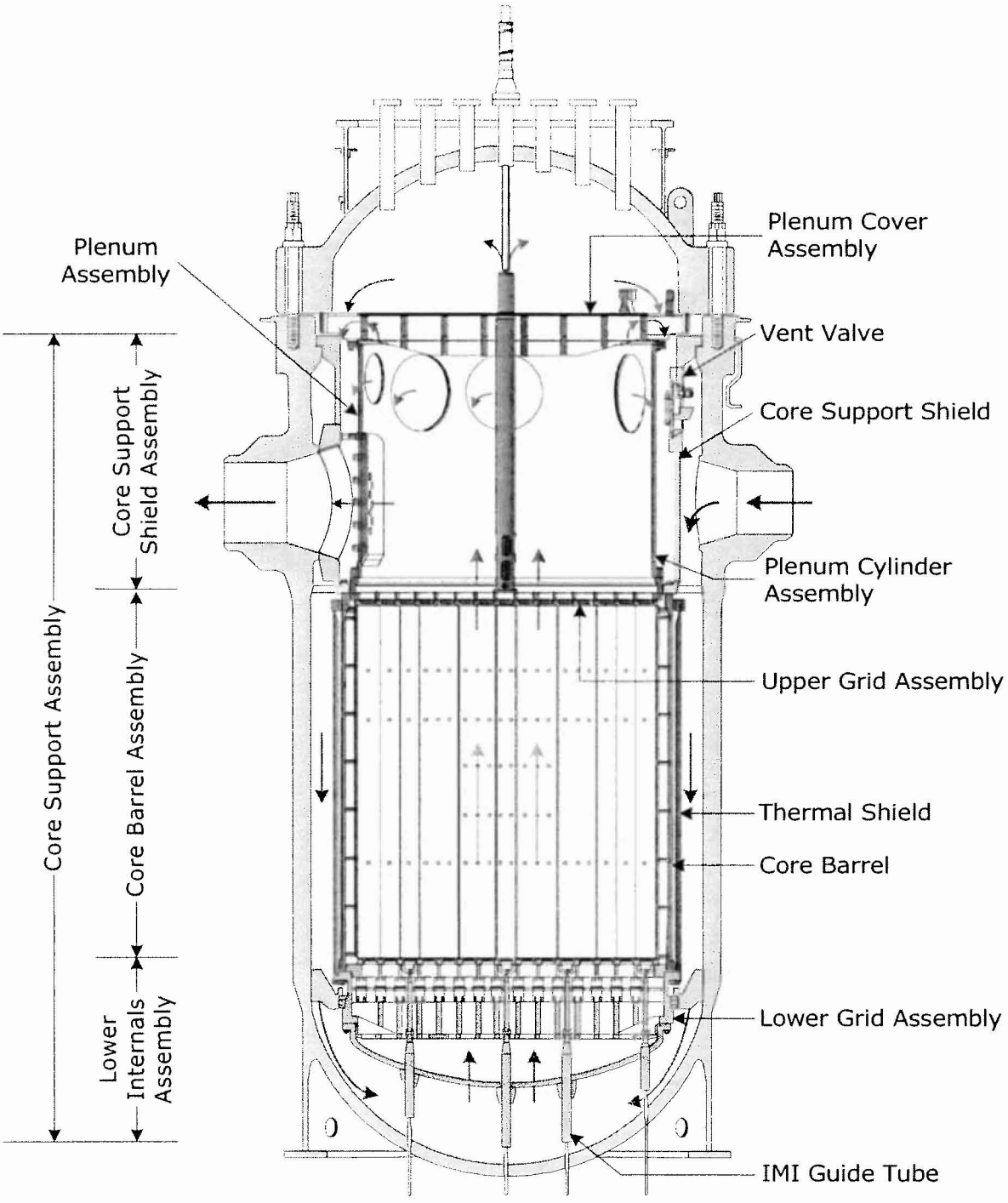
The functions of PWR reactor internals, as stated in Section 3.1 of MRP-227-A, are to:

1. provide support, guidance, and protection for the reactor core;
2. provide a passageway for the distribution of the reactor coolant flow to the reactor core;

3. provide a passageway for support, guidance, and protection for control elements and invessel/core instrumentation; and
4. provide gamma and neutron shielding for the RV.

The TMI-1 RV Internals consists of two structural subassemblies that are located within the RV: the plenum assembly and the core support assembly (CSA). The general arrangement of the RV Internals is shown in Figure 2-1.[1] Note that the TMI-1 LRA includes the fuel and the control rods as RV Internals; however, these components are short-lived and they require no aging management.

Figure 2-1: General Arrangement of the TMI-1 RV Internals



3.0 PROGRAM OWNER

The TMI-1 Engineering Programs Group is responsible for creating, maintaining, and implementing the TMI-1 RV Internals Inspection Plan.

4.0 INDUSTRY AND TMI-1 PROGRAMS AND ACTIVITIES

The TMI-1 RV Internals Inspection Plan is based on the TMI-1 LRA, NUREG-1928, and MRP-227-A. The TMI-1 RV Internals AMP implements MRP-227-A through this RV internals inspection plan. The TMI-1 RV Internals AMP also includes the continuation of some of the programs and activities discussed in this section.

4.1 TMI-1 Programs and Activities

The TMI-1 RV Internals AMP consists of a number of programs and activities that support aging management of the RV Internals; these include the ASME B&PV Code Section XI ISI Program, primary water chemistry program, plant technical specifications (vent valve inspection and exercise program), TLAAs, fabrication records searches, upper core barrel (UCB) and lower core barrel (LCB) bolt analysis, past RV Internals inspections, and a fuel/baffle interaction investigation.

4.1.1 ASME B&PV Code Section XI ISI Program

The ASME B&PV Code Section XI ISI program is an existing program developed under ASME B&PV Code Section XI, Subsection IWB-2500.[15] ASME B&PV Code Section XI, Table IWB-2500-1, Examination Category B-N-3 applies to core support structures (i.e., RV internals). Examination of these B-N-3 RV Internals is required once every 10-year ISI interval. The VT-3 examinations are performed with the aid of visual examination tools, in accordance with a code compliant VT-3 procedure.

The next TMI-1 ASME B&PV Code Section XI 10-year ISI inspection requiring CSA removal is currently scheduled for the Fall 2015 refueling outage (RFO).[13]

4.1.2 Primary Water Chemistry Program

The TMI-1 reactor coolant chemistry program, as implemented by the TMI-1 Reactor Coolant System Chemistry Program, limits the concentration of oxygen, halogens, and sulfate species in the primary water. The intent of these limits is to prevent the reactor coolant from becoming an environment favorable to SCC or IASCC, therefore greatly reducing the probability of SCC and IASCC.

4.1.3 Plant Technical Specifications

As described in the TMI-1 Plant Technical Specifications, Section 4.16 "Reactor Internals Vent Valve Surveillance", vent valve testing and inspections are required to be performed each RFO. This requirement is fulfilled by the TMI-1 Reactor Internals Vent Valve Inspection and Exercise procedure. The accessible areas of the vent valve are typically inspected, including the locking devices. Additionally, vent valve operation is tested through manual actuation.

4.1.4 Time Limited Aging Analyses

As described briefly in Section 2.0, the TMI-1 RV Internals Aging Management Program includes three Time Limited Aging Analyses that were evaluated and dispositioned in the License Renewal Application. The three TLAAs for the RV Internals include low cycle fatigue, high cycle fatigue, and neutron embrittlement.

Low cycle fatigue is managed by the Fatigue Monitoring Program (LRA Section 4.3.4).

High cycle fatigue (flow induced vibration) is projected through the period of extended operation (LRA Section 4.3.5).

The LRA committed to manage neutron embrittlement by participating in, evaluating, and implementing the results of RV Internals industry programs that were then in development. Those programs (i.e. MRP-227-A) are now approved and are implemented via this inspection plan as part of the TMI-1 RV Internals AMP. Neutron embrittlement is one of the aging effects considered in the development of MRP-227-A (see Section 3.2.6 of MRP-227-A).

The responses to Applicant/Licensee Action Items 6 and 7 from the NRC SER for MRP-227-A may result in additional analyses justifying the use of the TMI-1 RV Internals. As these analyses are developed, any time-dependent aspects of these analyses will be identified and addressed through the period of extended operation.

4.1.5 Fabrication Records Searches

Fabrication records searches for TMI-1 RV Internals components listed as "Primary" and "Expansion" in MRP-227, Rev. 0 were conducted by AREVA NP.

These fabrication records searches included a search of original fabrication records for several cast austenitic stainless steel (CASS) RV Internals items, including the core support shield (CSS) vent valve discs and control rod guide tube (CRGT) spacer castings.

In 2012, a search of the original fabrication records was performed to confirm that the CSS upper flange weld was stress relieved, as required by Applicant/Licensee Action Item#4 in the NRC SER for MRP-227. This search confirmed that the TMI-1 CSS upper flange weld was stress relieved.

4.1.6 UCB and LCB Bolt Analysis

An analysis was performed for the TMI-1 UCB and LCB bolts. The stress limits for threaded structural fasteners in Subsection NG of the ASME B&PV Code[18] were used to develop the acceptance criteria for the integrity of the bolted joint. The analytical model is intended to be used to assess inspection results for the UCB and LCB bolts at TMI-1.

Five cases representing hypothetical UCB and LCB degraded bolt configurations were analyzed to provide insight to the number and pattern of degraded bolts that can be tolerated without exceeding the analytical criteria. The results indicate a large number of degraded UCB and LCB bolts can be tolerated without exceeding the analytical criteria for the joint if the degraded bolts are not adjacent. If degraded bolts are adjacent to each other, and located in the worst location, the number of degraded UCB and LCB bolts that can be tolerated is lower.

4.1.7 Past RV Internals Inspections

Past inspections of the RV Internals include the vent valve inspections, UCB inspections, and core clamping measurements at TMI-1.

4.1.7.1 Vent Valve Inspection

As discussed in Section 4.1.3 of this report, vent valve testing and inspections are required to be performed each RFO. Results from the vent valve inspection and exercise test performed in the 2007 and 2009 RFOs, were deemed acceptable. During the vent valve inspection and exercise test performed during the 2011 RFO, one vent valve exceeded the stay open force acceptance criteria. The valve was cycled five times, after which the holding force was found to be acceptable. The high as-found loading force required to maintain the valve open was attributed to crud from the reactor coolant system oxidation process. No other notable conditions were observed during the 2011 inspection.

4.1.7.2 UCB UT Examination at TMI-1

During the TMI-1 2009 RFO, AREVA NP performed an UT examination of 100% of the UCB bolts. The examinations were performed under direction of the AREVA NP non-destructive examination (NDE) group. No recordable indications were detected in any of the UCB bolts. UT examinations were also performed at TMI-1 on the UCB bolts in 1982 (partial) and 1991 (100%). No recordable indications were detected by these examinations.

4.1.7.3 Core Clamping Measurements

Core clamping measurements were obtained by AREVA NP at TMI-1 in 2010 to satisfy the MRP-227-A examination requirements for a one-time physical measurement of the differential height of top of the plenum rib pads to the reactor vessel seating surface. This measurement was taken with the plenum cover weldment

rib pads, plenum cover support flange, and CSS top flange inside the RV, but with the fuel assemblies removed per Section 4.3.1 of MRP-227-A. The conclusions of the core clamping summary document are that there was no evidence of wear occurring during the service period and the measurements were acceptable. Therefore, these core clamping measurements at TMI-1 meet the one-time physical measurement requirement in MRP-227-A.

4.1.8 Fuel/Baffle Interaction Investigation

An investigation was conducted on the interaction between the baffle plates and fuel assembly grid straps in similarly-designed units between 2004 and 2010. Exelon has participated and will continue to participate in this project.

4.2 Other Industry Programs and Activities

Exelon participates in industry activities which support the management of aging of the RV Internals. These activities are described in the sections below. These industry programs and activities have helped to define the required examinations and examination techniques for the components covered by this TMI-1 RV Internals Inspection Plan.

4.2.1 B&WOG Generic License Renewal Project Report (BAW-2248A)

As described previously in Section 2.2 of this report, the B&WOG GLRP report (BAW-2248A) contains a technical evaluation of aging effects for B&W RV Internals components. The B&WOG sent the report to the NRC staff to demonstrate that participating member plant owners subscribing to the report could adequately manage effects of aging on RV Internals during the period of extended operation.

BAW-2248A was a predecessor to ongoing industry work through the EPRI PWR MRP for the B&W units, which resulted in the current guidance in MRP-227-A.

