



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

December 19, 2011

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

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1) - THIRD  
INSERVICE INSPECTION INTERVAL RELIEF REQUESTS RR-11-01 AND  
RR-11-02 (TAC NOS. ME5670 AND ME5671)

Dear Mr. Pacilio:

By letter dated February 10, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110410126), supplemented by letter dated August 30, 2011 (ADAMS Accession No. ML112430091), Exelon Generation Company, LLC (the licensee) submitted two relief requests for Three Mile Island Nuclear Station, Unit 1 (TMI-1) associated with the third inservice inspection interval. In the two requests, the licensee requested relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements. The first request, RR-11-01, concerns requirements for examination of certain steam generator welds. The TMI-1 steam generators were replaced in the 2009 refueling outage, eliminating the original limited examination welds from service prior to the end of the third inservice inspection interval. The second request, RR-11-02, concerns the pre-service examination of four High Pressure Injection circumferential valve to safe-end welds installed in the 2009 refueling outage. Both of these requests were submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Paragraph 50.55a(g)(5)(iii), on the basis that the code requirement is impractical.

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of relief requests RR-11-01 and RR-11-02, as discussed in the enclosed safety evaluation. The NRC staff review concludes that it is impractical for the licensee to comply with the specified requirements of the ASME Code for which relief was sought. Further, the NRC staff also concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, relief requests RR-11-01 and RR-11-02 are granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the third 10-year inservice inspection interval at TMI-1. The third 10-year interval began on April 20, 2001, and will end on, or before, April 19, 2012, including the one year extension allowed by paragraph IWA-2430(d)(1) of the ASME Code, Section XI.

M. Pacilio

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

Sincerely,



for

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

Docket No. 50-289

Enclosure:  
As stated

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELIEF REQUESTS ASSOCIATED WITH THE THIRD INSERVICE INSPECTION INTERVAL

REQUEST NOS. RR-11-01 AND RR-11-02

EXELON GENERATION COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

DOCKET NO. 50-289

1.0 INTRODUCTION

By letter dated February 10, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110410126), supplemented by letter dated August 30, 2011 (ADAMS Accession No. ML112430091), Exelon Generation Company, LLC (the licensee) submitted two relief requests for Three Mile Island Nuclear Station, Unit 1 (TMI-1) associated with the third inservice inspection interval. The first request, RR-11-01, concerns requirements for examination of certain steam generator welds. The TMI-1 steam generators were replaced in the 2009 refueling outage, eliminating the original limited examination welds from service prior to the end of the third inservice inspection interval. The second request, RR-11-02, concerns the pre-service examination of four High Pressure Injection circumferential valve to safe-end welds installed in the 2009 refueling outage. Both of these requests were submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Paragraph 50.55a(g)(5)(iii). The U.S. Nuclear Regulatory Commission (NRC, or Commission) staff reviewed and evaluated RR-11-01 and RR-11-02 pursuant to the provisions of 10 CFR 50.55a(g)(6)(i).

2.0 REGULATORY EVALUATION

The inservice inspection of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1, 2, and 3 components is to be performed in accordance with the applicable edition and addenda of ASME Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, as required by Title 10 of the *Code of Federal Regulations*, Part 50 (specifically 10 CFR 50.55a(g)), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Paragraph 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements set forth in the ASME Code, Section XI to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in

Enclosure

10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The inservice inspection code of record for the third 10-year inservice inspection interval at TMI-1 is the 1995 Edition, 1996 Addenda, of the ASME Code, Section XI. The third 10-year ISI interval began on April 20, 2001, and is scheduled to end on, or before, April 19, 2012, including the one year extension allowed by paragraph IWA-2430(d)(1) of the ASME Code, Section XI.

