April 8, 2002

Mr. John L. Skolds, President
and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, Illinois 60555

SUBJECT: CLINTON POWER STATION, UNIT 1 - RISK-INFORMED INSERVICE INSPECTION PROGRAM, RELIEF REQUEST 4208 (TAC NO. MB3211)

Dear Mr. Skolds:

By letter dated October 15, 2001, as supplemented November 20, 2001, and February 7, 2002, AmerGen Energy Company, LLC (the licensee), requested approval of an alternative risk-informed inservice inspection (RI-ISI) program for the Clinton Power Station (CPS), Unit 1, ISI program for American Society of Mechanical Engineers (ASME) Class 1 and 2 piping welds. The letter consisted of Relief Request 4208 along with an attachment describing the proposed program.

The CPS Unit 1 RI-ISI program was developed in accordance with Electric Power Research Institute (EPRI) Topical Report TR-112657, Revision B-A, using the Nuclear Energy Institute template methodology. The results of our review indicate that CPS's proposed RI-ISI program is an acceptable alternative to the requirements of the ASME Code Section XI for inservice inspection. Therefore, the licensee's request for relief is authorized for the second 10-year ISI interval for CPS, Unit 1, pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternative provides an acceptable level of quality and safety.

The staff's safety evaluation is enclosed.

Sincerely,

/RA/

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-461

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM, RELIEF REQUEST 4208

AMERGEN ENERGY COMPANY, LLC

CLINTON POWER STATION, UNIT 1

DOCKET NO. 50-461

1.0 INTRODUCTION

Current inservice inspection (ISI) requirements for the Clinton Power Station Unit 1(CPS) are contained in the 1989 Edition of Section XI, Division 1 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, entitled *Rules for Inservice Inspection of Nuclear Power Plant Components* (hereinafter referred to as the ASME Code). In a submittal dated October 15, 2001, (Ref. 1), AmerGen Energy Company, LLC, (the licensee), proposed a new risk-informed inservice inspection (RI-ISI) program as an alternative to a portion of its current ISI program. Additional information was provided in letters dated November 20, 2001, (Ref. 2), and February 7, 2002 (Ref. 3).

The RI-ISI program is limited to ASME Class 1 and Class 2 piping welds. The program was developed in accordance with the Electric Power Research Institute (EPRI) methodology contained in the Nuclear Regulatory Commission (NRC) approved EPRI Topical Report EPRI TR-112657, Revision B-A (TR-112657) (Ref. 4).

In the proposed RI-ISI program, piping failure potential estimates were determined using TR-112657 guidance, which utilizes industry piping failure history, plant-specific piping failure history, and other relevant information. Using the failure potential and supporting insights on piping failure consequences from the licensee's probabilistic risk assessment (PRA), a safety ranking of piping segments was established for determination of new inspection locations. The proposed program maintains the fundamental requirements of the ASME Code, such as the examination technology, examination frequency, and acceptance criteria. However, the proposed program reduces the required examination locations significantly while demonstrating that an acceptable level of quality and safety is maintained. Thus, the proposed alternative approach is based on the conclusion that it provides an acceptable level of quality and safety and, therefore, is in conformance with Title 10, Code of Federal Regulations (10 CFR), Part 50.55a(a)(3)(i).

ENCLOSURE

2.0 SUMMARY OF PROPOSED APPROACH

The ASME Code, Section XI, requires that for each successive 10-year ISI interval, 100 percent of Category B-F welds and 25 percent of Category B-J welds for ASME Code Class 1 piping greater than one inch in nominal diameter, be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors. For Category C-F piping welds, 7.5 percent of non-exempt welds shall be selected for volumetric and/or surface examination. The licensee submitted the application as an RI-ISI "template" application. Template applications are short overview submittals intended to expedite preparation and review of RI-ISI submittals that comply with a pre-approved methodology. The licensee proposed to implement the staff-approved RI-ISI methodology set forth in TR-112657.

In accordance with Table 6.2 of the EPRI TR-112657, some augmented inspection programs may be integrated into the RI-ISI program. In accordance with the guidance in TR-112657, thermal fatigue is subsumed into the RI-ISI program since the issues raised by NRC Bulletin 88-08 are all addressed by the thermal fatigue assessment as part of the RI-ISI program. Augmented programs for intergranular stress corrosion cracking (IGSCC) Category B-G (Generic Letter 88-01), service water integrity (Generic Letter 89-13), flow accelerated corrosion (FAC, Generic Letter 89-09), and high energy line break (USNRC Branch Technical Position MEB 3-1) are not subsumed into the RI-ISI program and remain unaffected.

The licensee requested approval of this alternative for the remainder of the second 10-year interval for Unit 1. According to the information provided in Reference 1, CPS Unit 1 is currently in the second 10-year interval that started on January 1, 2000, and ends on December 31, 2009.

The implementation of an RI-ISI program for piping should be initiated at the start of a plant's 10-year ISI interval consistent with the requirements of the ASME Code and Addenda committed to by the licensee in accordance with 10 CFR 50.55a. However, the implementation may begin at any point in an existing interval as long as the examinations are scheduled and distributed consistent with the ASME Code requirements (e.g., the minimum examinations completed at the end of the three inspection periods under ASME Code Program B should be 16 percent, 50 percent, and 100 percent, respectively, and the maximum examinations credited at the end of the respective periods should be 34 percent, 67 percent, and 100 percent). In the licensee's submittal, a commitment was made to achieve these percentages during the first period of the second interval since a portion of the inspections performed during the early part of the first period were completed under the existing ISI program. This approach is considered acceptable by the staff, because it complies with the existing ASME Code inspection interval requirements.