4.2.2 MRP-227-A

The MRP-227-A "Pressurized Water Reactor Internals Inspections and Evaluation (I&E) Guidelines" were developed by a team of industry representatives who reviewed available data and industry experience to identify and prioritize I&E requirements for RV Internals. MRP-227-A is the result of the industry work and NRC review that began with BAW-2248A for the B&W plants. The key sequential steps in the process included the following:

- The development of screening criteria, with susceptibility for the eight postulated aging mechanisms relevant to reactor internals and their effects;
- An initial component screening and categorization, using the susceptibility levels and FMECA (failure modes, effects, and criticality analysis) to identify the relative ranking of the components;
- Functionality assessment of degradation for components and assemblies of components; and
- Aging management strategy development combining the functionality assessment with component accessibility, operating experience, existing evaluations, and prior examination results to determine the appropriate aging management methodology, baseline examination timing, and the need for and the timing of subsequent inspections.

Through this process, the RV Internals for all three PWR designs in the U.S. were evaluated, and appropriate requirements for aging management actions specific to each component were provided.

MRP-227-A utilized the screening and ranking process to aid in the identification of required examinations for "Primary" and "Expansion" components and credits "Existing Programs" when they were deemed adequate.

The basic description of each classification is as follows:

- **"Primary"**

Those PWR internals that are highly susceptible to the effects of at least one of the eight aging mechanisms were placed in the "Primary" group. The aging management needed to ensure functionality of "Primary" components are described in these I&E guidelines [MRP-227-A]. The "Primary" group also includes components which have shown a degree of tolerance to a specific aging degradation effect, but for which no highly susceptible component exists or for which no highly susceptible component is accessible.

- **'Expansion"**

  Those PWR internals that are highly or moderately susceptible to the effects of at least one of the eight aging mechanisms, but for which functionality assessment has shown a degree of tolerance to those effects, were placed in the "Expansion" group. The schedule for implementation of aging management examinations for "Expansion" components will depend on the findings from the examinations of the "Primary" components at individual plants.

- **"Existing Programs"**

  Those PWR internals that are susceptible to the effects of at least one of the eight aging mechanisms and for which generic and plant-specific existing AMP elements are capable of managing those effects, were placed in the "Existing Programs" group. There are no B&W plant internals components in this group.

- **"No Additional Measures"**

  Those PWR internals for which the effects of all eight aging mechanisms are below the screening criteria were placed in the "No Additional Measures" group. Additional components were placed in the "No Additional Measures" group as a result of FMECA and the functionality assessment. No further action is recommended by these guidelines for managing the aging of the "No Additional Measures" components.

The categorization and analysis processes used in the MRP-227-A approach are not intended to supersede ASME B&PV Code Section XI requirements.

The requirements of MRP-227-A are classified in accordance with NEI 03-08[19] guidelines. For the MRP-227-A guidelines there are one "Mandatory", five "Needed", and zero "Good Practice" requirements as follows:

- **"Mandatory"**

  Each commercial U. S. PWR unit shall develop and document a program for management of aging of reactor internal components within thirty-six months following issuance of MRP-227, Rev 0 (that is no later than December 31, 2011).

  Exelon has established procedures to develop and document an AMP for the Reactor Vessel Internals.

- **"Needed"**

  Each commercial U. S. PWR unit shall implement Tables 4-1 through 4-9 and Tables 5-1 through 5-3 for the applicable design within twenty-four months following issuance of MRP-227-A.

  The applicable B&W tables are MRP-227-A, Table 4-1 ("Primary"), Table 4-4 ("Expansion"), and Table 5-1 (Examination Acceptance and Expansion Criteria). There are no "Existing Program" components in MRP-227-A for B&W-designed PWRs. TMI-1 has followed the MRP-227-A requirements by the inspection activities already planned or performed as described in this TMI-1 RV Internals Inspection Plan. Appendix A is MRP-227-A Table 4-1 modified to reflect only the TMI-1 primary components. Appendix B is MRP-227-A Table 4-4 modified to reflect only TMI-1 expansion components. Appendix C is MRP-227-A Table 5-1 modified to reflect only TMI-1 acceptance/expansion criteria. Therefore, implementation of this inspection plan will fulfill this "Needed" requirement for TMI-1.

- **"Needed"**

  Examinations specified in these guidelines shall be conducted in accordance with the Inspection Standard [MRP-228].

Inspection standards developed under MRP-228[20] will be used by Exelon for the augmented examinations described in this TMI-1 RV Internals Inspection Plan developed in accordance with MRP-227-A. Implementation of this RV Internals Inspection Plan will fulfill this "Needed" requirement for TMI-1.

- **"Needed"**

  Examination results that do not meet the examination acceptance criteria defined in Section 5 of the MRP-227-A guidelines shall be recorded and entered in the plant corrective action program and dispositioned.

  The TMI-1 Corrective Action Program (CAP) will be used, as discussed in Section 5.7 of this report. Implementation of this TMI-1 RV Internals Inspection Plan will fulfill this "Needed" requirement for TMI-1.

- **"Needed"**

  Each commercial U. S. PWR unit shall provide a summary report of all inspections and monitoring, items requiring evaluation, and new repairs to the MRP Program Manager within 120 days of the completion of an outage during which PWR internals within the scope of MRP-227-A are examined.

  Exelon will provide a summary report of all inspections and monitoring, items requiring evaluation, and new repairs to the MRP program manager for future TMI-1 inspection activities within 120 days of the completion of an outage during which PWR RV Internals within the scope of MRP-227-A are examined. Implementation of this TMI-1 RV Internals Inspection Plan will fulfill this "Needed" requirement for TMI-1.

- **"Needed"**

  If an engineering evaluation is used to disposition an examination result that does not meet the examination acceptance criteria in Section 5 [of MRP-227-A], this engineering evaluation shall be conducted in accordance with an NRC-approved evaluation methodology.

  Exelon will disposition all examination results that do not meet the acceptance criteria [in Section 5 of MRP-227-A] in accordance with NRC approved evaluation methodology. Implementation of this TMI-1 RV Internals Inspection Plan will fulfill this "Needed" requirement for TMI-1.

4.2.2.1 MRP-227-A Applicability to TMI-1

The applicability of MRP-227-A guidelines are based on several general assumptions that were used for the analysis in the development of MRP-227-A. Additional assumptions in the Failure Modes, Effects, and Criticality Analysis (FMECA - MRP-190[21]) and the functionality analysis report (MRP-229[22]) are also included as required by Applicant/Licensee Action Item #1 from the NRC SER for MRP-227, Rev 0.

MRP-227-A:

The assumptions found in Section 2.4 of MRP-227-A and their applicability to TMI-1 are listed below:

- 30 years of operation with high leakage core loading patterns (fresh fuel assemblies loaded in peripheral locations) followed by implementation of a low-leakage fuel management strategy for the remaining 30 years of operation.

  The fuel management program for TMI-1 changed from a high to a low leakage core loading pattern prior to 30 years of plant operation. This change was started in TMI-1 Cycle 6 (1987) and has been continually implemented through the most recent fuel cycle, TMI-1 Cycle 19 (2011). This change is considered to be a preventative action to lessen the effects of aging on the TMI-1 RV Internals. TMI-1 will continue to use low-leakage core loading pattern.

- Base load operation, i.e., typically operates at fixed power levels and does not usually vary power on a calendar or load demand schedule.

TMI-1 operates as a base load unit.

- No design changes beyond those identified in general industry guidance or recommended by the original vendors.

  MRP-227-A states that the requirements are applicable to all U. S. PWR operating plants as of May 2007 for the three designs (i.e., B&W, Westinghouse, and CE) considered. No modifications have been made to the TMI-1 RV Internals since May 2007.

MRP-190:

Section 4 of MRP-190 (the FMECA) contains 6 assumptions and observations. As stated in Section 4 of MRP-190, these assumptions are either bounding or methodological, and do not require plant-specific verification for each of the B&W-designed operating units.

MRP-229, Rev. 3:

Section 2.4.1 of MRP-229 (the functionality analysis report) identifies eight bulleted limitations and assumptions. Seven of those are programmatic rather than site specific. Only one pertains to the plant design and operating history, and that one is discussed below:

- The effect of power uprates has not been considered by the functionality analysis.

  TMI-1 intends to apply for a measurement uncertainty recapture (MUR) uprate in the future. The impact of that uprate and any other uprates on MRP-227-A will be formally reviewed and reported as part of the LAR for the power uprate.

Based on the above review, MRP-227-A is applicable to TMI-1 and Applicant/Licensee Action Item #1 from the NRC SER for MRP-227-A is complete. See Appendix D, Table D-2 for more information.

4.2.3 Joint Owner's Baffle Bolt Program

The Joint Owners' Baffle Bolt (JOBB) Program stemmed from UT examinations of baffle-to-former bolts at several European plants. Indications were noted under the bolt head in the head-to-shank fillet radius. The bolt failures were attributed to IASCC. Various tasks, including NDE examinations, irradiation and mechanical testing, corrosion testing, and microstructural evaluation were used to characterize the effect of irradiation on bolting materials under the JOBB program.

The JOBB program is now being managed by EPRI with additional research on RV Internals material being performed under EPRI programs. The results of the JOBB program have been incorporated into EPRI PWR MRP documents, and specifically referenced in MRP-227-A. The EPRI PWR MRP provides results to the NRC during meetings; an example of the results presented in these meetings is given in Reference 23.

4.2.4 PWROG and EPRI/MRP

The utilities sponsor activities related to PWR RV Internals aging management through both the PWROG and EPRI PWR MRP. Exelon's participation in current PWROG and EPRI PWR MRP activities will continue.

4.3 Conclusions of Section 4.0

This section contains a description of the TMI-1 Reactor Vessel Internals Aging Management Program, including this RV Internals Inspection Plan. The TMI-1 RV Internals Inspection Plan is based on the TMI-1 LRA, NUREG-1928, and evaluations supporting MRP-227-A. Inspections will consist of the ASME B&PV Code Section XI inspections and the augmented examinations from MRP-227-A. Changes resulting from the NRC's review of this report will be incorporated as appropriate.

As part of the TMI-1 License Renewal Program, Exelon agreed, by updated final safety analysis (UFSAR) commitment, to participate in industry programs for investigating and managing aging effects on RV Internals and to evaluate and implement the results of the industry programs as applicable to the RV Internals. Once these programs have been completed, but not less than twenty-four months before entering the period of

extended operation, Exelon has committed to submitting a TMI-1 RV Internals Inspection Plan to the NRC for review and approval, which is the completion and submission of this TMI-1 RV Internals Inspection Plan.

Appendix E of this report provides a comparison of the results of the TMI-1 LRA AMR and the results of the industry activity that lead up to MRP-227-A.

5.0 TMI-1 RV INTERNALS AMP ATTRIBUTE EVALUATION

The TMI-1 RV Internals AMP, which includes this TMI-1 RV Internals Inspection Plan, utilizes a combination of prevention and condition monitoring to manage the effects of the eight age-related degradation mechanisms given in Section 2.3 of this report, thereby providing reasonable assurance the RV Internals continue to perform their LR function during the period of extended operation. Where applicable, credit is taken for existing programs and activities (e.g., primary water chemistry program, vent valve testing, TLAAs, and ASME B&PV Code Section XI inspections). This TMI-1 RV Internals Inspection Plan incorporates the industry guidance in MRP-227-A.

This section compares the TMI-1 RV Internals AMP, including this inspection plan, to the ten element AMP XI.M16A from NUREG-1801, Revision 2. The conclusion of this comparison is that the TMI-1 Reactor Internals AMP is consistent with the NUREG-1801 XI.M16A program with no exceptions and no enhancements.

Aging Management Program Description (from NUREG-1801, Revision 2, XI.M16A):

Age-related degradation in the reactor internals is managed through an integrated program. Specific features of the integrated program are listed in the following ten program elements. Degradation due to changes in material properties (e.g., loss of fracture toughness) was considered in the determination of inspection recommendations and is managed by the requirement to use appropriately degraded properties in the evaluation of identified defects. The integrated program is implemented by the applicant through an inspection plan that is submitted to the NRC for review and approval with the application for license renewal.

5.1 AMP Element 1 – Scope of Program

5.1.1 NUREG-1801, XI.M16A Scope of Program

The scope of the program includes all RVI components at Three Mile Island Unit 1, which is built to a B&W NSSS design. The scope of the program applies the methodology and guidance in the most recently NRC-endorsed version of MRP-227, which provides augmented inspection and flaw evaluation methodology for assuring the functional integrity of safety-related internals in commercial operating U.S. PWR nuclear power plants designed by B&W, CE, and Westinghouse. The scope of components considered for inspection under MRP-227 guidance includes core support structures (typically denoted as Examination Category B-N-3 by the ASME Code, Section XI), those RVI components that serve an intended license renewal safety function pursuant to criteria in 10 CFR 54.4(a)(1), and other RVI components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii). The scope of the program does not include consumable items, such as fuel assemblies, reactivity control assemblies, and nuclear instrumentation, because these components are not typically within the scope of the components that are required to be subject to an aging management review (AMR), as defined by the criteria set in 10 CFR 54.21(a)(1). The scope of the program also does not include welded attachments to the internal surface of the reactor vessel because these components are considered to be ASME Code Class 1 appurtenances to the reactor vessel and are adequately managed in accordance with an applicant's AMP that corresponds to GALL AMP XI.M1, "ASME Code, Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

The scope of the program includes the response bases to applicable license renewal applicant action items (LRAAIs) on the MRP-227 methodology, and any additional programs, actions, or activities that are discussed in these LRAAI responses and credited for aging management of the applicant's RVI components. The LRAAIs are identified in the staff's safety evaluation on MRP-227 and include applicable action items on meeting those assumptions that formed the basis of the MRP's augmented inspection and flaw evaluation methodology (as discussed in Section 2.4 of MRP-227), and NSSS vendor-specific or plant-specific LRAAIs as well. The responses to the LRAAIs on MRP-227 are provided in Appendix C of the LRA.

