‘

November 12, 2003

Mr. John L. Skolds, Chairman
and Chief Executive Officer
AmerGen Energy Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1, RE: THIRD 10-YEAR INTERVAL INSERVICE INSPECTION (ISI) PROGRAM REQUESTS FOR RELIEF (TAC NOS. MB6498 AND MB6499)

Dear Mr. Skolds:

By letter dated October 1, 2002, AmerGen Energy Company, LLC (AmerGen), submitted Relief Request RR-21, Revision 0, as a proposed alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements for the selection and examination of Class 1 and 2 piping welds at Three Mile Island, Unit 1 (TMI-1), during the third 10-year inservice inspection (ISI) interval. AmerGen also submitted a modification to Relief Request RR-13 to clarify applicability to risk-informed inservice inspection (RI-ISI). By letters dated July 7 and August 27, 2003, AmerGen provided additional information concerning the proposed alternative associated with the RI-ISI program. The proposed RI-ISI program was developed in accordance with the methodology contained in the Nuclear Regulatory Commission’s (NRC) approved Electric Power Research Institute (EPRI) topical report EPRI-TR-112657 Revision B-A.

The staff has reviewed the proposed alternatives and finds them acceptable as documented in the enclosed safety evaluation (SE). The staff concludes that the proposed RI-ISI program and the proposed alternative to perform up to 50 and 75 percent of the examinations in the first and second period of the inspection interval instead of the Code-allowed maximum of 34 and 67 percent, are acceptable on the basis that the alternatives would provide an acceptable level of quality and safety. Therefore, the proposed alternatives of Relief Requests RR-21 and RR-13 are authorized for the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i).

Sincerely,

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure: As stated

cc w/encl: See next page

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The staff has reviewed the proposed alternatives and finds them acceptable as documented in the enclosed safety evaluation (SE). The staff concludes that the proposed RI-ISI program and the proposed alternative to perform up to 50 and 75 percent of the examinations in the first and second period of the inspection interval instead of the Code-allowed maximum of 34 and 67 percent, are acceptable on the basis that the alternatives would provide an acceptable level of quality and safety. Therefore, the proposed alternatives of Relief Requests RR-21 and RR-13 are authorized for the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i).

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ACCESSION NO.: ML032930264 *Safety evaluation provided **See previous concurrence

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

REQUEST FOR RELIEF

AMERGEN ENERGY COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

DOCKET NO. 50-289

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 55a(g), (10 CFR 50.55a(g)), except where specific written relief has been granted by the Nuclear Regulatory Commission (NRC or the Commission) pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) of 10 CFR states, in part, that 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 pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) 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 ISI Code of record for the Three Mile Island Nuclear Station, Unit 1 (TMI-1), third 10-year ISI interval is the 1995 Edition with 1996 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in

10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

The licensee is required to perform ISIs in accordance with ASME Code, Section XI, which specifies that for each successive 10-year ISI interval, 100% of Examination Category B-F welds and 25% of Examination Category B-J welds in Class 1 piping greater than 1 inch in nominal diameter be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors. For Examination Category C-F piping welds in Class 2 piping, 7.5% of non-exempt welds shall be selected for volumetric and/or surface examination.

By letter dated October 1, 2002, AmerGen Energy Company, LLC (AmerGen or the licensee), submitted Relief Requests RR-21, Revision 0, and a modification to Relief Request RR-13 and proposed to use a risk-informed inservice inspection (RI-ISI) program for a subset of ASME Code, Class 1 and Class 2 piping (Examination Categories B-F, B-J, and C-F) welds, as an alternative to the ASME Code, Section XI requirements. The proposed RI-ISI program follows a previously approved RI-ISI methodology delineated in Electric Power Research Institute (EPRI) TR-112657.

The licensee stated that the existing augmented ISI programs implemented in response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to [reactor coolant system] RCS," NRC Bulletin 88-11, "Pressurizer Surge Line Stratification," and Information Notice 93-020, "Thermal Fatigue Cracking of Feedwater Piping to Steam Generators," are subsumed into the RI-ISI program. As indicated in Table 6-2 of EPRI TR-112657, these degradation mechanisms are all addressed by the evaluation of thermal fatigue and, therefore, these programs may be subsumed into the RI-ISI program. All other existing augmented ISI programs are unaffected by the proposed RI-ISI program.

