



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

August 17, 2011

Mr. Thomas Joyce  
President and Chief Nuclear Officer  
PSEG Nuclear LLC  
P.O. Box 236, N09  
Hancocks Bridge, NJ 08038

SUBJECT: SAFETY EVALUATION OF RELIEF REQUEST TO CONTINUE USING A RISK-  
INFORMED INSERVICE INSPECTION PROGRAM FOR SALEM NUCLEAR  
GENERATING STATION, UNIT NO. 1 (TAC NO. ME4918)

Dear Mr. Joyce:

By letter dated October 21, 2010, as supplemented by letter dated April 12, 2011, PSEG Nuclear LLC (PSEG) submitted relief request S1-I4R-105 for Salem Nuclear Generating Station (Salem), Unit No. 1. The proposed relief would allow PSEG to continue using a risk-informed inservice inspection program as an alternative to the examination requirements specified in Section XI of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code) for certain Class 1 and 2 piping welds.

The U.S. Nuclear Regulatory Commission staff has completed its review of the subject relief request as documented in the enclosed Safety Evaluation (SE). Our SE concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations*, the proposed alternative is authorized for the remainder of the fourth 10-year ISI interval at Salem Unit No. 1.

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

If you have any questions concerning this matter, please contact the Salem Project Manager, Mr. Richard Ennis, at (301) 415-1420.

Sincerely,

A handwritten signature in black ink, appearing to read "Harold K. Chernoff", is written over the typed name.

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

Docket No. 50-272

Enclosure: Safety Evaluation

cc w/encl: Distribution via Listserv



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST S1-I4R-105

FOR THE FOURTH INSERVICE INSPECTION INTERVAL

PSEG NUCLEAR LLC

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

DOCKET NO. 50-272

1.0 INTRODUCTION

By letter dated October 21, 2010, as supplemented by letter dated April 12, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML103060462 and ML111030186, respectively), PSEG Nuclear LLC (PSEG, the licensee) submitted relief request S1-I4R-105 for Salem Nuclear Generating Station (Salem), Unit No. 1. The subject relief request is for the fourth 10-year inservice inspection (ISI) interval at Salem Unit No. 1 which began on May 20, 2011, and is scheduled to end on May 20, 2021.

Relief request S1-I4R-105 would allow PSEG to continue using a risk-informed (R-I) ISI program as an alternative to the examination requirements specified in Section XI of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code) for certain Class 1 and 2 piping welds. The proposed alternative would be a continuation of the RI-ISI program used during the third 10-year ISI interval at Salem Unit No. 1. The Nuclear Regulatory Commission (NRC or the Commission) authorized PSEG to implement a RI-ISI program during the third 10-year ISI interval by letter dated October 1, 2003 (ADAMS Accession No. ML032390034).

2.0 REGULATORY EVALUATION

The ISI of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific 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.

Enclosure

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulation requires that inservice examination of components and system pressure tests conducted during the first 10-year interval, and subsequent intervals, comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

As stated above, the subject relief request is for the fourth 10-year ISI interval at Salem Unit No. 1 which began on May 20, 2011, and is scheduled to end on May 20, 2021. The applicable ISI Code of Record for the fourth 10-year ISI interval is the 2004 Edition of Section XI of the ASME Code.

Risk-informed applications are assessed by the NRC staff against Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 4). RG 1.174 states that a probabilistic risk assessment (PRA) used in risk-informed licensing actions should be performed in a manner that is consistent with accepted practices. The NRC staff utilized RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Reference 5) to determine whether the technical adequacy of the PRA used to support PSEG's submittal is consistent with accepted practices. The NRC staff also assessed the licensee's proposed RI-ISI program against the guidance in RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping" (Reference 6), and Standard Review Plan (SRP) Chapter 3.9.8, "Standard Review Plan for the Review of Risk-Informed Inservice Inspection of Piping" (Reference 7).

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3), PSEG proposed to use a RI-ISI program for certain ASME Code Class 1 and 2 piping welds (Class 1 Category B-F and B-J piping welds and Class 2 Category C-F-1 and C-F-2 piping welds) as an alternative to the examination requirements in the 2004 Edition of Section XI of the ASME Code. The ASME Code requires, in part, that a certain percentage of Category B-F, B-J, C-F-1, and C-F-2 pressure-retaining piping welds receive ISI during each 10-year ISI interval. Specifically, 100 percent of all B-F welds and 25 percent of all B-J welds greater than 1-inch nominal pipe size must be selected for volumetric or surface examination, or both, on the basis of existing stress analyses. For Categories C-F-1 and C-F-2 piping welds, 7.5 percent of non-exempt welds must be selected for volumetric or surface examination, or both. The proposed alternative is sought for the fourth 10-year ISI interval for Salem Unit No. 1.

The Salem RI-ISI program was initially submitted during the third 10-year ISI interval. This initial RI-ISI program was developed in accordance with Electric Power Research Institute (EPRI) Topical Report (TR) TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection

Evaluation Procedure" (Reference 1), as supplemented by ASME Code Case N-578-1 (Reference 2). The NRC staff authorized PSEG to implement the RI-ISI program during the third 10-year ISI interval by letter dated October 1, 2003 (ADAMS Accession No. ML032390034). As discussed in the safety evaluation (SE) enclosed with the letter dated October 1, 2003, the NRC staff determined that the Salem RI-ISI program is consistent with the guidelines contained in EPRI TR-112657. The guidelines state that industry and plant-specific piping failure information, if any, is to be utilized to identify piping degradation mechanisms and failure modes, and consequence evaluations are to be performed using PRAs to establish piping segment safety ranking for determining new inspection locations. The NRC staff concluded that the licensee's application of the EPRI TR-112657 approach was acceptable with regard to the number, locations, and methods of inspections, and provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3). The NRC's SE also concluded that the implementation of the RI-ISI program would have a small impact on risk, consistent with the guidelines in RG 1.174. In its letter dated October 21, 2010, the licensee states that the RI-ISI program has been updated and continues to meet EPRI TR-112657 and RG 1.174 acceptance guidelines.