The guidance in MRP-227 specifies applicability limitations to base-loaded plants and the fuel loading management assumptions upon which the functionality analyses were based. These limitations and assumptions require a determination of applicability by the applicant for each reactor and are covered in Section 2.4 of MRP-227.

5.1.2 TMI-1 Scope of Program

A description of the TMI-1 RV Internals is provided in Section 2.4 of this report. Additional RV Internals details are provided in the TMI-1 UFSAR.

The TMI-1 RV Internals Program includes the components identified in MRP-227-A for B&W-designed RV Internals applicable to TMI-1.

The TMI-1 RV Internals Program includes responses to the applicant/licensee action items in the MRP-227-A SER (see Appendix D to this document). Those responses are in this inspection plan rather than in the TMI-1 LRA, because the NRC SER for MRP-227, Rev. 0 was not available when the TMI-1 LRA was written.

The scope of the TMI-1 RV Internals Program includes those components identified in the results of the TMI-1 LRA AMR. Appendix E compares the results of the TMI-1 LRA AMR with the results of the industry activity for all TMI-1 components in scope for license renewal.

The limitations and assumptions in MRP-227-A, as well as in the FMECA (MRP-190) and functionality analysis (MRP-229), are applicable to TMI-1, and are discussed in detail in Section 4.2.2.1 of this report.

5.1.3 Conclusion

The scope of the TMI-1 RV Internals Program is consistent with the scope of NUREG-1801 program XI.M16A.

5.2 AMP Element 2 – Preventative Actions

5.2.1 NUREG-1801, XI.M16A Preventive Actions

The guidance in MRP-227 relies on PWR water chemistry control to prevent or mitigate aging effects that can be induced by corrosive aging mechanisms (e.g., loss of material induced by general, pitting corrosion, crevice corrosion, or stress corrosion cracking or any of its forms [SCC, PWSCC, or IASCC]). Reactor coolant water chemistry is monitored and maintained in accordance with the Water Chemistry Program. The program description, evaluation, and technical basis of water chemistry are presented in GALL AMP XI.M2, "Water Chemistry."

5.2.2 TMI-1 Preventive Actions

The TMI-1 RV Internals AMP credits the Reactor Coolant Chemistry Program for maintaining high water purity (See Section 4.1.2 of this report).

Additionally, TMI-1 has implemented low-leakage core loading patterns as a preventative action (See Section 4.2.2.1 of this report).

5.2.3 Conclusion

The preventative actions for the TMI-1 RV Internals AMP are consistent with the preventive actions in NUREG-1801 program XI.M16A.

5.3 AMP Element 3 – Parameters Monitored/Inspected

5.3.1 NUREG-1801, XI.M16A Parameters Monitored/Inspected

The program manages the following age-related degradation effects and mechanisms that are applicable in general to the RVI components at the facility: (a) cracking induced by SCC, PWSCC, IASCC, or fatigue/cyclical loading; (b) loss of material induced by wear; (c) loss of fracture toughness induced by either thermal aging or neutron irradiation embrittlement; (d) changes in dimension due to void swelling and irradiation growth, distortion, or deflection; and (e) loss of preload caused by thermal and irradiation-enhanced stress relaxation or creep. For the management of cracking, the program monitors for evidence of surface breaking linear discontinuities if a visual inspection technique is used as the non-destruction examination (NDE) method, or for relevant flaw presentation signals if a volumetric UT method is used as the NDE method. For the management of loss of material, the program monitors for gross or abnormal surface conditions that may be indicative of loss of

material occurring in the components. For the management of loss of preload, the program monitors for gross surface conditions that may be indicative of loosening in applicable bolted, fastened, keyed, or pinned connections. The program does not directly monitor for loss of fracture toughness that is induced by thermal aging or neutron irradiation embrittlement, or by void swelling and irradiation growth; instead, the impact of loss of fracture toughness on component integrity is indirectly managed by using visual or volumetric examination techniques to monitor for cracking in the components and by applying applicable reduced fracture toughness properties in the flaw evaluations if cracking is detected in the components and is extensive enough to warrant a supplemental flaw growth or flaw tolerance evaluation under the MRP-227 guidance or ASME Code, Section XI requirements. The program uses physical measurements to monitor for any dimensional changes due to void swelling, irradiation growth, distortion, or deflection.

Specifically, the program implements the parameters monitored/inspected criteria for B&W designed Primary Components in Table 4-1 of MRP-227. Additionally, the program implements the parameters monitored/inspected criteria for B&W designed Expansion Components in Table 4-4 of MRP-227. The parameters monitored/inspected for Existing Program Components follow the bases for referenced Existing Programs, such as the requirements for ASME Code Class RVI components in ASME Code, Section XI, Table IWB-2500-1, Examination Categories B-N-3, as implemented through the applicant's ASME Code, Section XI program, or the recommended program for inspecting Westinghouse-designed flux thimble tubes in GALL AMP XI.M37, "Flux Thimble Tube Inspection." No inspections, except for those specified in ASME Code, Section XI, are required for components that are identified as requiring "No Additional Measures," in accordance with the analyses reported in MRP-227.

5.3.2 TMI-1 Parameters Monitored/Inspected

The TMI-1 RV Internals Inspection Plan monitors for the detectable effects of the eight aging degradation mechanisms outlined in Section 2.3 of this report. The TMI-1 RV Internals AMP credits, and further augments, the ASME Section XI Inservice Inspection Program with the examinations in MRP 227-A, Tables 4-1 and 4-4 as applicable to TMI-1. See Appendices A and B of this report.

The TMI-1 RV Internals Inspection Plan uses Ultrasonic Testing (UT), Visual Examination (VT-3), and physical measurement to monitor for the detectable effects of the eight degradation mechanisms outlined in Section 2.3 of this report.

5.3.3 Conclusion

The parameters monitored/inspected in the TMI-1 RV Internals AMP are consistent with the parameters monitored/inspected in the NUREG-1801 program XI.M16A.

5.4 AMP Element 4 – Detection of Aging Effects

5.4.1 NUREG-1801, XI.M16A Detection of Aging Effects

The detection of aging effects is covered in two places: (a) the guidance in Section 4 of MRP-227 provides an introductory discussion and justification of the examination methods selected for detecting the aging effects of interest; and (b) standards for examination methods, procedures, and personnel are provided in a companion document, MRP-228. In all cases, well-established methods were selected. These methods include volumetric UT examination methods for detecting flaws in bolting, physical measurements for detecting changes in dimension, and various visual (VT-3, VT-1, and EVT-1) examinations for detecting effects ranging from general conditions to detection and sizing of surface-breaking discontinuities. Surface examinations may also be used as an alternative to visual examinations for detection and sizing of surface-breaking discontinuities.

Cracking caused by SCC, IASCC, and fatigue is monitored/inspected by either VT-1 or EVT-1 examination (for internals other than bolting) or by volumetric UT examination (bolting). The VT-3 visual methods may be applied for the detection of cracking only when the flaw tolerance of the component or affected assembly, as evaluated for reduced fracture toughness properties, is known and has been shown to be tolerant of easily detected large flaws, even under reduced fracture toughness conditions. In addition, VT-3 examinations are used to monitor/inspect for loss of material induced by wear and for general aging conditions, such as gross distortion caused by void

swelling and irradiation growth or by gross effects of loss of preload caused by thermal and irradiation-enhanced stress relaxation and creep.

In addition, the program adopts the recommended guidance in MRP-227 for defining the Expansion criteria that need to be applied to inspections of Primary Components and Existing Requirement Components and for expanding the examinations to include additional Expansion Components. As a result, inspections performed on the RVI components are performed consistent with the inspection frequency and sampling bases for Primary Components, Existing Requirement Components, and Expansion Components in MRP-227, which have been demonstrated to be in conformance with the inspection criteria, sampling basis criteria, and sample Expansion criteria in Section A.1.2.3.4 of NRC Branch Position RLSB-1.

Specifically, the program implements the parameters monitored/inspected criteria and bases for inspecting the relevant parameter conditions for B&W designed Primary Components in Table 4-1 of MRP-227; and for B&W designed Expansion Components in Table 4-4 of MRP-227.

The program is supplemented by the following plant-specific Primary Component and Expansion Component inspections for the program (as applicable): For TMI-1, the reactor vessel internals vent valve locking devices will be evaluated as possible plant-specific RV Internals components to be inspected.

In addition, in some cases (as defined in MRP-227), physical measurements are used as supplemental techniques to manage for the gross effects of wear, loss of preload due to stress relaxation, or for changes in dimension due to void swelling, deflection or distortion. The physical measurements methods applied in accordance with this program include the physical measurements needed for the B&W RV internals core clamping items already identified in MRP-227-A, Table 4-1.

5.4.2 TMI-1 Detection of Aging Effects

The methods for detection of aging effects in the TMI-1 RV Internals Inspection Plan include UT examination methods for detecting flaws in bolting, physical measurements for detecting changes in dimension, and visual (VT-3) examinations.

Visual (VT-3) examinations are conducted to determine the general mechanical and structural condition of components by detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion; and by identifying conditions that could affect operational or functional adequacy of components. In accordance with Tables 4-1 and 4-4 of MRP-227-A, VT-3 is scheduled to be used to detect cracking and other aging effects in various components. VT-3 examinations will be used to detect cracking only after evaluation of the flaw tolerance of the component or affected assembly, under reduced fracture toughness conditions, has been shown to be tolerant of easily detected flaws.

The TMI-1 Reactor Vessel Internals Aging Management Program requires inspections of the "Expansion" components in MRP-227-A in accordance with the expansion criteria in MRP-227-A.

Applicant/licensee action item #2 requires each licensee to identify whether additional RV Internals components need to be inspected based upon review of the licensee's License Renewal Application. As summarized in Appendix D, Table D-2 of this report and tabulated in Appendix E of this report, the vent valve locking devices were the only additional components in the TMI-1 LRA that were not included in the RV Internals industry program.

The one-time physical measurements needed for the B&W RV Internals core clamping items has already been completed at TMI-1 and are discussed in Section 4.1.7.3.

5.4.3 Conclusion

The detection of aging effects in the TMI-1 RV Internals AMP is consistent with the detection of aging effects in NUREG-1801 program XI.M16A.

5.5 AMP Element 5 – Monitoring and Trending

5.5.1 NUREG-1801, XI.M16A Monitoring and Trending

The methods for monitoring, recording, evaluating, and trending the data that result from the program's inspections are given in Section 6 of MRP-227 and its subsections. The evaluation methods include recommendations for flaw depth sizing and for crack growth determinations as well for performing applicable limit load, linear elastic and elastic-plastic fracture analyses of relevant flaw indications. The examinations and re-examinations required by the MRP-227 guidance, together with the requirements specified in MRP-228 for inspection methodologies, inspection procedures, and inspection personnel, provide timely detection, reporting, and corrective actions with respect to the effects of the age-related degradation mechanisms within the scope of the program. The extent of the examinations, beginning with the sample of susceptible PWR internals component locations identified as Primary Component locations, with the potential for inclusion of Expansion Component locations if the effects are greater than anticipated, plus the continuation of the Existing Programs activities, such as the ASME Code, Section XI, Examination Category B- N-3 examinations for core support structures, provides a high degree of confidence in the total program.

5.5.2 TMI-1 Monitoring and Trending

The TMI-1 RV Internals AMP, including one-time, periodic, and conditional examinations and other aging management methodologies, scheduled in accordance with the ASME B&PV Code, Section XI and MRP-227-A, provide timely detection of aging effects. The TMI-1 program includes both the "Primary" components, and the "Expansion" components identified in MRP-227-A. The "Expansion" components will be inspected as required by the results of the examinations of the "Primary" components.

The TMI-1 RV Internals AMP will follow the reporting requirements in MRP-227-A which allow the industry to monitor and trend results, thus driving preemptive industry action through notifications and updating of the MRP-227-A guidelines.