2.0 REGULATORY EVALUATION

2.1 Components for Which Relief is Requested

ASME Code, Class 1 and 2 piping welds under Examination Categories B-F, C-F-1, and C-F-2. The Examination Item Numbers are B5.10, B5.20, B9.11, B9.21, B9.31, B9.32, B9.40, C5.11, C5.21, C5.51, C5.61, and C5.81.

2.2 Code Requirements

ASME Code, Section XI, 1995 Edition through the 1996 Addenda, Table IWB 2500-1, Examination Category B-F requires a volumetric and/or surface examination on all piping welds for Item Numbers B5.10 and B5.20.

Table IWB 2500-1, Examination Category B-J requires a volumetric and/or surface examination on all piping welds for Item Numbers B9.11, B9.21, B9.31, B9.32, and B9.40.

Table IWB 2500-1, Examination Categories C-F-1 and C-F-2 require volumetric and/or surface examinations for Item Numbers C5.11, C5.21, C5.51, C5.61, and C5.81.

IWB-2430, “Additional Examinations,” requires that any indications revealed that exceed the acceptance standards of Table IWB-3410-1 shall be extended to include additional examinations during the same outage. The additional examinations shall include an additional number of welds, areas, or parts, that were scheduled to be performed during the same inspection period. If the additional examinations revealed any indications exceeding the acceptance standards of Table IWB 3410-1, the examinations shall be further extended to include additional examinations during the same outage. The additional examinations shall include all remaining welds, areas, or parts of similar material and service subject to the same type of flaws or relevant conditions.

IW-2430, “Additional Examinations,” requires that any indications revealed that exceed the acceptance standards of Table IWC-3410-1 shall be extended to include additional examinations during the same outage. The additional examinations shall include an additional number of welds, areas, or parts equal to 20% of the number of welds, areas, or parts that are scheduled to be performed during the interval. If the additional examinations detect further indications exceeding the allowable standards of IWC-3410-1, the remaining number of welds, areas, or parts of similar material and service subject to the same type of flaws or relevant conditions shall be examined.

2.3 Proposed Alternative

The licensee proposes to use the alternative of utilizing the examination methodology and selection criteria of EPRI TR-112657, Revision B-A, “Revised Risk-Informed Inservice Inspection Evaluation Procedure.” In lieu of the evaluation and sample expansion requirements of EPRI TR-112657, Revision B-A, Section 3.6.6.2, “RI-ISI Selected Examinations,” TMI-1 will utilize the requirements of Subarticle 2430, “Additional Examinations,” which is contained in Code Case N-578-1.

2.4 Licensee Basis for Relief

In a letter from W. H. Bateman, NRC, to G. L. Vine, EPRI, dated October 28, 1999, “Safety Evaluation Report Related to EPRI Risk-Informed Inservice Inspection Evaluation Procedure,” the NRC stated that the topical report was acceptable for referencing in licensing applications.

The alternative criteria for additional examinations contained in Code Case N-578-1 provides more guidance for examination method and categorization for parts to be examined.

2.5 Staff’s Evaluation

Pursuant to 10 CFR 50.55a(a)(3)(i), the staff has reviewed and evaluated the licensee’s proposed RI-ISI program, based on guidance and acceptance criteria provided in the following documents: EPRI TR-112657; NRC’s SE to EPRI TR-112657 (Reference 4); Regulatory Guides (RGs) 1.174 (Reference 5) and 1.178 (Reference 6); and Standard Review Plan (SRP), Chapter 3.9.8 (Reference 7).

2.5.1 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, the licensee provided the results of an engineering analysis of the proposed changes, using a combination of traditional

engineering analysis and supporting insights from the Probablistic Risk Assessment (PRA). The licensee stated that the results of the engineering analysis demonstrate that the proposed changes are consistent with the principles of defense-in-depth because the evaluation first determines the susceptibility of components (i.e., a weld on a pipe) to a particular degradation mechanism that may be a precursor to a leak or rupture, and then performs an independent assessment of the consequence of a failure at that location.

