

October 2, 2001

Mr. Mark E. Warner  
Vice President - TMI Unit 1  
AmerGen Energy Company, LLC  
P.O. Box 480  
Middletown, PA 17057

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1) - INSERVICE  
INSPECTION RELIEF REQUESTS VIII-1 AND VIII-2 FOR THE SECOND AND  
THIRD 10-YEAR INTERVALS AND REQUEST NUMBER VIII-3 FOR THE FALL  
2001 OUTAGE (TAC NO. MB0882)

Dear Mr. Warner:

By letter dated December 21, 2000, and supplemented by letters dated February 20, 2001, July 6, 2001, and August 13, 2001, AmerGen Energy Company, LLC (the licensee) submitted inservice inspection Relief Requests VIII-1, VIII-2, and VIII-3 for TMI-1. The Nuclear Regulatory Commission staff evaluated the three relief requests and found them to be acceptable. Thus, the licensee's proposed alternatives in Relief Requests VIII-1 and VIII-2 are authorized pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) on the basis that they would provide an acceptable level of quality and safety. Relief Request VIII-3 is granted pursuant to 10 CFR 50.55a(g)(6)(i) because the examination requirements are impractical to perform and the alternative is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest. Details of the NRC staff's evaluation and the applicable durations of these alternatives and relief are delineated in the enclosed safety evaluation.

Sincerely,

*/RA/*

Lakshminaras Raghavan, Acting Chief, Section 1  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure: Safety Evaluation

cc w/encl: See next page

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Three Mile Island Nuclear Station, Unit No. 1

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO INSERVICE INSPECTION RELIEF REQUESTS VIII-1, VIII-2, AND VIII-3

AMERGEN ENERGY COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)

DOCKET NO. 50-289

## 1.0 INTRODUCTION

By letter dated December 21, 2000, and supplemented by letters dated February 20, 2001, July 6, 2001, and August 13, 2001, the AmerGen Energy Company, LLC (the licensee, previously PECO Energy Company), submitted inservice inspection (ISI) Relief Requests VIII-1, VIII-2, and VIII-3 for TMI-1. Details of the Nuclear Regulatory Commission (NRC) staff's evaluation and the applicable durations of these alternatives are delineated below.

## 2.0 BACKGROUND

Inservice inspection of the American Society of Mechanical Engineers (ASME) Code Class 1, 2 and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel (BPV) Code (ASME Code) and applicable addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee 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) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in Section XI of the ASME Code, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the second 10-year ISI interval at TMI-1 is the 1986 Edition and for the third 10-year ISI interval is the 1995 Edition through the 1996 Addenda.

### 3.0 RELIEF REQUESTS

#### 3.1 Relief Request VIII-1: Depth Sizing Criterion (and Statistical Parameters)

##### 3.1.1 Code Requirements for which Relief is Requested

Section XI (1995 Edition with the 1996 Addenda), Appendix VIII, Supplement 4, Subparagraph 3.2(b), requires “flaw lengths estimated by ultrasonics shall be the true length  $-\frac{1}{4}$  inch + 1 inch.”

The regulations, as specified in 10 CFR 50.55a(b)(2)(xv)(C)(1), as amended by *Federal Register* Notice (64 FR 51370), published September 22, 1999, require that when applying Appendix VIII, Supplement 4, a depth sizing acceptance criterion of 0.15-inch Root Mean Square (RMS) shall be used in lieu of the requirements of Subparagraphs 3.2(a) and 3.2(b) of the 1995 Edition with the 1996 Addenda of the ASME BPV Code, Section XI, Appendix VIII. Subparagraph 3.2(c) contains additional requirements for statistical parameters.

##### 3.1.2 Licensee’s Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requests approval to use a length sizing qualification criterion of 0.75-inch RMS in lieu of Appendix VIII, Supplement 4, Subparagraph 3.2(b), and to use the RMS value of 10 CFR 50.55a(b)(2)(xv)(C)(1) which modifies the depth sizing criterion of Appendix VIII, Supplement 4, Subparagraph 3.2(a), in lieu of the statistical parameters of Subparagraph 3.2(c).