5.5.3 Conclusion

The monitoring and trending in the TMI-1 RV Internals AMP is consistent with the monitoring and trending in NUREG-1801 program XI.M16A.

5.6 AMP Element 6 – Acceptance Criteria

5.6.1 NUREG-1801, XI.M16A Acceptance Criteria

Section 5 of MRP-227 provides specific examination acceptance criteria for the Primary and Expansion Component examinations. For components addressed by examinations referenced to ASME Code, Section XI, the IWB-3500 acceptance criteria apply. For other components covered by Existing Programs, the examination acceptance criteria are described within the Existing Program reference document. The guidance in MRP-227 contains three types of examination acceptance criteria:

- *For visual examination (and surface examination as an alternative to visual examination), the examination acceptance criterion is the absence of any of the specific, descriptive relevant conditions; in addition, there are requirements to record and disposition surface breaking indications that are detected and sized for length by VT-1/EVT-1 examinations;*
- *For volumetric examination, the examination acceptance criterion is the capability for reliable detection of indications in bolting, as demonstrated in the examination Technical Justification; in addition, there are requirements for system-level assessment of bolted or pinned assemblies with unacceptable volumetric (UT) examination indications that exceed specified limits; and*
- *For physical measurements, the examination acceptance criterion for the acceptable tolerance in the measured differential height from the top of the plenum rib pads to the vessel seating surface in B&W plants are given in Table 5-1 of MRP-227.*

5.6.2 TMI-1 Acceptance Criteria

The TMI-1 RV Internals AMP uses the examination acceptance criteria in Section 5 of MRP-227-A for the "Primary" and "Expansion" components. This includes examination acceptance criteria for visual examinations, volumetric examinations (as demonstrated in the examination Technical Justification), and physical measurements, as well as Criteria for expanding the examinations from the "Primary" components to include the "Expansion" components. TMI-1 NDE examination techniques will be qualified to the extent required by MRP-227-A and MRP-228. Component degradation that exceeds the examination acceptance criteria will be evaluated per MRP-227-A, but will also be evaluated considering the supplemental guidance in WCAP-17096, including any additional guidance resulting from the ongoing NRC review of that document.

Relevant conditions requiring corrective action for ASME B&PV Code Section XI Category B-N-3 VT-3 examinations of RV Internals components are detailed in ASME B&PV Code Section XI, IWB-3000.

5.6.3 Conclusion

Acceptance criteria for the TMI-1 RV Internals AMP are consistent with the acceptance criteria in NUREG-1801 program XI.M16A.

5.7 AMP Element 7 – Corrective Actions

5.7.1 NUREG-1801 XI.M16A Corrective Actions

Corrective actions following the detection of unacceptable conditions are fundamentally provided for in each plant's corrective action program. Any detected conditions that do not satisfy the examination acceptance criteria are required to be dispositioned through the plant corrective action program, which may require repair, replacement, or analytical evaluation for continued service until the next inspection. The disposition will ensure that design basis functions of the reactor internals components will continue to be fulfilled for all licensing basis loads and events. Examples of methodologies that can be used to analytically disposition unacceptable conditions are found in the ASME Code, Section XI or in Section 6 of MRP-227. Section 6 of MRP-227 describes the options that are available for disposition of detected conditions that exceed the examination acceptance criteria of Section 5 of the report. These include engineering evaluation methods, as well as supplementary examinations to further characterize the detected condition, or the alternative of component repair and replacement procedures. The latter are subject to the requirements of the ASME Code, Section XI. The implementation of the guidance in MRP-227, plus the implementation of any ASME Code requirements, provides an acceptable level of aging management of safety-related components addressed in accordance with the corrective actions of 10 CFR Part 50, Appendix B or its equivalent, as applicable.

Other alternative corrective action bases may be used to disposition relevant conditions if they have been previously approved or endorsed by the NRC. Examples of previously NRC-endorsed alternative corrective actions bases include those corrective actions bases for B&W-designed RVI components in B&W Report No. BAW-2248. B&W Report No. BAW-2248 was endorsed for use in an SE to Framatome Technologies on behalf of the B&W Owners Group, dated December 9, 1999. Alternative corrective action bases not approved or endorsed by the NRC will be submitted for NRC approval prior to their implementation.

5.7.2 TMI-1 Corrective Actions

In accordance with 10 CFR 50, Appendix B, Exelon has established a CAP for TMI-1. The CAP at TMI-1 is implemented through the Exelon CAP Procedure. The purpose of the CAP is to promote continuous improvement through organizational learning and provide direction on the resolution and documentation of undesirable conditions. The CAP procedure encompasses investigation, corrective action determination, investigation report review and approval, action tracking, and issue analysis. TMI-1 will evaluate any RV Internals examination that fails to meet established acceptance criteria via the CAP.

5.7.3 Conclusion

Exelon's corrective actions are consistent with the corrective actions in NUREG-1801 program XI.M16A.

5.8 AMP Element 8 – Confirmation Process

5.8.1 NUREG-1801, XI.M16A Confirmation Process

Site quality assurance procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B, or their equivalent, as applicable. It is expected that the implementation of the guidance in MRP-227 will provide an acceptable level of quality for inspection, flaw evaluation, and other elements of aging management of the PWR internals that are addressed in accordance with the 10 CFR Part 50, Appendix B, or their equivalent (as applicable), confirmation process, and administrative controls.

5.8.2 TMI-1 Confirmation Process

Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. Effectiveness reviews are performed after implementation of the final corrective action to prevent recurrence or action; the reviews are performed after sufficient time has elapsed to challenge the corrective action to prevent recurrence or action. The effectiveness reviews are performed to determine whether the associated corrective action or corrective action to prevent recurrence or other actions have eliminated the cause or reduced the recurrence to an acceptable level.

5.8.3 Conclusion

Exelon's confirmation process is consistent with the confirmation process in NUREG-1801 program XI.M16A.

5.9 AMP Element 9 – Administrative Controls

5.9.1 NUREG-1801 XI.M16A Administrative Controls

The administrative controls for such programs, including their implementing procedures and review and approval processes, are under existing site 10 CFR 50 Appendix B Quality Assurance Programs, or their equivalent, as applicable. Such a program is thus expected to be established with a sufficient level of documentation and administrative controls to ensure effective long-term implementation.

5.9.2 TMI-1 Administrative Controls

Administrative controls, including Exelon-specific and TMI-1-specific documents used to implement this TMI-1 RV Internals Inspection Plan, provide for a formal review and approval process. The Exelon Quality Assurance (QA) Topical Report (QATR) provides administrative controls for the review and approval process for TMI-1. The QATR is based on 10 CFR 50, Appendix B.

5.9.3 Conclusion

Exelon's administrative controls are consistent with the administrative controls in NUREG-1801 program XI.M16A.

5.10 AMP Element 10 – Operating Experience

5.10.1 NUREG-1801 XI.M16A Operating Experience

Relatively few incidents of PWR internals aging degradation have been reported in operating U.S. commercial PWR plants. A summary of observations to date is provided in Appendix A of MRP-227-A. The applicant is expected to review subsequent operating experience for impact on its program or to participate in industry initiatives that perform this function.

The application of the MRP-227 guidance will establish a considerable amount of operating experience over the next few years. Section 7 of MRP-227 describes the reporting requirements for these applications, and the plan for evaluating the accumulated additional operating experience.

5.10.2 TMI-1 Operating Experience

Relatively few incidents of PWR internals aging degradation have been reported in operating U.S. commercial PWR plants. In B&W units, the only incidents have been in the baffle-to-baffle bolts, RV Internals high-strength bolting, and locking devices for the vent valve jackscrews. This operating experience (OE) was considered in the development of the MRP-227-A examination requirements.

The Exelon Operating Experience Program provides direction for the receipt, screening, processing, evaluation, implementation, and distribution of OE information to prevent or mitigate the consequences of similar events reported by both external and internal sources. The TMI-1 Reactor Internals AMP will report findings in accordance with Section 7 of MRP-227-A.

5.10.3 Conclusion

TMI-1's OE is consistent with the OE in NUREG-1801 program XI.M16A.

6.0 SUMMARY AND CONCLUSIONS

This report documents and provides a description of the TMI-1 RV Internals Inspection Plan and how it relates to the AMP at TMI-1 for the management of aging effects consistent with previous commitments. This TMI-1 RV Internals Inspection Plan is based on MRP-227-A, as applicable to TMI-1. Section 5.0 of this report demonstrates the TMI-1 RV Internals AMP, which includes the TMI-1 RV Internals Inspection Plan, is consistent with the ten program elements of NUREG-1801, Revision 2 AMP XI.M16A.

This TMI-1 RV Internals Inspection Plan contains a discussion of the background of the B&W-designed plant RV Internals programs, including operational experience, TLAAs, and TMI-1 programs and activities.

The next removal of the RV Internals from the TMI-1 RV is scheduled during the 2015 RFO. The appropriate examinations required by ASME B&PV Code Section XI, and the remainder of the initial examinations required by MRP-227-A are scheduled to be performed at that time. Any relevant conditions will be documented and dispositioned in Exelon's CAP and reported to the industry.

The TMI-1 RV Internals AMP will include this TMI-1 RV Internals Inspection Plan and will manage the effects of aging for RV Internals components. This plan provides reasonable assurance that the RV Internals components will remain functional through the TMI-1 LR period of extended operation.

Appendix D to this RV Internals Inspection Plan provides the Exelon responses to the Topical Report Conditions and Applicant/Licensee Action Items found in the NRC SER for MRP-227.

Appendix E of this report provides a comparison of the TMI-1 LRA AMR and the results of the industry activity that lead up to the development of MRP-227-A.

7.0 REFERENCES

1 Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A). EPRI, Palo Alto, CA: 2011. 1022863.

2 NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," Dated December, 2010.

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4 Issuance of Renewed Facility Operating License No. DPR 50 for Three Mile Island, Unit 1, October 22, 2009 (Accession No. ML092710401)

5 U. S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of Three Mile Island Nuclear Station, Unit 1," NUREG-1928, October 31, 2009 (Accession Nos. ML092950449 and ML092950450)

6 Three Mile Island Nuclear Station, Unit 1, License Renewal Application, January 8, 2008 (Accession No. ML080220219)

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11 Letter from Robert A Nelson (NRC) to Niel Wilmshurst (EPRI), "Revision 1 to the Final Safety Evaluation of Electric Power Research Institute (EPRI) Report, Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, "Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines" (TAC NO. ME0680)," December 16, 2011, NRC Accession No. ML11308A770

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14 Letter from Peter J. Bamford, US NRC, to Michael J. Pacilio, "Three Mile Island Nuclear Station, Unit 1 (TMI-1) – Correction Letter Regarding Request to extend the Inservice Inspection Interval for Reactor Vessel Internal Examinations, RR-09-02 (TAC No. M2484)," November 5, 2010, NRC Accession No. ML102950612

15 American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Rules for In-Service Inspection of Nuclear Power Plant Components, American Society of Mechanical Engineers, New York, NY

16 Materials Reliability Program: Screening, Categorization, and Ranking of B&W-Designed PWR Internals Component Items (MRP-189-Rev. 1). EPRI, Palo Alto, CA: 2009. 1018292.

17 Materials Reliability Program: Aging Management Strategies for B&W PWR Internals (MRP-231-Rev. 2). EPRI, Palo Alto, CA: 2010. 1021028.

18 American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NG, "Core Support Structures," 1998 Edition through 2000 Addenda

19 Nuclear Energy Institute, "Guideline for the Management of Materials Issues," NEI 03-08, Revision 2, January 2010, (NRC Accession No. ML102880028)

20 Materials Reliability Program: Inspection Standard for PWR Internals (MRP-228). EPRI, Palo Alto, CA: 2009. 1016609.

21 Materials Reliability Program: Failure Modes, Effects, and Criticality Analysis of B&W-Designed PWR Internals (MRP-190). EPRI, Palo Alto, CA: 2006. 1013233.

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APPENDIX A: TMI-1 PRIMARY COMPONENTS

Appendix A contains selected columns from Table 4-1, "B&W Plants Primary Components" from MRP-227-A modified to be TMI-1 unit-specific. Items not applicable to TMI-1 are not included in this Appendix.