As stated in Section 2.3 of the submittal, the existing augmented ISI program implemented in response to NRC Bulletin 79-17, "Stagnant Borated Water Systems," Generic Letter (GL) 89-13, "Service Water Integrity Program," GL 89-08, "Flow Accelerated Corrosion (FAC)," and Branch Technical Position MEB 3-1, "High Energy Line Breaks," is not affected nor changed by the RI-ISI program. However, elements that are covered by these augmented programs were included in the consequence assessment, degradation assessment, and risk categorization evaluations to determine whether the affected piping was subject to damage mechanisms other than those addressed by the augmented program. If another damage mechanism was identified, the element was retained within the scope of consideration for element selection as part of the RI-ISI program. When inspections are required under the RI-ISI and augmented programs, all inspection requirements for both RI-ISI and augmented programs are met. If no other damage mechanism was identified, the element was excluded from the RI-ISI element selection population (i.e., not included in the population of elements from which 25% or 10% must be selected for inspection) and retained in the appropriate augmented inspection program. The licensee's approach deviates from the approved methodology because the methodology in TR-112657 includes all elements in the RI-ISI element selection population but allows crediting up to 50% of the augmented inspections as RI-ISI element inspections. The deviation is acceptable because inspections required only in the augmented programs are not credited as RI-ISI inspections, elements in the augmented programs will continue to be inspected for the appropriate degradation mechanisms, and the RI-ISI program will address other damage mechanisms.

The methodology in EPRI-112657 requires that piping systems within the scope of the RI-ISI program be divided into piping segments. Pipe segments are defined as lengths of pipe whose failure (anywhere within the pipe segment) would lead to the same consequence and which are exposed to the same degradation mechanisms. That is, some lengths of pipe whose failure would lead to the same consequence may be split into two or more segments when two or more regions are exposed to different degradation mechanisms. The licensee reported no deviations from the definition of piping segments approved by the staff in the EPRI report. The staff concludes that the definition of segments performed by the licensee for this application did not deviate from the approved methodology and is, therefore, acceptable.

The licensee's submittal states that failure potential was assessed (as presented in Table 2 of the submittal) utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in EPRI TR-112657. The staff concludes that the licensee has met the SRP 3.9.8 guidelines to confirm that a systematic process was used to identify the component's (i.e., pipe segments) susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture.

Additionally, the licensee stated that the consequences of pressure boundary failures were evaluated and ranked based on their impact on core damage and large early release, and that

the impact due to both direct and indirect effects was considered using guidance provided in EPRI TR-112657. The licensee reported no deviations from the consequence evaluation methodology approved by the staff in the EPRI report. The staff concludes that the consequence evaluation performed by the licensee for this application did not deviate from the approved methodology and is, therefore, acceptable.

2.5.1 Probablistic Risk Assessment

The licensee used the TMI-1 Nuclear Station 2000 PRA Model TMIL2RV2, August 2000, to evaluate the consequences of pipe rupture for the RI-ISI assessment. This version of the risk model is an update to the individual plant examination (IPE) model. In Reference 2, the licensee stated the baseline core damage frequency (CDF) estimated from the TMIL2RV2 PRA model is 4.02E-5/year and the baseline large early release frequency (LERF) estimated is 2.81E-6/year.

The original IPE was submitted to the NRC on May 20, 1993. The SE of the IPE, dated December 19, 1996, concluded that the TMI-1 IPE satisfied the intent of GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," but did not include a containment phenomena sensitivity analysis requested by GL 88-20. A Boiling Water Reactor Owners Group (BWROG) Probablistic Safety Assessment (PSA) Peer Review/Certification Review was performed in 2000. The review team identified three areas for improvement: (1) PRA maintenance and updated procedures; (2) thermal-hydraulic analysis documentation; and (3) containment performance analysis. AmerGen has introduced and implemented a “Full Power Internal Events PRA Model Update” procedure at the TMI-1 site and is improving the thermal-hydraulic documentation. These two improvements relate to procedure and documentation issues that will not directly affect the PRA model or quantitative results. If the improved procedure and documentation identifies errors in the PRA up-date and thermal hydraulic analyses, respectively, the monitoring and feedback requirements of an RI-ISI will guide the need to re-evaluate the RI-ISI program.