TMI-1 has invoked ASME Section XI, Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1," for the third interval ISI program. Code Case N-460 states, in part, that when the entire examination volume or area cannot be examined, a reduction in examination coverage may be accepted provided the reduction in coverage for that weld is less than 10 percent. NRC Information Notice 98-42, "Implementation of 10 CFR50.55a(g) Inservice Inspection Requirement," termed the reduction in coverage of less than 10 percent to be "essentially 100 percent." Information Notice 98-42 states, in part, that the NRC has adopted and further refined the definition of "essentially 100 percent" to mean "greater than 90 percent," which has been applied to examination of welds or other areas required by ASME Section XI.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Relief Request RR-11-01

##### 3.1.1 ASME Components for Which Relief is Requested and Applicable Code Requirement

As specified in ASME Section XI, Table IWB-2500-1, Examination Category B-D, Item Number B3.130, ASME Code Class 1, Pressure Retaining Welds in Steam Generator Nozzles, essentially 100 percent volumetric examination of the steam generator nozzle-to-vessel head welds is required. For this relief request, the six ASME Class 1 nozzle-to-vessel head welds are as follows:

Component Identification	Percent Coverage Attained
RCH0001ASG0002N	43.3
RCH0001ASG0003N	69.5
RCH0001ASG0004N	69.5
RCH0001BSG0008N	47.1
RCH0001BSG0009N	47.1
RCH0001BSG0010N	43.3

As specified in ASME Section XI, Table IWC-2500-1, Examination Category C-B, Item Number C2.21, ASME Code Class 2, Pressure Retaining Welds in Steam Generator Nozzles, essentially 100 percent volumetric examination of the steam generator nozzle-to-vessel shell welds is required. For this relief request the (one) ASME Class 2 nozzle-to-vessel shell weld is as follows:

Component Identification	Percent Coverage Attained
RCH0001BSG0030N	68.0

### 3.1.2 Licensee's Proposed Alternative Examination and Basis

The licensee requested relief pursuant to 10 CFR 50.55a(g)(5)(iii), for the components listed above, on the basis that the required examination coverage of "essentially 100 percent" is impractical due to physical obstructions in the work area. As an alternative, the licensee performed the ASME Code-required examinations to the extent practical. The seven welds were examined during the first and second period of the third inservice inspection interval in accordance with ASME Section V, Article 4 requirements. The seven steam generator nozzle welds were credited for volumetric examination during the first and second period of the third inservice inspection interval, even though the overall volumetric examination coverage was less than "essentially 100 percent" (i.e., less than 90 percent).

The licensee replaced the steam generators during the third period 2009 refueling outage, thereby removing these nozzle welds from service. The new steam generators installed in 2009 either eliminated the nozzle welds, or utilized a design that allows for the required ASME Code examination coverage to be obtained. ASME Section XI examinations and tests of the new steam generators were completed prior to the plant returning to service after the 2009 refueling outage.

In order to satisfy literal compliance with the requirements of 10 CFR 50.55a and the ASME Code, the licensee determined that a relief request should be submitted for these limited nozzle weld examinations.

### 3.1.3 NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of the steam generator nozzle-to-vessel welds; however, due to the design of the steam generator nozzles, there were geometric limitations to the scanning area. To comply with the ASME Code, for the old steam generators, the steam generator nozzle-to-vessel welds would have required a re-design and modification to increase the coverage to 90 percent or better. Imposition of this requirement would have created a burden on the licensee.

Ultrasonic examination scanning (UT) was performed on these nozzles to obtain the highest examination volume practical. The examination volume coverage is shown above. This was confirmed by the NRC staff's review of figures and drawings provided by the licensee, by letter dated August 30, 2011, detailing the coverage obtained. Therefore, the NRC staff agrees with the licensee that "essentially 100 percent" examination coverage is impractical. Furthermore, the welds were subsequently replaced when the steam generators were replaced during the 2009 Refueling Outage. ASME Section XI examinations and tests of the new steam generators were completed prior to the plant returning to service. The new steam generators either eliminated the nozzle welds, or utilized a design that allows ASME Code examination coverage.