Table A-1, TMI-1 Primary Components (based on Table 4-1 from MRP-227-A)

Item	Effect (Mechanism)	Expansion Link (Note 2)	Examination Method/Frequency (Note 2)	Examination Coverage
Plenum Cover Assembly & Core Support Shield Assembly Plenum cover weldment rib pads Plenum cover support flange CSS top flange	Loss of material and associated loss of core clamping pre-load (Wear)	None	One-time physical measurement no later than two refueling outages from the beginning of the license renewal period. Perform subsequent visual (VT-3) examination on the 10-year ISI interval.	Determination of differential height of top of plenum rib pads to reactor vessel seating surface, with plenum in reactor vessel. See Figure 4-1 of MRP-227-A.
Control Rod Guide Tube Assembly CRGT spacer casting	Cracking (TE), including the detection of fractured spacers or missing screws	None	Visual (VT-3) examination during the next 10-year ISI. Subsequent examination on the 10-year ISI interval.	Accessible surfaces at each of the 4 screw locations (at every 90°) of 100% of the CRGT spacer castings (limited accessibility) See Figure 4-5 of MRP-227-A.
Core Support Shield Assembly CSS vent valve top retaining ring CSS vent valve bottom retaining ring (Note 1)	Cracking (TE), including the detection of surface irregularities, such as damaged, fractured material, or missing items	None	Visual (VT-3) examination during the next 10-year ISI. Subsequent examinations on the 10-year ISI interval.	100% of accessible surfaces. See Page 4-3 and Table 4-1 of BAW-2248A. See Figure 4-11 of MRP-227-A.

Item	Effect (Mechanism)	Expansion Link (Note 2)	Examination Method/Frequency (Note 2)	Examination Coverage
Core Support Shield Assembly Upper core barrel (UCB) bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged, distorted or missing locking devices (Wear or Fatigue damage by failed bolts).	UTS bolts and LTS bolts and their locking devices Lower grid shock pad bolts and their locking devices	Volumetric examination (UT) of the bolts within two refueling outages from 1/1/2006 or next 10-year ISI interval, whichever is first. Subsequent examination on the 10-year ISI interval unless an evaluation of the baseline results submitted for NRC staff approval justifies a longer interval between examinations. Visual (VT-3) examination of bolt locking devices on the 10-year ISI interval.	100% of accessible bolts and their locking devices (Note 3) See Figure 4-7 of MRP-227-A.
Core Barrel Assembly Lower core barrel (LCB) bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged, distorted, or missing locking devices (Wear or Fatigue damage by failed bolts)	UTS bolts and LTS bolts and their locking devices Lower grid shock pad bolts and their locking devices	Volumetric examination (UT) of the bolts during the next 10-year ISI interval from 1/1/2006. Subsequent examination on the 10-year ISI interval unless an evaluation of the baseline results submitted for NRC staff approval justifies a longer interval between examinations. Visual (VT-3) examination of bolt locking devices on the 10-year ISI interval.	100% of accessible bolts and their locking devices (Note 3). See Figure 4-8 of MRP-227-A.
Core Barrel Assembly Baffle-to-former bolts	Cracking (IASCC, IE, Overload) (Note 4)	Baffle-to-baffle bolts, Core barrel-to-former bolts	Baseline volumetric examination (UT) no later than two refueling outages from the beginning of the license renewal period with subsequent examination after 10 additional years.	100% of accessible bolts (Note 3). See Figure 4-2 of MRP-227-A.
Core Barrel Assembly Baffle plates	Cracking (IE), including the detection of readily detectable cracking in the baffle plates	Core barrel cylinder (including vertical and circumferential seam welds) Former plates	Visual (VT-3) examination during the next 10-year ISI. Subsequent examinations on the 10-year ISI interval.	100% of the accessible surface within 1 inch around each flow and bolt hole. See Figure 4-2 of MRP-227-A.

Item	Effect (Mechanism)	Expansion Link (Note 2)	Examination Method/Frequency (Note 2)	Examination Coverage
Core Barrel Assembly Locking devices, including locking welds, of baffle-to-former bolts and internal baffle-to-baffle bolts	Cracking (IASCC, IE, Overload), including the detection of missing, non-functional, or removed locking devices or welds	Locking devices, including locking welds, for the external baffle-to-baffle bolts and Core barrel-to-former bolts	Visual (VT-3) examination during the next 10-year ISI. Subsequent examinations on the 10-year ISI interval.	100% of accessible baffle-to-former and internal baffle-to-baffle bolt locking devices (Note 3). See Figure 4-2 of MRP-227-A.
Flow Distributor Assembly Flow distributor (FD) bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged or distorted or missing locking devices (Wear or Fatigue damage by failed bolts).	UTS bolts and LTS bolts and their locking devices. Lower grid shock pad bolts and their locking devices	Volumetric examination (UT) of the bolts during the next 10-year ISI interval from 1/1/2006. Subsequent examination on the 10-year ISI interval unless an evaluation of the baseline results, submitted for NRC staff approval, justifies a longer interval between examinations. Visual (VT-3) examination of bolt locking devices on the 10-year ISI interval.	100% of accessible bolts and their locking devices (Note 3). See Figure 4-8 of MRP-227-A.
Lower Grid Assembly Alloy X-750 dowel-to-guide block welds	Cracking (SCC), including the detection of separated or missing locking welds, or missing dowels	Alloy X-750 dowel locking welds to the upper and lower fuel assembly support pads	Initial visual (VT-3) examination no later than two refueling outages from the beginning of the license renewal period. Subsequent examination on the 10-year ISI interval.	Accessible surfaces of 100% of the 24 dowel-to-guide block welds. See Figure 4-4 of MRP-227-A.
Incore Monitoring Instrumentation (IMI) Guide Tube Assembly IMI guide tube spiders IMI guide tube spider-to-lower grid rib section welds	Cracking (TE/IE), including the detection of fractured or missing spider arms or, Cracking (IE), including separation of spider arms from the lower grid rib section at the weld	Lower grid fuel assembly support pad items: pad, pad-to-rib section welds, Alloy X-750 dowel, cap screw, and their locking welds (Note: the pads, dowels, and cap screws are included because of IE of the welds)	Initial visual (VT-3) examination no later than two refueling outages from the beginning of the license renewal period. Subsequent examinations on 10-year ISI interval.	100% of top surfaces of 52 spider castings and welds to the adjacent lower grid rib section. See Figures 4-3 and 4-6 of MRP-227-A.

Notes:

1. A verification of the operation of each vent valve shall also be performed through manual actuation of the valve. Verify that the valves are not stuck in the open position and that no abnormal degradation has occurred. Examine the valves for evidence of scratches, pitting, embedded particles, leakage of the seating surfaces, cracking of lock welds and locking cups, jack screws for proper position, and wear. The frequency is defined in TMI-1's technical specifications.

2. Examination acceptance criteria and expansion criteria are in Appendix C of this report.
3. A minimum of 75% of the total population (examined + unexamined), including coverage consistent with the Expansion criteria in Appendix C, must be examined for inspection credit.
4. The primary aging degradation mechanisms for loss of joint tightness for this item are IC and ISR. Fatigue and Wear, which can also lead to cracking, are secondary aging degradation mechanisms after significant stress relaxation and loss of preload has occurred due to IC/ISR. Bolt stress relaxation cannot readily be inspected by NDE. Only bolt cracking is inspected by UT inspection. The effect of loss of joint tightness on the functionality will be addressed by analysis of the core barrel assembly, which will be performed to address Applicant/Licensee Action Item #6 of the NRC Safety Evaluation for MRP-227 (See Appendix D of this report).

APPENDIX B: TMI-1 EXPANSION COMPONENTS

Appendix B contains selected columns from Table 4-4, "B&W Plants Expansion Components" from MRP-227-A, modified to be TMI-1 unit-specific. Items not applicable to TMI-1 are not included in this Appendix.

Table B-1, TMI-1 Expansion Components (based on Table 4-4 from MRP-227-A)

Item	Effect (Mechanism)	Primary Link (Note 1)	Examination Method/Frequency (Note 1)	Examination Coverage
Upper Grid Assembly Alloy X-750 dowel-to-upper grid fuel assembly support pad welds	Cracking (SCC) including the detection of separated or missing locking welds, or missing dowels	Alloy X-750 dowel-to-guide block welds	Visual (VT-3) examination. Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	Accessible surfaces of 100% of dowel locking welds. See Figure 4-6 of MRP-227-A, (i.e., these are similar to the lower grid fuel assembly support pads).
Core Barrel Assembly Upper thermal shield (UTS) bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged, distorted or missing locking devices (Wear or Fatigue damage by failed bolts).	UCB, LCB or FD bolts and their locking devices	Bolt: Volumetric examination (UT) Locking Devices: Visual (VT-3) examination Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	100% of accessible bolts and their locking devices (Note 2) See Figure 4-7 of MRP-227-A.
Core Barrel Assembly Core barrel cylinder (including vertical and circumferential seam welds) Former plates	Cracking (IE) including readily detectable cracking	Baffle plates	No examination requirements. Justify by evaluation or by replacement	Inaccessible See Figure 4-2 of MRP-227-A.
Core Barrel Assembly Baffle-to-baffle bolts Core barrel-to-former bolts	Cracking (IASCC, IE, Overload) (Note 3)	Baffle-to-former bolts	Internal baffle-to-baffle bolts: No examination requirements, Justify by evaluation or by replacement	An acceptable examination technique currently not available See Figure 4-2 of MRP-227-A.

Item	Effect (Mechanism)	Primary Link (Note 1)	Examination Method/Frequency (Note 1)	Examination Coverage
			External baffle-to-baffle bolts, core barrel-to-former bolts: No examination requirements, Justify by evaluation or by replacement	Inaccessible See Figure 4-2 of MRP-227-A.
Core Barrel Assembly Locking devices, including locking welds, for the external baffle-to-baffle bolts and core barrel-to-former bolts	Cracking (IASCC, IE)	Locking devices, including locking welds, of baffle-to-former bolts or internal baffle-to-baffle bolts	No examination requirements. Justify by evaluation or by replacement	Inaccessible See Figure 4-2 of MRP-227-A.
Lower Grid Assembly Lower grid fuel assembly support pad items: pad, pad-to-rib sections welds, Alloy X-750 dowel, cap screw, and their locking welds (Note: the pads, dowels, and cap screws are included because of IE of the welds)	Cracking (IE), including the detection of separated or missing welds, missing support pads, dowels, cap screws and locking welds, or misalignment or the support pads	IMI guide tube spiders and spider-to-lower grid rib section welds	Visual (VT-3) examination Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	Accessible surfaces of the pads, dowels, and cap screws and associated welds in 100% of the lower grid fuel assembly support pads. See Figure 4-6 of MRP-227-A.
Lower Grid Assembly Alloy X-750 dowel-to-lower grid fuel assembly support pad welds	Cracking (SCC), including the detection of separated or missing locking welds, or missing dowels	Alloy X-750 dowel-to-guide block welds	Visual (VT-3) examination Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	Accessible surfaces of 100% of the support pad dowel locking welds. See Figure 4-6 of MRP-227-A.

Item	Effect (Mechanism)	Primary Link (Note 1)	Examination Method/Frequency (Note 1)	Examination Coverage
Lower Grid Assembly Lower grid shock pad bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged, distorted or missing locking devices (Wear or Fatigue damage by failed bolts).	UCB, LCB or FD bolts and their locking devices	Bolt: Volumetric examination (UT) Locking Devices: Visual (VT-3) examination Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	100% of accessible bolts and their locking devices (Note 2) See Figure 4-4 of MRP-227-A.
Lower Grid Assembly Lower thermal shield (LTS) bolts and their locking devices	Bolts: Cracking (SCC) Locking Devices: Loss of material, damaged, distorted or missing locking devices (Wear or Fatigue damage by failed bolts).	UCB, LCB or FD bolts and their locking devices	Bolt: Volumetric examination (UT) Locking Devices: Visual (VT-3) examination Subsequent examinations on the 10-year ISI interval unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	100% of accessible bolts and their locking devices (Note 2) Figure 4-8 of MRP-227-A

Notes:

1. Examination acceptance criteria and expansion criteria are in Appendix C of this report.
2. A minimum of 75% of the total population (examined + unexamined) must be examined for inspection credit.
3. The primary aging degradation mechanisms for loss of joint tightness for these items are IC and ISR. Fatigue and Wear, which can also lead to cracking, are secondary aging degradation mechanisms after significant stress relaxation and loss of preload has occurred due to IC/ISR. Bolt stress relaxation cannot readily be inspected by NDE. Only bolt cracking could be inspected by UT inspection if it were possible for these bolts. Therefore, the effects of loss of joint tightness and/or cracking on the functionality of these bolts relative to the entire core barrel assembly will be addressed by analysis of the core barrel assembly, which will be performed to address Applicant/Licensee Action Item #6 of the NRC Safety Evaluation for MRP-227 (See Appendix D of this report).

APPENDIX C: TMI-1 EXAMINATION ACCEPTANCE AND EXPANSION CRITERIA

Appendix C contains selected columns from Table 5-1, "B&W Plants Examination Acceptance and Expansion Criteria" from MRP-227-A. Items not applicable to TMI-1 are not included in this Appendix.