Issues regarding the containment evaluation and, therefore, the LERF estimates were identified by the staff during the review of the IPE completed in 1996, and peer review team during the PSA Certification Review in 2000. The staff identified the lack of sensitivity studies. In Reference 2, the licensee reported an evaluation of the conditional large early release probability (CLERP) values used in the risk ranking that might be affected by changes in key assumptions for which sensitivity studies have not been performed. The licensee stated that changes in key assumptions would need to increase the CLERP by 70% to 200% to cause a change in the risk ranking of any segment, and that required changes of this magnitude make it highly unlikely that there would be any change in the risk ranking due to changes in the key assumptions. Sensitivity studies identify the range of results that are expected given reasonable variations of input parameters, and do not directly lead to the selection of different input parameters. The peer review recommended that work be completed in validating key assumptions related to LERF, reviewing the analyses based on the Modular Accident Analysis Program computer program used to support the LERF evaluation, and reviewing the fission product scrubbing analyses. In Reference 1, the licensee reported that the peer review recommendations were addressed and changes were incorporated into the model used to support the submittal.

As discussed above, recommendations from the peer review have been incorporated into the PRA. The sensitivity studies requested in GL 88-20 have not been performed. However, sensitivity studies do not necessarily lead to modifications in key assumptions and the staff concludes that the likelihood that further modifications would cause the large magnitude of changes required to affect the risk ranking is remote. Therefore, the staff concludes that the technical adequacy of the LERF analysis is sufficient to support the relief request.

The staff did not review the PRA model to assess the accuracy of the quantitative estimates. The staff recognizes that the quantitative results of the PRA model are used as order of magnitude estimates to support the assignment of segments into three broad consequence categories. Inaccuracies in the models or in assumptions large enough to invalidate the broad categorizations developed to support the RI-ISI should have been identified during the staff's review of the IPE and by the licensee's model update control program that included peer review of the PRA model by a certification team. Minor errors or inappropriate assumptions will affect only the consequence categorization of a few segments and will not invalidate the general results or conclusions.

As required by Section 3.7 of the EPRI Topical Report (TR), the licensee evaluated the change in risk expected from replacing the current ISI program with the RI-ISI program. The calculations estimated the change in risk due to removing locations and adding locations to the inspection program. The licensee deviated from the EPRI methodology by excluding some elements from the population of elements from which RI-ISI locations for inspection were selected. In Reference 1, the licensee stated that the change in risk estimates included a quantitative evaluation of the change in risk due to changes in the ISI program for each piping element in the scope of the RI-ISI evaluation. Therefore, excluding some elements from the population of elements for possible inspection does not affect the change in risk calculations.

The licensee used the failure frequencies developed in EPRI TR-111880 (Reference 8) to support the estimate for the change in risk. The nonproprietary version of EPRI TR-111880 (Reference 9) illustrates the characteristics and format of the information used, but does not include the calculated parameters. The change in risk is calculated utilizing the Markov model described in EPRI TR-111061 (Reference 10) to estimate the "inspection efficiency factor" (IEF). The IEF calculation incorporates the time between ISI inspections and the time between opportunities to detect a leak together with the probability of detection (POD) to estimate the reduction in pipe failure frequency arising from including the element in an ISI program. The method is the same as that used by the licensee, and approved by the staff, in the Dresden RI-ISI submittal (Reference 11). The staff finds the calculations acceptable to use in support of this RI-ISI submittal.

The staff finds the licensee's process to evaluate and bound the potential change in risk reasonable because it 1) accounts for the change in the number and location of elements inspected, 2) recognizes the difference in degradation mechanism related to failure likelihood, and 3) considers the synergistic effects of multiple degradation mechanisms within the same piping segment.

In Reference 1, the licensee estimated an aggregate increase of 8.8E-08/year for CDF and 5.0E-9/year for LERF for the transition from the Section XI to the RI-ISI program. The estimated change in CDF and LERF for each system is provided in Table 6 of Reference 1. System level and aggregate estimates of the changes in CDF and LERF are less than the corresponding guideline values in the EPRI-TR. The staff finds that re-distributing the welds to

be inspected, with consideration of the safety significance of the segments, provides assurance that segments whose failure have a significant impact on plant risk receive an acceptable and often improved level of inspection.