##### 3.1.3 Evaluation

The U.S. nuclear utilities created the Performance Demonstration Initiative (PDI) in 1991 to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. To this end, the PDI has developed a performance demonstration program for qualifying ultrasonic examination (UT) equipment, procedures, and personnel. During the development of the performance demonstration for Supplement 4, the PDI determined that the ASME Code criteria for flaw sizing was unworkable. The length sizing tolerance of  $-\frac{1}{4}$  inch +1.0 inch in Supplement 4, Subparagraph 3.2(b), allowed examiners to bias their results on the plus side. To discourage testmanship (passing the test based on manipulation of results rather than skill), the PDI adopted a length sizing tolerance of 0.75-inch RMS which has been in use since 1994. As early as 1995, the NRC staff has recognized and accepted the PDI’s use of 0.75-inch RMS for length sizing. The PDI formalized their use of 0.75-inch RMS as the criterion for Supplement 4, Subparagraph 3.2(b), in ASME Code Case N-622, “Ultrasonic Examination of RPV and Piping and Bolts and Stubs, Section XI, Division 1.”

The NRC staff intended to formalize the acceptability of the 0.75-inch RMS length sizing criterion in 10 CFR 50.55a(b)(2)(xv)(C)(1), but mistakenly published the value of 0.15-inch RMS for depth sizing tolerance in place of the existing length sizing tolerance. The omission of the length sizing tolerance of 0.75-inch RMS in the rule was an oversight, and the inclusion of the depth sizing tolerance in Subparagraph 3.2(b) was an error. This mistake has been corrected with the publication in the *Federal Register* of a rule correction on March 26, 2001 (66 FR 16390), which revised 10 CFR 50.55a(b)(2)(xv)(C)(1) to read as follows:

A depth sizing requirement of 0.15 RMS shall be used in lieu of the requirement in

Subparagraph 3.2(a), and a length sizing requirement of 0.75 inch RMS shall be used in lieu of the requirement in Subparagraph 3.2(b).

Therefore, the NRC staff considers that this part of the proposed alternative, to use a length sizing tolerance of 0.75-inch RMS in lieu of the requirements in Supplement 4, Subparagraph 3.2(b), is now required and relief is no longer necessary.

In the second part of the alternative, the licensee proposed eliminating the use of Supplement 4, Subparagraph 3.2(c), which imposes three statistical parameters for depth sizing. The first parameter, 3.2(c)(1), pertains to the slope of a linear regression line. The linear regression line is the difference between actual versus true value plotted along a through-wall thickness. For Supplement 4 performance demonstrations, a linear regression line of the data is not applicable because the performance demonstrations are performed on test specimens with flaws located in the inner 15 percent through-wall. The differences between actual versus true value produce a tight grouping of results which resemble a shotgun pattern. The slope of a regression line from such data is extremely sensitive to small variations, thus making the parameter of Subparagraph 3.2(c)(1) a poor and inappropriate acceptance criterion. The second parameter, 3.2(c)(2), pertains to the mean deviation of flaw depth. The value used in the Code is too lax with respect to evaluating flaw depths within the inner 15 percent of wall thickness. Therefore, the licensee proposed to use the more appropriate criterion of 0.15-inch RMS of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies Subparagraph 3.2(a), as the acceptance criterion. The third parameter, 3.2(c)(3), pertains to a correlation coefficient. The value of the correlation coefficient in Subparagraph 3.2(c)(3) is inappropriate for this application since it is based on the linear regression from Subparagraph 3.2(c)(1).

The PDI was aware of the inappropriateness of Subparagraph 3.2(c) early in the development of their program. They brought the issue before the appropriate ASME committee which formalized eliminating the use of Supplement 4, Subparagraph 3.2(c), in ASME Code Case N-622. The NRC staff representatives participated in the discussions and consensus process of the Code case. Based on the above, the NRC staff believes that the use of Subparagraph 3.2(c) requirements in this context is inappropriate and that the proposed alternative to use the RMS value of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies the criterion of Appendix VIII, Supplement 4, Subparagraph 3.2(a), in lieu of Subparagraph 3.2(c), will provide an acceptable level of quality and safety.

#### 3.1.4 Conclusion

Based on the discussion above, the NRC staff has concluded that the proposed Relief Request VIII-1, Depth Sizing Criterion, for the second and third 10-year ISI intervals will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternative for the remainder of examinations required for the second 10-year ISI interval and for the third 10-year ISI interval at TMI-1.