Table C-1, TMI-1 Examination Acceptance and Expansion Criteria (based on Table 5-1 from MRP-227-A)

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Plenum Cover Assembly & Core Support Shield Assembly Plenum cover weldment rib pads Plenum cover support flange CSS top flange	One-time physical measurement. In addition, a visual (VT-3) examination is conducted for these items. The measured differential height from the top of the plenum rib pads to the vessel seating surface shall average less than 0.004 inches compared to the as-built condition. The specific relevant condition for these items is wear that may lead to a loss of function.	None	N/A	N/A
Control Rod Guide Tube Assembly CRGT spacer castings	The specific relevant condition for the VT-3 of the CRGT spacer castings is evidence of fractured spacers or missing screws.	None	N/A	N/A
Core Support Shield Assembly CSS vent valve top retaining ring CSS vent valve bottom retaining ring	Visual (VT-3) examination. The specific relevant condition is evidence of damaged or fractured retaining ring material, and missing items.	None	N/A	N/A

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Core Support Shield Assembly Upper core barrel (UCB) bolts and their locking devices	1) Volumetric (UT) examination of the UCB bolts. The examination acceptance criteria for the UT of the UCB bolts shall be established as a part of the examination technical justification. 2) Visual (VT-3) examination of the UCB bolt locking devices. The specific relevant condition for the VT-3 of the UCB bolt locking devices is evidence of broken or missing bolt locking devices.	UTS bolts and, LTS bolts and their locking devices Lower grid shock pad bolts and their locking devices	1) Confirmed unacceptable indications exceeding 10% of the UCB bolts shall require that the UT examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolts and 100% of the accessible LTS bolts and, 100% of the accessible lower grid shock pad bolts. 2) Confirmed evidence of relevant conditions exceeding 10% of the UCB bolt locking devices shall require that the VT-3 examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolt locking devices and 100% of the accessible LTS bolt locking devices and 100% of the accessible lower grid shock pad bolt locking devices,	1) The examination acceptance criteria for the UT of the expansion bolting shall be established as part of the examination technical justification. 2) The specific relevant condition for the VT-3 of the expansion locking devices is evidence of broken or missing bolt locking devices.

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Core Barrel Assembly Lower core barrel (LCB) bolts and their locking devices	1) Volumetric (UT) examination of the LCB bolts. The examination acceptance criteria for the UT of the LCB bolts shall be established as part of the examination technical justification. 2) Visual (VT-3) examination of the LCB bolt locking devices. The specific relevant condition for the VT-3 of the LCB bolt locking devices is evidence of broken or missing bolt locking devices.	UTS bolts and LTS bolts and their locking devices Lower grid shock pad bolts and their locking devices	1) Confirmed unacceptable indications exceeding 10% of the LCB bolts shall require that the UT examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolts and 100% of the accessible LTS bolts and 100% of the accessible lower grid shock pad bolts 2) Confirmed evidence of relevant conditions exceeding 10% of the LCB bolt locking devices shall require that the VT-3 examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolt locking devices and 100% of the accessible LTS bolt locking devices and 100% of the accessible lower grid shock pad bolt locking devices.	1) The examination acceptance criteria for the UT of the expansion bolting shall be established as part of the examination technical justification. 2) The specific relevant condition for the VT-3 of the expansion locking devices is evidence of broken or missing bolt locking devices.

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Core Barrel Assembly Baffle-to-former bolts	Baseline volumetric (UT) examination of the baffle-to-former bolts. The examination acceptance criteria for the UT of the baffle-to-former bolts shall be established as part of the examination technical justification.	Baffle-to-baffle bolts, Core barrel-to-former bolts	Confirmed unacceptable indications in greater than or equal to 5% (or 43) of the baffle-to-former bolts, provided that none of the unacceptable bolts are on former elevations 3, 4, and 5, or greater than 25% of the bolts on a single baffle plate, shall require an evaluation of the internal baffle-to-baffle bolts for the purpose of determining whether to examine or replace the internal baffle-to-baffle bolts. The evaluation may include external baffle-to-baffle bolts and core barrel-to-former bolts for the purpose of determining whether to replace them.	N/A
Core Barrel Assembly Baffle plates	Visual (VT-3) examination. The specific relevant condition is readily detectable cracking in the baffle plates.	a. Former plates b. Core barrel cylinder (including vertical and circumferential seam welds)	a and b. Confirmed cracking in multiple (2 or more) locations in the baffle plates shall require expansion, with continued operation of former plates and the core barrel cylinder justified by evaluation or by replacement by the completion of the next refueling outage.	a and b: N/A
Core Barrel Assembly Locking devices, including locking welds, of baffle-to-former bolts and internal baffle-to-baffle bolts	Visual (VT-3) examination. The specific relevant condition is missing, non-functional, or removed locking devices including locking welds.	Locking devices, including locking welds, for the external baffle-to-baffle bolts and core barrel-to-former bolts	Confirmed relevant conditions in greater than or equal to 1% (or 11) of the baffle-to-former or internal baffle-to-baffle bolt locking devices, including locking welds, shall require and evaluation of the external baffle-to-baffle and core barrel-to-former bolt locking devices for the purpose of determining continued operation or replacement.	N/A

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Lower Grid Assembly Alloy X-750 dowel-to-guide block welds	Initial visual (VT-3) examination The specific relevant condition is separated or missing locking weld, or missing dowel.	Alloy X-750 dowel locking welds to the upper and lower grid fuel assembly support pads	Confirmed evidence of relevant conditions at two or more locations shall require that the VT-3 examination be expanded to include the Alloy X-750 dowel locking welds to the upper and lower grid fuel assembly support pads by the completion of the next refueling outage.	The specific relevant condition for the VT-3 of the expansion dowel locking weld is separated or missing locking weld, or missing dowel.
Flow Distributor Assembly Flow distributor (FD) bolts and their locking devices	1) Volumetric (UT) examination of the FD bolts. The examination acceptance criteria for the UT of the FD bolts shall be established as part of the examination technical justification. 2) Visual (VT-3) examination of the FD bolt locking devices. The specific relevant condition for the VT-3 of the FD bolt locking devices is evidence of broken or missing bolt locking devices.	UTS bolts and LTS bolts and their locking devices Lower grid shock pad bolts and their locking devices	1) Confirmed unacceptable indications exceeding 10% of the FD bolts shall require that the UT examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolts and 100% of the accessible LTS bolts and 100% of the accessible lower grid shock pad bolts. 2) Confirmed evidence of relevant conditions exceeding 10% of the FD bolt locking devices shall require that the VT-3 examination be expanded by the completion of the next refueling outage to include: 100% of the accessible UTS bolt locking devices and 100% of the accessible LTS bolt locking devices, and 100% of the accessible lower grid shock pad bolt locking devices.	1) The examination acceptance criteria for the UT of the expansion bolting shall be established as part of the examination technical justification. 2) The specific relevant condition for the VT-3 of the expansion locking devices is evidence of broken or missing bolt locking devices.

Item	Examination Acceptance Criteria (Note 1)	Expansion Link(s)	Expansion Criteria	Additional Examination Acceptance Criteria
Incore Monitoring Instrumentation (IMI) Guide Tube Assembly IMI guide tube spiders IMI guide tube spider-to-lower grid rid section welds	Initial visual (VT-3) examination The specific relevant conditions for the IMI guide tube spiders are fractured or missing spider arms. The specific relevant conditions for the IMI spider-to-lower grid rib section welds are separated or missing welds.	Lower fuel grid assembly support pad items: pad, pad-to-rib section welds, Alloy X-750 dowel, cap screw, and their locking welds	Confirmed evidence of relevant conditions at two or more IMI guide tube spider locations or IMI guide tube spider to lower grid rib section welds shall require that the VT-3 examination be expanded to include lower fuel assembly support pad items by the completion of the next refueling outage.	The specific relevant conditions for the VT-3 of the lower grid fuel assembly support pad items (pads, pad-to-rib section welds, Alloy X-750 dowels, cap screws, and their locking welds) are separated or missing welds, missing support pads, dowels, cap screws and locking welds, or misalignment of the support pads.

Notes:

1. The examination acceptance criterion for visual examination is the absence of the specified relevant condition(s).

APPENDIX D: TMI-1 RESPONSE TO THE TOPICAL REPORT CONDITIONS AND THE APPLICANT/LICENSEE ACTION ITEMS FROM THE NRC SER, REVISION 1, FOR MRP-227, REVISION 0

Topical Report Conditions and Limitations:

These conditions were incorporated into MRP-227-A, which was in turn incorporated into this TMI-1 RV Internals Inspection Plan.

Table D-1, Topical Report Condition/Limitation (from the NRC SER for MRP-227)

Topical Report Condition/Limitation # **SER Section**	**Topical Report Condition/Limitation**	**TMI-1 Response**
1 4.1.1	The examination coverage and re-examination frequency requirements for specific Westinghouse-designed and CE-designed RV Internals components shall be as addressed when publishing MRP-227-A. Tables 4-5, and 4-6 shall be revised accordingly.	This item is not applicable to TMI-1; there are no B&W internals components identified in this condition/limitation, only Westinghouse and CE components.
2 4.1.2	To ensure that the structural integrity and functionality of specific Westinghouse-designed and CE-designed RV Internals components are maintained under all licensing basis conditions during the period of extended operation, the staff has determined that each of these components shall be included in the "Primary" inspection category in the NRC-approved version of MRP-227.	This item is not applicable to TMI-1; there are no B&W internals components identified in this condition/limitation, only Westinghouse and CE components.
3 4.1.3	To ensure that the structural integrity and functionality of these RV Internals components [flow distributor to shell forging bolts] are maintained under transient loading conditions during the period of extended operation, the staff has determined that the subject components shall be included in the "Primary" inspection category in the NRC-approved version of MRP-227. The examination methods shall be consistent with the MRP's recommendations for these components, the examination coverage for the aforementioned components shall conform to the criteria as described in Section 3.3.1 of the SE for MRP-227, and the re-examination frequency shall be on a 10-year interval similar to other "Primary" inspection category components.	MRP-227-A Table 3-1 has been modified to designate the flow distributor bolts as Primary category components. MRP-227-A Table 4-1 (B&W Primary Components) has been modified to include the flow distributor bolts, along with the required examination method and coverage. In addition, the B&W LCB bolts, flow distributor (FD) bolts, and their locking devices were deleted as Expansion Links for the UCB bolts. Note 3, about the "Examination Method/Frequency" column entry for the LCB bolts and FD bolts, has also been deleted. MRP-227-A Table 4-2 is not applicable to TMI-1. MRP-227-A Table 4-4 has been modified to delete the flow distributor bolts. MRP-227-A Table 4-5 is not applicable to

Topical Report Condition/Limitation # SER Section	Topical Report Condition/Limitation	TMI-1 Response
	In addition, in MRP-227 Table 4-1, the MRP included the B&W LCB bolts, flow distributor (FD) bolts, and their locking devices as applicable "Expansion Category" components for B&W upper core barrel (UCB) bolts and their locking devices. Note 3 indicated this expansion was only applicable if the primary inspections of the LCB bolts or FD bolts had not yet been conducted. However, since the LCB and FD bolts are already included as "Primary" inspection category components in MRP-227 Table 4-1, it is inappropriate to include the LCB and FD bolts in the "Expansion Link" column references. Specifically, the staff determined that this note could be interpreted to mean that B&W licensees would not need to perform the primary inspections of the LCB or FD bolts at their next scheduled opportunity because, as "Expansion" components, the inspections of LCB or FD bolts would only be performed if aging was detected from the "Primary" inspections of the UCB bolts. Therefore, the staff requires the MRP to move the reference for Note 3 to the "Examination Method/Frequency" column entry for the LCB bolts and FD bolts in MRP-227 Table 4-1 and should delete the "Expansion Category" reference for the LCB bolts and FD bolts from the "Expansion Link" column of the UCB bolt line item in that table. In Table 4-1 of MRP-227, the MRP identified that the pads, pad-to-rib section welds, and Alloy X-750 dowel cap screws and their locking devices in the lower grid fuel assembly were applicable "Expansion" category components for the Primary inspections that would be performed on the CRGT spacer castings. The relevant mechanism for the spacer castings is thermal embrittlement, while the relevant mechanism for the pads, pad-to-rib section welds, and Alloy X-750 dowel cap screws and their locking devices in the lower grid fuel assembly is	TMI-1.