The information provided by the licensee in support of the request has been evaluated and the basis for disposition is documented below.

### 3.2 NRC Staff Evaluation

The NRC staff has reviewed and evaluated the licensee's proposed RI-ISI program, including those portions related to the applicable methodology and processes, based on guidance and acceptance guidelines provided in RGs 1.174 and 1.178, in SRP 3.9.8, and in EPRI-TR-112657, Revision B-A. An acceptable RI-ISI program plan is expected to meet the five key principles discussed in RGs 1.174 and 1.178, SRP 3.9.8, and the EPRI-TR, as stated below:

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

The first key principle states that the proposed change must meet the current regulations unless it is explicitly related to a requested exemption. The proposed RI-ISI program is an alternative to the requirements in Section XI of the ASME Code. Alternatives to the ASME Code may be requested by the licensee and authorized by the NRC staff under the provisions of 10 CFR 50.55a(a)(3). Therefore, the NRC staff concludes that the first key principle is met.

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

The fourth key principle requires that, when proposed changes result in an increase in CDF or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement. With respect to the proposed alternative, the change in risk is dependent on the location of inspections in the RI-ISI program compared to the location of inspections that would be performed using the requirements of ASME Code, Section XI. The fourth key principle also requires demonstration of the technical adequacy of the PRA.

As discussed in RGs 1.178 and 1.200, an acceptable change in risk evaluation (and risk-ranking evaluation used to identify the most risk significant locations) requires the use of a PRA of appropriate technical quality that models the as-built and as-operated plant. In the present relief request dated October 21, 2010, and in an April 12, 2011, response to an NRC staff request for additional information (RAI), the licensee provided information on the technical adequacy of its PRA. The licensee reported that Revision 3 of the model was released as a draft in November 2001 in preparation for the Westinghouse Owners Group (WOG) peer review. This version was used for the original RI-ISI submittal. More recently, the Pressurized-Water Reactor Owners Group conducted a peer review based on Regulatory Guide 1.200, Revision 1, in November 2008. The licensee has made changes to the model post-peer review. In its letter dated October 21, 2010, and as clarified in the RAI response dated April 12, 2011, the licensee provided an impact assessment of the open items from the 2008 WOG peer review. The licensee provided its evaluation of all identified gaps indicating that they are not significant to the RI-ISI application. In response to the RAI, the licensee provided justification for less-detailed modeling of certain flooding scenarios based on negligible risk impact. The NRC staff finds the licensee has assessed the technical adequacy of its PRA using the appropriate version of RG 1.200 and the quality of the PRA is sufficient to support the proposed RI-ISI program.

The NRC staff has previously determined that it is not necessary to develop a new deterministic ASME program for each new 10-year interval but, instead, it is acceptable to compare the new proposed RI-ISI program with the last deterministic ASME program. The licensee states in their letter dated October 21, 2010, that, as part of the RI-ISI living program update, the delta risk assessment was re-evaluated. The licensee's evaluation determined that the revised RI-ISI program continues to satisfy the acceptance guidelines of RG 1.174 and EPRI TR-112657 when compared to the last deterministic ASME Code, Section XI inspection program. The NRC staff finds that, based on the statements by the licensee, there is reasonable assurance that implementation of the RI-ISI program would have a small impact on risk, consistent with the guidelines in RG 1.174.

Based on the above considerations, the NRC staff concludes that the fourth key principle is met.

The fifth key principle of risk-informed decision-making requires that the impact of the proposed change be monitored by using performance measurement strategies. As described in the licensee's letters dated October 21, 2010, and April 21, 2011, the RI-ISI program is a living program that requires periodic updating and that, as a minimum, will include reviews of risk ranking of piping segments on an ASME period basis. In addition to the continued application of the approved EPRI methodology, the licensee indicated in its submittals that those welds subject to primary water stress-corrosion-cracking (PWSCC) degradation have been included in an augmented inspection program. The augmented inspections for PWSCC are in accordance with industry guidelines detailed in MRP-139 (Reference 3). Based on the above considerations, the NRC staff concludes that the fifth key principle is met.

In summary, as discussed above, the NRC staff concludes that the proposed RI-ISI program meets the five key principles of risk-informed decision-making. On this basis, the NRC staff further concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative is authorized for the remainder of the fourth 10-year ISI interval at Salem Unit No. 1.

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

## 5.0 REFERENCES

1. EPRI Topical Report TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Final Report dated December 1999 (ADAMS Accession No. ML013470102).
2. ASME Code Case N-578-1, "Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method B, Section XI, Division 1."
3. EPRI Guideline MRP-139, Revision 1, "Material Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline," Final Report dated December 2008 (ADAMS Accession No. ML100970671).
4. NRC RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2, dated May 2011 (ADAMS Accession No. ML100910006).
5. NRC RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, dated March 2009 (ADAMS Accession No. ML090410014).
6. NRC RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping," Revision 1, dated September 2003 (ADAMS Accession No. ML032510128).

7. NUREG-0800, Chapter 3.9.8, "Standard Review Plan for the Review of Risk-Informed Inservice Inspection of Piping," dated September 2003 (ADAMS Accession No. ML032510135).

Principal Contributors: J. Patel  
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Date: August 17, 2011

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Sincerely,

/ra/

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

Docket No. 50-272  
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