## 3.2 Relief Request VIII-2: Annual Training

### 3.2.1 Code Requirements for which Relief is Requested

The 1995 Edition, with the 1996 Addenda of ASME Code, Section XI, Subarticle VII-4240, requires a minimum of 10 hours of annual training.

Pursuant to 10 CFR 50.55a(b)(2)(xiv), all personnel qualified for performing ultrasonic examinations in accordance with Appendix VIII shall receive 8 hours of annual hands-on training on specimens that contain cracks. This training must be completed no earlier than 6 months prior to performing ultrasonic examinations at a licensee's facility.

### 3.2.2 Licensee's Proposed Alternative

The licensee proposed conducting annual UT training in accordance with 10 CFR 50.55a(b)(2)(xiv) requirements in lieu of Subarticle VII-4240 to Appendix VII of Section XI of the ASME Code.

### 3.2.3 Evaluation

Subarticle VII-4240, Appendix VII of Section XI of the ASME Code requires 10 hours of annual training to impart knowledge of new developments, material failure modes, and any pertinent technical topics as determined by the licensee. No hands-on training or practice is required to be included in the 10 hours of training. This training is required of all UT personnel qualified to perform examinations of ASME Code Class 1, 2, and 3 systems. Independent of the ASME Code, 10 CFR 50.55a(b)(2)(xiv) imposes the requirement for the Appendix VIII qualification that 8 hours of hands-on training with specimens containing cracks be performed no earlier than 6 months prior to performing examinations at a licensee's facility. The licensee contends that maintaining two separate UT annual training programs is redundant and can be simplified to reduce recordkeeping and confusion while satisfying the need to maintain skills.

As part of the NRC staff's rulemaking effort to revise 10 CFR 50.55a(b)(2), the issue of UT annual training requirements was reviewed. This review was included in the summary of comments to the rule published September 22, 1999, which revised 10 CFR 50.55a (64 FR 51370). In the review, the NRC staff determined that the 10 hours of annual training requirement specified in the ASME Code was inadequate for two reasons. The first reason was that the training does not require practice with flawed specimens. Practice with flaws is necessary because signals can be difficult to interpret. The second reason is related to the length of training and its frequency. Studies have shown that an examiner's capability begins to diminish within 6 months if skills are not maintained. Therefore, examiners must practice on a frequent basis to maintain their capability for proper interpretation of flaws.

Based on resolution of public comments for the above rulemaking, the NRC staff accepted an industry recommendation advanced by the Electric Power Research Institute (EPRI), which proposed 8 hours of hands-on practice with flawed specimens containing cracks. The practice would occur no earlier than 6 months prior to performing examinations at a licensee's facility. The recommendations were adopted in 10 CFR 50.55a(b)(2)(xiv) for personnel maintaining their Appendix VIII qualifications. The NRC staff believes that the proposed alternative to use 10 CFR 50.55a(b)(2)(xiv) in lieu of Subarticle VII-4240 will maintain the skill and proficiency of all UT personnel at or above the level provided in the ASME Code for annual UT training,

thereby providing an acceptable level of quality and safety.

### 3.2.4 Conclusion

Based on the discussion above, the NRC staff concludes that the proposed Relief Request VIII-2, Annual Training, for the second and third 10-year ISI intervals will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed alternative for the remainder of examinations required for the second 10-year ISI interval and for the third 10-year ISI interval at TMI-1.

## 3.3 Relief Request VIII-3, Welds Examined from the Inside Surface

### 3.3.1 Code Requirements for which Relief is Requested

Pursuant to 10 CFR 50.55a(g)(6)(ii)(C), Supplements 2 and 3 to Appendix VIII of ASME Code, Section XI (1995 Edition with 1996 Addenda) are required to be implemented by May 22, 2000.

ASME Code, Section XI (1995 Edition with the 1996 Addenda), Appendix I, requires that welds in piping be examined using personnel, procedures and equipment qualified by performance demonstration in accordance with Appendix VIII.