2.4.3 Integrated Decision Making

As described in the licensee's submittal, an integrated approach is utilized in defining the proposed RI-ISI program by considering, in concert, the traditional engineering analysis, the risk evaluation, the implementation of the RI-ISI program, and performance monitoring of piping degradation. This is consistent with the guidelines given in RG 1.178.

The selection of pipe segments to be inspected is described in Section 3.5 of the submittal using the results of the risk category ranking and other operational considerations. Table 3 of the submittal provides the number of elements (welds) in each risk category within the scope of the RI-ISI program. Table 4 provides a summary table comparing the number of inspections required under the existing ASME Code, Section XI, ISI program with the alternative RI-ISI program.

As required by Section 6.4 of the EPRI TR, the licensee has completed an evaluation of existing relief requests to determine if any should be withdrawn or modified due to changes that occur from implementing the RI-ISI program. The licensee states, in its submittal, that any examination location where greater than 90% volumetric coverage can not be obtained, the process outlined in the EPRI TR-112657 will be followed. The licensee withdrew Relief Request RR-01, which requested approval to perform alternative examination of Categories B-F and B-J welds where piping and nozzle to safe-end welds are located inside the reactor vessel primary shield wall are inaccessible. Relief Request RR-01 is no longer needed in the RI-ISI program, because the EPRI element selection process for Examination Category R-A has allowed for examination of alternate, similarly risk-ranked welds. However, a new relief request will be generated for any RI-ISI examination location for which greater than 90% coverage is not achieved.

Through Relief Request RR-13, the licensee has requested to implement an alternative to the Code-required percentages of examination during each inspection period for components examined within the scope of the RI-ISI program. The proposed alternative is based on Code Case N-598, "Alternative Requirements to Required Percentages of Examinations," which has been authorized for the third 10-year ISI interval of TMI-1. The proposed alternative allows the licensee to perform up to 50% and 75% of the examinations in the first and second period of the inspection interval instead of the ASME Code examinations allowed maximum of 34% and 67%. The licensee's basis for the alternative is the fact that, due to longer fuel cycles, one of the inspection periods in the interval may have one refueling outage which may not provide sufficient outage time to complete the ASME Code-required percentage of examinations for the inspection period. However, the proposed alternative allows taking credit for a greater percentage of examinations than that of the ASME Code and, thereby, provides more flexibility to complete the RI-ISI or the ASME Code-required examinations in a given period. The staff believes that by allowing the maximum percentages of examinations to be 50% and 75% in the first and the second inspection periods, respectively, any degradation or relevant condition can be detected early in the interval and appropriate corrective measures can be taken to preclude failures of components. Therefore, the implementation of the proposed alternative would

provide an acceptable level of quality and safety and the staff authorizes this alternative pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval.

The objective of the ISI required by ASME Code, Section XI is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. The RI-ISI program is judged to meet this objective. Further, the risk-informed selection process is a technically sound "inspection for cause" program. The process not only identifies the risk-important areas of the piping systems, but also defines the appropriate examination methods, examination volumes, procedures, and evaluation standards necessary to address the degradation mechanism(s) of concern and the ones most likely to occur at each location to be inspected. Thus, the location selection process is acceptable since it is consistent with the process described in EPRI TR-112657, which takes into account defense-in-depth and includes coverage of systems subjected to degradation mechanisms in addition to those covered by augmented inspection programs.

Chapter 4 of EPRI TR-112657 provides guidelines for the areas and/or volumes to be inspected as well as examination methods, acceptable standards, and evaluation standards for each degradation mechanism. Based on the review of the cited portion of the EPRI report, the staff concludes that the examination methods for the proposed RI-ISI program are acceptable since they are selected based on specific degradation mechanisms, pipe sizes, and materials of concern.