Because the licensee has acceptably demonstrated that the essentially 100 percent ASME Code-required examination requirement is impractical, the NRC staff has determined that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Since the old steam generators are no longer installed at the plant, granting this relief request will have no bearing on the structural integrity of the currently installed steam generators.

### 3.2 Relief Request RR-11-02

#### 3.2.1 ASME Code Components for Which Relief is Requested and Applicable Code Requirement

The four ASME Class 1, Valve to Safe-End Welds, Category/Item Number R-A/R1.11, are described in the table below. For each weld, the applicable fabrication materials are: Valve - A351-CF8M (Cast Austenitic Stainless Steel or CASS); Safe-End - SA-182, type 316/316L; Weld - ER316/316L.

Weld ID	Percent Coverage Attained	Examination Figure	Examination Method/Angle
MU0901BM	50	EPRI* TR-112657, Rev B-1, Fig 4-1	UT/ 45 and 70
MU0903BM	50	EPRI TR-112657, Rev B-1, Fig 4-1	UT/ 45 and 70
MU0907BM	50	EPRI TR-112657, Rev B-1, Fig 4-1	UT/ 45 and 70
MU0952BM	50	EPRI TR-112657, Rev B-1, Fig 4-1	UT/ 45 and 70

\* EPRI – Electric Power Research Institute

These four High Pressure Injection circumferential valve to safe-end welds were installed during the 2009 Refueling outage at TMI-1. ASME Section XI, paragraph IWA-4530(a) requires that:

When portions of items requiring preservice or inservice inspection are affected by repair/replacement activities, or for items being installed, including welded joints made for installation of items, preservice inspections shall be performed in accordance with IWB-2200, IWC-2200, IWD-2200, IWE-2200, IWF-2200, or IWL-2200 prior to return of the system to service. The preservice inspection may be performed either prior to or following the pressure test required by IWA-4540.

By letter dated November 12, 2003 (ADAMS Accession No. ML032930264), the NRC approved the TMI-1 risk-based inservice inspection (RISI) program for the third inspection interval at TMI-1. This program is based upon EPRI TR-112657, Revision B-A ("Revised Risk-Informed Inservice Inspection Evaluation Procedure," December 1999). Figure 4-1 of EPRI TR-112657 provides the required coverage location for these welds. Figure 4-1 of EPRI TR-112657, Revision B-A also depicts the required examination volume (A-B-C-D), which includes the lower one-third thickness of the circumferential weld and one-half inch on each side of the weld toes used to define the required examination volume.

As required by 10 CFR50.55a(g)(6)(ii)(C), ASME Section XI 1995 Edition, 1996 Addenda, Appendix VIII, "Performance Demonstration for Ultrasonic Examination System," is required to be used for examination procedures, equipment and personnel, unless the licensee opts to conform directly to Appendix VIII, as executed by the Performance Demonstration Initiative (PDI), as detailed in 10 CFR 50.55a(b)(2)(xv). TMI-1 utilizes ASME Section XI 1995 Edition, 1996 Addenda, Appendix VIII for the third inservice inspection interval program.

In summary, the requirements described above would require an examination of essentially 100 percent of the welds' volume.

### 3.2.2 Proposed Alternative and Basis

According to the licensee, due to the original design, cast valve material, physical obstructions, and geometric interferences associated with these welds, it is not feasible to effectively perform examinations of 100 percent of the weld volume as required for pre-service examination. Attaining the geometry required to achieve the code-required examination coverage would require major modifications to components (replacement of existing cast stainless steel valve with a valve of different design and material). The four High Pressure Injection circumferential valve to safe-end welds were installed in the fall 2009 refueling outage. The safe-ends and associated welds were changed from Alloy 600/82/182 material to stainless steel material as a part of the Alloy 600 pre-emptive mitigation program. The original valve remained installed to the original stainless steel piping on the side of the valve that was opposite the safe-end. The valve is comprised of CASS material. There are currently no PDI-qualified UT techniques for CASS materials. In addition, there are no stainless steel piping PDI qualified UT examination techniques qualified for 100 percent examination coverage when the weld configuration allows access from one side of the weld only. Replacement of the previously installed valve would have required additional installation welds and additional engineering analysis.