Topical Report Condition/Limitation # SER Section	Topical Report Condition/Limitation	TMI-1 Response
	irradiation embrittlement. Consistent with SE Sections 3.3.7 and 4.2.7, the CRGT spacer castings are subject to the Applicant/Licensee Action Item No. 7 on the MRP-227 methodology. When publishing the approved version of MRP-227, Tables 3-1, 4-1, 4-2, 4-4, and 4-5 shall be revised accordingly.	
4 4.1.4	As discussed in Section 3.3.1 and Section 3.3.2 of this SE, for "Primary" inspection category components, MRP-227 will require that 100 percent of a "Primary" inspection category component's accessible inspection area or volume be examined and 75 percent of a "Primary" inspection category component's total (accessible + inaccessible) inspection area or volume be examined or, when addressing a set of like components (e.g., bolting), that the inspection examine a minimum sample size of 75 percent of the total population of like components. For the inspection of a set of like components, 100 percent of the accessible volume/area of each accessible like component will be examined. This defines the minimum inspection required to meet the intent of MRP-227 provided that no defects are discovered during the inspection. If defects are discovered during the inspection, the licensee shall enter that information into the plant's corrective action program and evaluate whether the results of the examination ensure that the component (or set of like components) will continue to meet its intended function under all licensing basis conditions of operation until the next scheduled examination. The maximum number of like components possible will be inspected (i.e., if 95 percent of the population is accessible for inspection then 95 percent must be inspected). This condition does not apply to components having a predefined scope of inspection less than 100 percent of accessible components, area, or length. Examples of such	MRP-227-A Table 4-4 (including Note 2), has been modified to include this requirement. MRP-227-A Tables 4-5, and 4-6 are not applicable to TMI-1.

Topical Report Condition/Limitation # SER Section	Topical Report Condition/Limitation	TMI-1 Response
	exceptions include welds for which the inspection requirements call for only a certain length of weld above and below the core mid-plane to be inspected, or components where the inspection addresses a predefined sample portion of the population; for example the inspection requirements for the Westinghouse control rod guide plates (cards) which calls for a 20 percent sample inspection. Another situation where the condition would not apply is a component for which 100 percent of the population or area must be inspected and any lesser percentage of coverage would be unacceptable. This condition also is understood not to apply where there is a known access limitation (generic to all plants of the NSSS type) such that the population of components or the area/volume accessible for inspection is known to be less than 75 percent of the total. As discussed in Section 3.3.2 of this SE, an equivalent requirement shall be imposed for the inspection of components in the MRP-227 "Expansion" inspection category. When the approved version of MRP-227 is published, Tables 4-4, 4-5, and 4-6 shall be updated to include this requirement.	
5 4.1.5	The staff has determined that the NRC-approved version of MRP-227 shall specify a 10-year inspection frequency for these components [baffle-to-former bolts] following the initial or baseline inspection unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections. MRP-227 Tables 4-1, 4-2, and 4-3 shall be modified when the approved version of MRP-227 is published to reflect this change.	MRP-227-A, Table 4-1 was modified to require re-inspection of the baffle-to-former bolts at 10 year intervals. The change was also made in Appendix A to the TMI RV Internals Inspection Plan. MRP-227-A, Tables 4-2 and 4-3 are not applicable to TMI-1.

Topical Report Condition/Limitation # SER Section	Topical Report Condition/Limitation	TMI-1 Response
6 4.1.6	Tables 4-4, 4-5, and 4-6 shall be modified when the approved version of MRP-227 is published to apply a baseline 10-year re examination interval to all "Expansion" inspection category components (once degradation is identified in the associated "Primary" inspection category component and examination of the "Expansion" category component commences) unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections.	MRP-227-A, Table 4-4 was modified to require subsequent examination of expansion components on the 10-year ISI intervals unless an applicant/licensee provides an evaluation for NRC staff approval that justifies a longer interval between inspections. MRP-227-A, Tables 4-5 and 4-6 are not applicable to TMI-1.
7 4.1.7	When the approved version of MRP-227 is published, MRP-227, Appendix A shall be updated to include a reference to AMP XI.M16A in NUREG-1801, Revision 2 (or in subsequent revisions of the GALL report that follow) and the Operating Experience Summary.	MRP-227-A, Appendix A has been updated and now references AMP XI.M16A in NUREG-1801, Revision 2 (or subsequent revisions) for guidance on preparing an aging Management Program. Appendix A of MRP-227-A now contains the Operating Experience Summary.

Table D-2, Applicant/Licensee Action Items (from the NRC SER for MRP-227)

Applicant/Licensee Action Item # **SER Section**	**Applicant/Licensee Action Item**	**TMI-1 Response**
1 4.2.1	Each applicant/licensee is responsible for assessing its plant's design and operating history and demonstrating that the approved version of MRP-227 is applicable to the facility. Each applicant/licensee shall refer, in particular, to the assumptions regarding plant design and operating history made in the FMECA and functionality analyses for reactors of their design (i.e., Westinghouse, CE, or B&W) which support MRP-227 and describe the process used for determining plant-specific differences in the design of their RVI components or plant operating conditions, which result in different component inspection categories. The applicant/licensee shall submit this evaluation for NRC review and approval as part of its application to implement the approved version of MRP-227.	TMI-1 is bounded by the plant design and operating history assumptions in MRP-227-A, the FMECA (MRP-190) and the B&W design functionality analysis (MRP-229) as addressed in Section 4.2.2.1 of this TMI RV Internals Inspection Plan.
2 4.2.2	Each applicant/licensee is responsible for identifying which RVI components are within the scope of LR for its facility. Applicants/licensees shall review the information in Tables 4-1 and 4-2 in MRP-189, Revision 1, and Tables 4-4 and 4-5 in MRP-191 and identify whether these tables contain all of the RV I components that are within the scope of LR for their facilities in accordance with 10 CFR 54.4. If the tables do not identify all the RVI components that are within the scope of LR for its facility, the applicant or licensee shall identify the missing component(s) and propose any necessary modifications to the program defined in MRP-227, as modified by this SE, when submitting its plant-specific AMP. The AMP shall provide assurance that the effects of aging on the missing component(s) will be managed for the period of extended operation.	A review of the TMI-1 License Renewal Project documentation shows that all Reactor Vessel Internals sub-components in the scope of LR were included in LRA Table 3.1.2-3; i.e. no components were screened out during the AMR. Appendix E of this inspection plan provides a listing of components in the TMI-1 LRA Table 3.1.2-3 and where those components are addressed in the MRP-227-A supporting documents (MRP-189 and MRP-231). The only component identified that is not included in the MRP-227-A development is the vent valve locking device. A review of this component using the MRP-227-A development methodology will be performed and will be submitted to the NRC upon completion.

Applicant/Licensee Action Item # SER Section	Applicant/Licensee Action Item	TMI-1 Response
3 4.2.3	Applicants/licensees of CE and Westinghouse are required to perform plant-specific analysis either to justify the acceptability of an applicant's/licensee's existing programs, or to identify changes to the programs that should be implemented to manage the aging of these components for the period of extended operation. The results of this plant-specific analyses and a description of the plant-specific programs being relied on to manage aging of these components shall be submitted as part of the applicant's/licensee's AMP application. The CE and Westinghouse components identified for this type of plant-specific evaluation include: CE thermal shield positioning pins and CE in-core instrumentation thimble tubes (Section 4.3.2 in MRP-227, Revision 0), and Westinghouse guide tube support pins (split pins) (Section 4.3.3 in MRP-227, Revision 0).	This item is not applicable to TMI-1; there are no actions for B&W internals identified in this action item, only Westinghouse and CE internals.
4 4.2.4	B&W applicants/licensees shall confirm that the core support structure upper flange weld was stress relieved during the original fabrication of the RPV in order to confirm the applicability of MRP-227, as approved by the NRC, to their facility. If the upper flange weld has not been stress relieved, then this component shall be inspected as a "Primary" inspection category component. If necessary, the examination methods and frequency for non-stress relieved B&W core support structure upper flange welds shall be consistent with the recommendations in MRP-227, as approved by the NRC, for the Westinghouse and CE upper core support barrel welds. The examination coverage for this B&W flange weld shall conform to the staff's imposed criteria as described in Sections 3.3.1 and 4.3.1 of this SE. The applicant's/licensee's resolution of this plant-specific action item shall be submitted to the NRC for review and approval.	Original fabrication records have confirmed that the TMI-1 CSS upper flange weld was stress relieved (See Section 4.1.5 of this report). The CSS upper flange weld does not need to be inspected as a "Primary" component.

Applicant/Licensee Action Item # SER Section	Applicant/Licensee Action Item	TMI-1 Response
5 4.2.5	As addressed in Section 3.3.5 of this SE, applicants/licensees shall identify plant-specific acceptance criteria to be applied when performing the physical measurements required by the NRC-approved version of MRP-227 for loss of compressibility for Westinghouse hold down springs, and for distortion in the gap between the top and bottom core shroud segments in CE units with core barrel shrouds assembled in two vertical sections. The applicant/licensee shall include its proposed acceptance criteria and an explanation of how the proposed acceptance criteria are consistent with the plants' licensing basis and the need to maintain the functionality of the component being inspected under all licensing basis conditions of operation as part of their submittal to apply the approved version of MRP-227.	This item is not applicable to TMI-1; there are no actions for B&W internals identified in this action item, only Westinghouse and CE internals.
6 4.2.6	Applicants/licensees shall justify the acceptability of these components [B&W core barrel cylinders (including vertical and circumferential seam welds), B&W former plates, B&W external baffle-to-baffle bolts and their locking devices, B&W core barrel-to-former bolts and their locking devices, and B&W core barrel assembly internal baffle-to-baffle bolts] for continued operation through the period of extended operation by performing an evaluation, or by proposing a scheduled replacement of the components. As part of their application to implement MRP-227, applicants/licensees shall provide their justification for the continued operability of each of the inaccessible components and, if necessary, provide their plan for the replacement of the components for NRC review and approval.	Exelon is working with the PWROG to evaluate the acceptability of the subject components for continued service without inspection. The PWROG is currently concentrating analyses tasks for "Primary" components and is defining future analyses to support continued operation of the subject components. By April 19, 2013 Exelon will provide an update of the PWROG progress including a schedule showing when Exelon will submit for NRC review and approval either 1) an analysis of the acceptability of the subject components for continued service without inspection, or 2) a schedule for replacement of the subject components. The submittal schedule is one year prior to entering the Period of Extended Operation and approximately 2½ years prior to the majority of the currently planned TMI-1 MRP-227-A examinations.

Applicant/Licensee Action Item # SER Section	Applicant/Licensee Action Item	TMI-1 Response
7 4.2.7	The applicants/licensees of B&W, CE, and Westinghouse reactors are required to develop plant-specific analyses to be applied for their facilities to demonstrate that B&W IMI guide tube assembly spiders and CRGT spacer castings, CE lower support columns, and Westinghouse lower support column bodies will maintain their functionality during the period of extended operation or for additional RVI components that may be fabricated from CASS, martensitic stainless steel, or precipitation hardened stainless steel materials. These analyses shall also consider the possible loss of fracture toughness in these components due to thermal and irradiation embrittlement, and may also need to consider limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques. The requirement may not apply to components that were previously evaluated as not requiring aging management during development of MRP-227. That is, the requirement would apply to components fabricated from susceptible materials for which an individual licensee has determined aging management is required, for example during their review performed in accordance with Applicant/Licensee Action Item 2. The plant-specific analysis shall be consistent with the plant's licensing basis and the need to maintain the functionality of the components being evaluated under all licensing basis conditions of operation. The applicants/licensees shall include the plant-specific analysis as part of their submittal to apply the approved version of MRP-227.	Exelon will develop either a plant-specific analysis or a PWROG generic analysis that bounds TMI-1, to evaluate the acceptability of the subject components, and any additional RVI components that may be fabricated from CASS, martensitic stainless steel, or precipitation hardened stainless steel materials, for continued service. The analysis will consider the possible loss of fracture toughness in these components due to thermal embrittlement (TE) and/or IE, as well as limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques. By April 19, 2013 Exelon will provide an update including a schedule showing when Exelon will submit for NRC review and approval either 1) analyses of the acceptability of the subject components for the maintenance of functionality during the period of extended operation, or 2) a schedule for replacement of the components. The proposed date of April 19, 2013 is one year prior to the Period of Extended Operation and approximately 2½ years prior to the majority of the currently planned TMI-1 MRP-227-A examinations.
8 4.2.8	Applicants/licensees shall make a submittal for NRC review and approval to credit their implementation of MRP-227, as amended by this SE, as an AMP for the RVI components at their facility. This submittal shall include the information identified in Section 3.5.1, items 1 and 2, of the SE for MRP-227.	See subsections 8.1 and 8.2 below in this table.

Applicant/Licensee Action Item # **SER Section**	**Applicant/Licensee Action Item**	**TMI-1 Response**
8.1 3.5.1.1	An AMP for the facility that addresses the 10 program elements as defined in NUREG-1801, Revision 2, AMP XI.M16A.	The 10-element program for the AMP is addressed in Section 5.0 of this TMI RV Internals Inspection Plan.
8.2 3.5.1.2	Applicants/licensees are to submit an inspection plan which addresses the identified plant-specific action items for staff review and approval consistent with the licensing basis for the plant. If an applicant/licensee plans to implement an AMP which deviates from the guidance provided in MRP-227, as approved by the NRC, the applicant/licensee shall identify where their program deviates from the recommendations of MRP-227, as approved by the NRC, and shall provide a justification for any deviation which includes a consideration of how the deviation affects both "Primary" and "Expansion" inspection category components.	The TMI-1 RV Inspection Plan is consistent with MRP-227-A, contains no deviations, and addresses TMI-1 specific action items (this table).