The licensee proposed to inspect socket welds by the VT-2 examination method based on the guidance from Table 1 (Examination Categories) of Code Case N-578-1, since there is no specific guidance provided in EPRI TR-112657. In note 12 to Table 1 of Code Case N-578-1, it is stated that socket welds require only VT-2 examinations during each refueling outage. VT-2 examination is effective in identifying leakage when the cracks become through-wall in the welds. The staff notes that due to the weld geometry limitations, ultrasonic examinations of the socket welds are not practical as no meaningful results can be obtained from such examinations. The staff also notes that Table IWB-2500-1 of the Code requires surface examinations of the socket welds. Surface examinations are an effective method for the detection of cracks initiated from the weld outside surfaces by causes such as the external chloride stress corrosion cracking or fatigue resulting from high bending stresses or vibration. In its response to the staff's request for additional information, the licensee stated that the RI-ISI evaluation performed for TMI-1 did not identify any outside diameter surface initiated degradation. Based on the consideration discussed above, the staff has determined that the VT-2 examination of socket welds, in lieu of volumetric or surface examinations, is acceptable for TMI Unit 1 because there is reasonable assurance that the proposed examinations will not lead to degraded piping performance when compared to the existing performance levels.

The licensee also proposed to use the guidance from Table 1 of Code Case N-578-1 for examination of elements not subject to a damage mechanism (Item Number R1.20). This is due to the fact that EPRI TR-112657 did not provide any specific guidance for the examination of the referenced elements beyond the number of elements to be examined. In Table 1 of Code Case N-578-1, the elements in Item Number R1.20 are required to be examined by a volumetric method. In addition, for the examination of elements with full penetration welds, an expanded examination volume is specified in Note 1 of Table 1. Note 1 requires that the length for the examination volume shall be increased to include ½ inch, beyond each side of the base metal thickness transition or counterbore. Based on the above, the staff has determined that

the licensee's proposed examination method and volume for elements not subject to a damage mechanism (Item No. R1.20) is acceptable. This is based on the consideration that the proposed volumetric examination method is consistent with the guidance provided in EPRI TR-112657 and the proposed examination volume is similar to, or more conservative than, that required by the ASME Code.

Code Case N-578-1 has not been approved by NRC for generic use. Only the specific portions of the Code Case cited in this safety evaluation (SE) or in EPRI TR-112657 are accepted for use in the RI-ISI program at TMI-1. It is necessary to point out that this SE does not endorse the use of Code Case N-578 in its entirety.

2.5.4 Implementation and Monitoring

Performance-based implementation and performance monitoring strategies require careful consideration by the licensee, and are addressed in Element 3 of RG 1.178 and SRP Section 3.9.8. The objective of Element 3 is to assess performance of the affected piping systems under the proposed RI-ISI program by utilizing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. Pursuant to 10 CFR 50.55a(a)(3)(i), a proposed alternative, in this case the implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

The licensee states that upon approval of the RI-ISI program, procedures that comply with the EPRI TR-112657 guidelines will be prepared to implement and monitor the RI-ISI program. The remaining portions of the ASME Code, Section XI, ISI program that are unaffected by the proposed RI-ISI program will be retained.

The licensee states in Section 4 of the submittal (Reference 1) that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of safety significant piping locations. The submittal also states that, as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME Code period basis and that significant changes may require more frequent adjustment as directed by NRC bulletin or GL requirements, or by industry and plant-specific feedback.

The licensee addressed additional examinations in References 1 and 2. Section 3.5 of the initial submittal (Reference 1) stated that examinations performed that reveal flaws or relevant conditions exceeding the applicable acceptance standards shall be extended to include additional examinations. These additional examinations shall include piping structural elements with the same postulated failure mode and the same or higher failure potential. Additional examinations will be performed on these elements up to a number equivalent to the number of elements with the same postulated failure mode originally scheduled for that fuel cycle. If the additional required examinations reveal flaws or relevant conditions exceeding the acceptance standards, the examinations shall be further extended. Reference 2 provided additional information to address the time frame for the second sample expansion. The licensee stated, in Reference 2, that "AmerGen will consider all R-A category welds as ASME Class 1, and will follow the provisions of the 1995 Edition through 1996 Addenda of ASME Section XI Code, IWB-2430(b), with regards to the second sample expansion. The required additional examinations will be performed during the same outage that the relevant condition was detected." The staff finds the licensee's approach acceptable since the additional

examinations, if required, will be performed during the outage that the indications or relevant conditions are identified.