### 3.3.2 Licensee's Proposed Alternative

The licensee proposes to perform a full volumetric examination (the weld and adjacent base material for a distance of ½ inch on each side of the weld crown from the pipe inside diameter surface to the pipe outside diameter surface) from the inside surface during the scheduled October 2001 outage using an automated ultrasonic examination system for the following welds: CF-0001, CF-0020, RC-0001, RC-0033, RC-0052, RC-0054, RC-0087, and RC-0106. These welds are scheduled to be examined during the fall 2001 refueling outage.

The following welds are being examined for the second 10-year ISI interval: CF-0001, CF-0020, RC-0001, RC-0052, RC-0087, and RC-0106. Welds RC-0033, and RC-0054 are being examined for the third 10-year ISI interval.

### 3.3.3 Evaluation

The U.S. nuclear utilities created the Performance Demonstration Initiative (PDI) in 1991 to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. The PDI started qualifying personnel and procedures to Appendix VIII, Supplements 2 and 3, in 1994. These qualifications were for UT examinations conducted from the outside surface of the pipe-to-pipe weld. By the time the proposed rule was published for comment in the *Federal Register* (62 FR 63892) on December 3, 1997, the NRC staff and PDI believed that a sufficient number of UT personnel were qualified to Supplement 2 requirements to satisfy the licensees' needs. The NRC staff established the accelerated implementation schedule for Supplement 2 based on this availability of qualified personnel. The final rule was published in the *Federal Register* (64 FR 51370) on September 22, 1999, which has since been reflected in the regulations.

Shortly after publishing the final rule, the PDI realized that their program could not support Supplement 2 performance demonstrations conducted from inside the pipe. For example, the existing test specimens were designed for performance demonstrations performed on the outside surface. To support performance demonstrations conducted from the inside pipe



surface, PDI has to design, fabricate, and acquire new test specimens; develop the appropriate protocol and test implementation procedures; "finger print" the specimens; develop inspection procedures; and train personnel. PDI projects that they will be able to support performance demonstrations from the pipe inside surface by November 22, 2002.

The licensee determined that Supplement 2 examinations performed on the outside surface of the subject core flood system pipe-to-safe end welds and the subject reactor coolant system nozzle-to-pipe welds would require removal of sand plugs, scaffold erection, insulation removal, and weld surface preparation prior to performing the volumetric examinations from the outside surface. In addition, there would still be limitations in meeting the coverage requirements. The dose estimate to perform the examinations and preparations is approximately 87 person-rem. Therefore, it is impractical for the licensee to perform the examinations from the outside surface to meet the requirements of Supplement 2 for the subject welds.

The licensee proposes to perform the examination of these welds from the inside surface similar to the relief granted by the NRC in a letter dated October 8, 1992. The licensee will perform a complete through-wall UT examination from the inside surface of the subject welds. This examination volume exceeds the ASME Code required volume of the inner 1/3 of the weld area.

The NRC staff concludes that examination of the full thickness of the weld area from the inside surface will provide reasonable assurance of structural integrity. The NRC staff concludes that granting relief for the examination of the subject welds during the October 2001 outage 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.

#### 3.3.4 Conclusion

Based on the above, the NRC staff finds that the examination requirements for which this relief is requested are impractical to perform and that the alternative to perform the UT examination from the inside surface and the inspection of the full thickness of the welds is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest. In making this determination, we have given due consideration to the burden that would result if the requirements to perform the examinations from the external surface (to meet the requirements of Supplement 2) were imposed on the facility for these subject welds. Therefore, Relief Request VIII-3 is granted in accordance with 10 CFR 50.55a(g)(6)(i) for the examination of the subject welds listed above, during the October 2001 outage at TMI-1.

#### 4.0 CONCLUSION

Pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed Relief Request VIII-1, Depth Sizing Criterion, for the remainder of examinations required for the second 10-year ISI interval and for the third 10-year ISI interval because the proposed alternative will provide an acceptable level of quality and safety.

Pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the proposed Relief Request VIII-2, Annual Training, for the remainder of examinations required for the second 10-year ISI interval and for the third 10-year ISI interval because the proposed alternative will provide an acceptable level of quality and safety.

Relief Request VIII-3, Welds Examined from the Inside Surface, is granted in accordance with 10 CFR 50.55a(g)(6)(i), for the examination of the subject welds listed in Section 3.3.2 of this safety evaluation because the examination requirements are impractical to perform and the alternative is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest.

Principal Contributor: A. Keim

Date: October 2, 2001