APPENDIX E: LRA AMR AND INDUSTRY PROGRAM COMPARISON

The table below shows how the components identified in the results of the TMI-1 LRA AMR are dispositioned by the industry program (summarized in MRP-227-A). Specifically, Appendix E recreates the "Component Type," "Intended Function," "Aging Effect Requiring Management," and "Aging Management Programs" columns from Table 3.1.2-3 of the TMI-1 LRA. Those columns in the LRA that had a "Note 1" for the Aging Management Program are to be managed by compliance with the industry RV Internals guidance under development at the time the LRA was submitted, i.e. by MRP-227-A and its supporting documents. The two additional columns show how the components that previously said "Note 1" in the LRA Aging Management Programs column have been dispositioned in MRP-227-A and/or its developmental references. The line items in the LRA that did not say "Note 1" in the AMPs column remain managed by the program identified in the LRA. This completes Applicant/Licensee Action Item #2 in the NRC SER for MRP-227, Rev. 0.

Table E-1, LRA AMR and Industry Program Comparison

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
1.	Control Rod Assembly	None - Short Lived	None	None.	N/A	N/A
2.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
3.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
4.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
5.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
6.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
7.	Control rod guide tube assembly; CRGT pipe and flange	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
8.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-231 Table 3-8	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
9.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8	Category A
10.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
11.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
12.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8	Category A
13.	Control rod guide tube assembly; CRGT rod guide sectors	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
14.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-231 Table 3-8	Category A
15.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8	Category A
16.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
17.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
18.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8	Category A
19.	Control rod guide tube assembly; CRGT rod guide tubes	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
20.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-231 Table 3-8	Category A
21.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8	Category A
22.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
23.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
24.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8	Category A
25.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Thermal Aging Embrittlement	See Note 1	MRP-231 Table 3-8 MRP-227-A	Expansion MRP-227-A changed this to a "Primary" component.
26.	Control rod guide tube assembly; CRGT spacer casting	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
27.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
28.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
29.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
30.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
31.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
32.	Control rod guide tube assembly; CRGT spacer screws	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
33.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
34.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
35.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
36.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
37.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
38.	Control rod guide tube assembly; Flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
39.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-231 Table 3-8	No Additional Measures
40.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8	Category A (SCC), No Additional Measures (IASCC)
41.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
42.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
43.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8, and Table 3-9, and Table 3-10	Primary: baffle plates (IE), and Expansion: former plates (IE)
44.	Core Barrel Assembly; Baffle/former assembly	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
45.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1 and MRP-231 Table 3-8	Category A, except No Additional Measures (core-barrel-to-former bolts, baffle-to-former bolts, and baffle-to-baffle bolts)
46.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1 and MRP-231 Table 3-8, and Table 3-9, and Table 3-10	Category A, except (IASCC) Primary baffle-to-former bolts, (IASCC) Expansion core barrel-to-former bolts and external baffle-to-baffle bolts, and (IASCC) No Additional Measures internal baffle-to-baffle bolts
47.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
48.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
49.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1 and MRP-231 Table 3-8, and Table 3-9, and Table 3-10	Category A, except (1E) Primary baffle-to-former bolts and (1E) Expansion core barrel-to-former bolts and baffle-to-baffle bolts
50.	Core Barrel Assembly; Baffle/former bolts and screws	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1 and MRP-231 Table 3-8, and Table 3-9, and Table 3-10	Primary baffle-to-former bolts, Expansion core barrel-to-former bolts and baffle-to-baffle bolts, and No Additional Measures thermal shield upper restraint cap screws
51.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
52.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
53.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
54.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
55.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
56.	Core Barrel Assembly; Core barrel cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
57.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
58.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-10	Expansion (SCC)
59.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
60.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
61.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
62.	Core Barrel Assembly; Core barrel-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
63.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
64.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary (SCC)
65.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
66.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
67.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
68.	Core Barrel Assembly; Lower Internals assembly-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
69.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
70.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
71.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
72.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
73.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
74.	Core support shield assembly; Core support shield cylinder (top and bottom flange)	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
75.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
76.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
77.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
78.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
79.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
80.	Core support shield assembly; Core support shield cylinder (top flange)	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
81.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
82.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary (SCC)
83.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
84.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
85.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
86.	Core support shield assembly; Core support shield-to-core barrel bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
87.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
88.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
89.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
90.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
91.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
92.	Core support shield assembly; Outlet and vent valve nozzles	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
93.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	N/A	Vent Valve locking devices are being considered for the TMI-1 RV Inspection plan. See Appendix D, response to L/AAI #2.
94.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	N/A	Vent Valve locking devices are being considered for the TMI-1 RV Inspection plan. See Appendix D, response to L/AAI #2.
95.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
96.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
97.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	N/A	Vent Valve locking devices are being considered for the TMI-1 RV Inspection plan. See Appendix D, response to L/AAI #2.
98.	Core support shield assembly; Vent valve assembly locking device	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
99.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
100.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
101.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
102.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
103.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
104.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Thermal Aging Embrittlement	See Note 1	MRP-189 Table 4-1	Category A
105.	Core support shield assembly; Vent valve body	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
106.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
107.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
108.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
109.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
110.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
111.	Core support shield assembly; Vent valve retaining ring	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
112.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
113.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
114.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
115.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
116.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
117.	Flow distributor assembly; Clamping ring	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
118.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
119.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
120.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
121.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
122.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
123.	Flow distributor assembly; Flow distributor head and flange	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
124.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
125.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
126.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
127.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
128.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
129.	Flow distributor assembly; Incore guide support plate	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
130.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
131.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-9 and Table 3-10 MRP-227-A	MRP-227-A changed these from "Expansion" to "Primary" components.

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
132.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
133.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
134.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
135.	Flow distributor assembly; Shell forging-to-flow distributor bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
136.	Fuel Assembly	None - Short Lived	None	None	N/A	N/A
137.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
138.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-10	Category A except Expansion Alloy X-750 dowel locking weld
139.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
140.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
141.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8 and Table 3-10	Expansion (1E)
142.	Lower grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
143.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
144.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
145.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
146.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
147.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
148.	Lower grid assembly; Guide blocks	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
149.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
150.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
151.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
152.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
153.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
154.	Lower grid assembly; Guide blocks bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
155.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
156.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
157.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
158.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
159.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary (IE)
160.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Thermal Aging Embrittlement	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary
161.	Lower grid assembly; Incore guide tube spider castings	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
162.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
163.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
164.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
165.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
166.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
167.	Lower grid assembly; Lower grid and shell forgings	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
168.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
169.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
170.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
171.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
172.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
173.	Lower grid assembly; Lower grid flow distributor plate	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
174.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
175.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
176.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
177.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
178.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
179.	Lower grid assembly; Lower grid rib section	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
180.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
181.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
182.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
183.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
184.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
185.	Lower grid assembly; Lower grid rib-to-shell forging screws	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-231 Table 3-8	No Additional Measures (ISR)
186.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
187.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-10	Expansion (SCC)
188.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
189.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
190.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
191.	Lower grid assembly; Lower internals assembly-to-thermal shield bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
192.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
193.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
194.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
195.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
196.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
197.	Lower grid assembly; Orifice plugs	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
198.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
199.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
200.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
201.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
202.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
203.	Lower grid assembly; Shock pads	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
204.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
205.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-231 Table 3-8 and Table 3-10	(SCC) Expansion
206.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
207.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
208.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
209.	Lower grid assembly; Shock pads bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
210.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
211.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
212.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
213.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
214.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
215.	Lower grid assembly; Support post pipes	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
216.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
217.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
218.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
219.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
220.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
221.	Plenum cover and plenum cylinder; Bottom flange-to-upper grid screws	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
222.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
223.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
224.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
225.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
226.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
227.	Plenum cover and plenum cylinder; Plenum cover assembly	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
228.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
229.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
230.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
231.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
232.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
233.	Plenum cover and plenum cylinder; Plenum cylinder	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
234.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
235.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
236.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
237.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
238.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
239.	Plenum cover and plenum cylinder; Reinforcing plates	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
240.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
241.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
242.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
243.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
244.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
245.	Plenum cover and plenum cylinder; Rib Pads	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
246.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
247.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
248.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
249.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
250.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
251.	Plenum cover and plenum cylinder; Top flange-to-cover bolts	Structural Support to maintain core configuration and flow distribution	Loss of Preload/Stress Relaxation	See Note 1	MRP-189 Table 4-1	Category A
252.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
253.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
254.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
255.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
256.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
257.	Reactor Vessel Internals; Incore Guide Tube Gussets	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
258.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
259.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
260.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
261.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
262.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
263.	Reactor Vessel Internals; Incore Guide Tube Nuts	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
264.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
265.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
266.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
267.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
268.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary
269.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Thermal Aging Embrittlement	See Note 1	MRP-231 Table 3-8 and Table 3-9	Primary

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
270.	Reactor Vessel Internals; Incore Guide Tube Spiders	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
271.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
272.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
273.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
274.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
275.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
276.	Reactor Vessel Internals; Incore Guide Tubes	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
277.	Thermal Shield	Shielding	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
278.	Thermal Shield	Shielding	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
279.	Thermal Shield	Shielding	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
280.	Thermal Shield	Shielding	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
281.	Thermal Shield	Shielding	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1, Table 4-2	Category A
282.	Thermal Shield	Shielding	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
283.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
284.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1 and MRP-231 Table 3-8 and Table 3-10	Category A except for Expansion (Alloy X-750 dowel locking weld)
285.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
286.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
287.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
288.	Upper grid assembly; Fuel assembly support pads	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
289.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
290.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
291.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
292.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
293.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
294.	Upper grid assembly; Rib-to-ring screws	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A

Line #	Component Type	Intended Function	Aging Effect Requiring Management	Aging Management Programs[1]	Supporting Document and Location	Disposition in Supporting Document[2]
295.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
296.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
297.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
298.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
299.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
300.	Upper grid assembly; Upper grid rib section	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A
301.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Changes in Dimensions/Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
302.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	See Note 1	MRP-189 Table 4-1	Category A
303.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Cracking/Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	N/A	N/A
304.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Cumulative Fatigue Damage/Fatigue	TLAA	N/A	N/A
305.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Loss of Fracture Toughness/Neutron Irradiation Embrittlement, Void Swelling	See Note 1	MRP-189 Table 4-1	Category A
306.	Upper grid assembly; Upper grid ring forging	Structural Support to maintain core configuration and flow distribution	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	N/A	N/A

1 Note 1 in the TMI-1 LRA said "A commitment will be made in the UFSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) Upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval."

2 Category A component items are those for which aging effects are below the screening criteria, so that age-related degradation significance is minimal. Typically, only the required ASME Boiler & Pressure Vessel Code Section XI Examination Category B-N-3 ISI visual examinations (VT-3) will be performed on these component items to assess potential aging effects.

Attachment 2

Summary of Commitments

Summary of Commitments

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE OR "OUTAGE"	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	Programmatic (Yes/No)
Applicant/Licensee Action Item 2 (Table D-2), based upon Section 4.2.2 of the Safety Evaluation Report (SER), requires a licensee to identify which Reactor Vessel Internals (RVI) components are within the scope of license renewal. Exelon has identified that the RVI vent valve locking device should be further reviewed with MRP-227-A methodology to determine impact on the RVI Aging Management Program (AMP) and the enclosed plan. TMI is currently working with the Pressurized Water Reactor Owners Group (PWROG) to address the action item. Exelon will submit an update of the PWROG progress in evaluating this item and a schedule for showing when Exelon will submit the results of an evaluation by April 19, 2013.	April 19, 2013	Yes	No

Applicant/Licensee Action Item 6 (Table D-2), based upon Section 4.2.6 of the SER, requires a licensee to justify the acceptability of certain inaccessible components that Table 4-4 of MRP-227-A identifies as expansion components. Exelon will submit an update of the PWROG progress in evaluating these components and a schedule for showing when Exelon will submit an evaluation for continued service or a schedule for replacement by April 19, 2013.	April 19, 2013	Yes	No
Applicant/Licensee Action Item 7 (Table D-2), based upon Section 4.2.7 of the SER, requires that the licensee develop plant-specific analyses to demonstrate that there is not a loss of functionality of the Incore Monitoring Instrumentation (IMI) guide tube assembly spiders and Control Rod Guide Tube (CRGT) spacer castings due to loss of fracture toughness. Exelon will submit an update of the PWROG progress in evaluating these components and a schedule for showing when Exelon will submit an evaluation for continued service or a schedule for replacement by April 19, 2013.	April 19, 2013	Yes	No