The proposed periodic program reporting requirements meet existing ASME Code requirements and applicable regulations and, therefore, are considered acceptable. The staff finds that the proposed process for RI-ISI program updates meets the guidelines of RG 1.174, which provide that risk-informed applications should include performance monitoring and feedback provisions; therefore, the licensee's proposed process for program updates is acceptable.

TMI-1 is currently in the first period of the third ISI interval. The TMI-1 RI-ISI program will be integrated into the third 10-year ISI inspection interval, starting from the second period of the interval. AmerGen will take credit for the ASME Code, Section XI, ISI inspection performed during the first period of the third 10-year ISI interval. The staff finds this acceptable because it is consistent with the guidance provided in the NRC staff's SE, dated October 28, 1999, related to EPRI risk-informed ISI evaluation procedure (EPRI TR-112657, Revision B-A, December 1999). The staff's guidance in the referenced SE stated, in part, that the implementation of the RI-ISI program at any time within an inspection interval is acceptable as long as the examination schedules are consistent with the interval requirements contained in Article IWA-2000 of ASME Code, Section XI as applied to Inspection Program B.

Pursuant to 10 CFR 50.55a(a)(3)(i), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that the proposed alternatives will provide an acceptable level of quality and safety. In this case, the licensee has proposed an alternative to use the risk-informed process described in the NRC-approved EPRI TR-112657. As discussed in Section 3.0 above, the staff concludes that the licensee's proposed RI-ISI program, which is consistent with the methodology described in EPRI TR-112657, will provide an acceptable level of quality and safety with regard to the number of inspections, location of inspections, and method of inspections.

The AmerGen methodology includes an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth quality is not degraded, in that the methodology provides reasonable assurance that any reduction in inspections will not lead to degraded piping performance when compared to the existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of system piping. The EPRI TR-112567 RI-ISI methodology is a process-driven approach, in which the process identifies high risk-significant pipe segment locations to be inspected. The AmerGen RI-ISI program demonstrates that unacceptable risk impacts will not occur and, thus, implementation of the RI-ISI program satisfies the acceptance guideline of RG 1.174.

The AmerGen methodology also considers implementation and performance monitoring strategies. Inspection strategies ensure that failure mechanisms of concern have been addressed and there is adequate assurance of detecting damage before structural integrity is affected. The risk significance of piping segments is taken into account in defining the inspection scope for the RI-ISI program.

System pressure tests and visual examination of piping structural elements will continue to be performed on all Class 1, 2, and 3 systems in accordance with ASME Code, Section XI. The RI-ISI program applies the same performance measurement strategies as the existing ASME

Code requirements and, in addition, increases the inspection volumes at weld locations that are susceptible to thermal fatigue.

As discussed above, the staff concludes that the licensee's proposed RI-ISI program is an acceptable alternative to the current ISI program for Class 1 and 2 piping welds at TMI-1 and, therefore, the proposed alternatives of Relief Requests RR-21 and RR-13 are authorized for the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternatives will provide an acceptable level of quality and safety.

3.0 CONCLUSION

Based on the above evaluation, the staff has determined that the licensee's proposed RI-ISI program is an acceptable alternative to the current ISI program for Class 1 and 2 piping welds at TMI-1. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), relief is granted for TMI-1, for the third 10-year ISI interval. This granting of relief is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the authorized nuclear inservice inspector.

4.0 REFERENCES

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2. Gallagher, M. P., Director, Licensing and Regulatory Affairs, AmerGen Energy Company, LLC, letter to the U.S. Nuclear Regulatory Commission, on *Third Ten-Year Interval Inservice Inspection (ISI) Program, Response to Request for Additional Information, Risk-Informed Inservice Inspection Program Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds,* dated July 7, 2003.

3. EPRI TR-112657, Revision B-A, *Revised Risk-Informed Inservice Inspection Evaluation Procedure,* Final Report, December 1999

4. NRC Staff Safety Evaluation on EPRI TR-112657, Revision B-A, dated October 28, 1999.

5. NRC Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,* July 1998.

6. NRC Regulatory Guide 1.178, *An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping,* September 1998.

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