According to the licensee, pre-service UT examinations were performed on these welds in order to examine the welds with methods and techniques that were expected to be used for inservice examination, should future examination be required. These pre-service examinations were performed using examination procedures and personnel qualified under the PDI program administered through the EPRI Non-destructive Examination Center, specifically PDI-UT-2, which is qualified to detect and measure length size flaws in the required examination volume of wrought austenitic piping welds. However, the PDI procedure is not qualified for the detection of flaws on the far side of austenitic stainless steel piping welds when examination access is limited to one side of the weld. According to the licensee, the examinations were performed to the maximum extent practical using the best available technology of the time. The valve geometry tapers away from the weld resulting in limited available scanning surface on the valve side, thus limiting the code coverage to 50 percent. In addition, the valve body is comprised of A351-CF8M (CASS) for which there are no qualified PDI UT examination techniques.

According to the licensee, the four new welds were examined in accordance with ASME Section III, Article NB-5000 requirements prior to plant heat-up. These welds received radiographic and liquid penetrant examinations prior to the applicable UT pre-service examination. The welds also received a system leakage examination per ASME Section XI prior to exiting the fall 2009 refueling outage.

### 3.2.3 NRC Staff Evaluation

The required examination for the four High Pressure injection circumferential valve to safe-end welds is essentially 100 percent volumetric examination coverage, which must be applied from both sides of the weld to maximize coverage. However, volumetric examinations are limited by the valve to safe-end geometry of the weld, which restricts scanning to the safe-end side only, and by the CASS material the valve is fabricated from, for which no qualified examination procedure exists.

liquid penetrant) were satisfactorily completed and met the Article NB-5000 acceptance criteria, thereby confirming that the welds were acceptable for service.

By letter dated August 30, 2011, in response to an NRC staff request for additional information, the licensee indicated that while the examination is not PDI qualified for detection of flaws on the far side of an austenitic weld, the 70-degree shear wave examination interrogates the far side of the weld along with a lower adjacent segment of the CASS valve body. While the licensee has only taken credit for obtaining 50 percent volumetric coverage, the utilized UT techniques would have provided coverage well beyond the near-side of the welds. No defects were identified in these welds.

The NRC staff agrees that the licensee has shown that it is impractical to meet the required 100 percent volumetric examination coverage for the subject welds due to the design, material and ultrasonic access restrictions. The UT methods employed would have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the opposite side of the welds. Considering the licensee's performance of UT, radiography and liquid penetrant testing, it is reasonable to conclude that if significant flaws were present, evidence of it would have been detected by the examinations that were performed. The NRC staff therefore concludes that the examinations performed provide reasonable assurance of structural integrity of the weld.

#### 4.0 CONCLUSION

The NRC staff has determined, as described above, that the inspections described in the licensee's request provide reasonable assurance of structural integrity and/or leak tightness of the subject components. Further, the staff has reviewed the licensee's submittals and concludes that ASME Code examination coverage requirements are impractical for the subject welds. Furthermore, imposition of the ASME Code requirements would create a burden on the licensee. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, the NRC staff grants relief for the subject examinations of the components contained in relief requests RR-11-01 and RR-11-02, as requested, at TMI-1 for the third 10-year ISI interval.

The staff has determined that granting relief requests RR-11-01 and RR-11-02, pursuant to 10 CFR 50.55a(g)(6)(i), is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

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Date: December 19, 2011



M. Pacilio

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

Sincerely,  
*/ra/ (REnnis for)*

Harold K. Chernoff, Chief  
Plant Licensing Branch 1-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-289

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