It is also the staff's view that the inspections for the RI-ISI program and for the balance of the ISI program should be on the same interval start and end dates. This can be accomplished by either implementing the RI-ISI program at the beginning of the interval or merging the RI-ISI program into the ISI program for the balance of the inspections if the RI-ISI program is to begin during an existing ISI interval. One reason for this view is that it eliminates the problem of having different Codes of record for the RI-ISI program and for the balance of the ISI program. A potential problem with using two different interval start dates and hence two different Codes of record would be having two sets of repair/replacement rules depending upon which program identified the need for repair (e.g., a weld inspection versus a pressure test).

The staff finds that the CPS Unit 1 RI-ISI program meets the ASME Code and 10 CFR 50.55a requirements for minimum and maximum inspections during inspection periods and intervals, and for program submittal to the NRC.

3.0 EVALUATION

The licensee's submittal was reviewed with respect to the methodology and criteria contained in TR-112657. Further guidance in defining acceptable methods for implementing an RI-ISI program is also provided in Regulatory Guide (RG) 1.174, RG 1.178, and Standard Review Plan (SRP) Chapter 3.9.8 (Refs. 5, 6, and 7).

3.1 Proposed Changes to ISI Program

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee has proposed to implement an RI-ISI program in accordance with the methodology contained in TR-112657 as an alternative to the ASME Code examination requirements for ASME Class 1 and 2 piping for CPS Unit 1. A general description of the proposed changes to the ISI program was provided in Section 3 of the licensee's submittal.

3.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, an engineering analysis of the proposed changes is required using a combination of traditional engineering analysis and supporting insights from the PRA. The licensee elaborated as to how the engineering analyses conducted for the CPS RI-ISI program ensures that the proposed changes are consistent with the principles of defense-in-depth. This is accomplished by evaluating a location's susceptibility to a particular degradation mechanism and then performing an independent assessment of the consequence of a failure at that location. No changes to the evaluation of design-basis accidents in the final safety analysis report are being made by the RI-ISI process. Therefore, sufficient safety margins will be maintained.

The licensee's RI-ISI program at CPS is applicable to ASME Class 1 Categories B-F and B-J and ASME Class 2 Categories C-F-1 and C-F-2 piping welds. The licensee stated in its submittal that other non-related portions of the ASME Code will be unaffected by this program. Piping systems defined by the scope of the RI-ISI program were divided into piping segments. Pipe segments are defined as lengths of pipe whose failure leads to similar consequences and that are exposed to the same degradation mechanisms. That is, some lengths of pipe whose failure would lead to the same consequences may be split into two or more segments when two or more regions are exposed to different degradation mechanisms.

The submittal states that failure potential categories were generated utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in TR-112657. The degradation mechanisms identified in the submittal include thermal fatigue, IGSCC, erosion-cavitation (E-C), and flow accelerated corrosion (FAC).

Augmented programs for IGSCC Category B-G (Generic Letter 88-01), service water integrity (Generic Letter 89-13), FAC (Generic Letter 89-08), and high energy line break (USNRC Branch Technical Position MEB 3-1) are not subsumed into the RI-ISI program and remain unaffected. Elements in the scope of CPS that were also 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 percent or 10 percent must be selected for inspection) and retained in the appropriate augmented inspection program. The CPS 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 percent of the augmented inspections as RI-ISI element inspections. The deviation as described in Reference 1 is acceptable since 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 licensee stated that the consequences of pressure boundary failure were evaluated and ranked based on their impact on core damage probability and large early release probability. Both direct and indirect effects of pipe ruptures were evaluated and included in the consequence characterization. The licensee used its PRA models to directly support its estimation of the consequences of pressure boundary failure for each piping element in the evaluation. The licensee reported no deviations from the segment definition and consequence characterization methodology approved by the staff in TR-112657 and the analyses are acceptable.

3.3 Probabilistic Risk Assessment

To support the RI-ISI submittal, the licensee used the *Clinton Power Station Revision 3a PRA Model,* dated December 29, 2000, as stated in Reference 2. The licensee stated in Reference 1 that the PRA used to support their submittal was an updated version on the CPS Individual Plant Examination and that the *Revision 3a PRA Model* calculated the Core Damage Frequency (CDF) to be 1.4E-5/yr and calculated the Large Early Release Frequency (LERF) to be 1.4E-7/yr.

The licensee submitted its individual plant examination (IPE) on September 23, 1992. The staff evaluation report on the IPE submittal was issued in November 1996, and concluded that the IPE satisfied the intent of Generic Letter 88-20. However, the staff states in the conclusion of their SER that "... the licensee did not provide an adequate technical justification for: (1) the extensive use of generic data, (2) the credit taken for equipment repair (other than diesel generator), (3) the credit taken for containment performance under hydrogen combustion upon power recovery (negligible failure probability) and (4) the credit taken for containment performance under ex-vessel steam-explosion conditions (no containment failure)…." In

Reference 2 , the licensee stated that the CPS PRA used for the RI-ISI submittal includes substantial input from plant specific data. The licensee addressed the issue of credit given for repair of equipment by stating that since the PRA results are used to support the assignment of pipe failures into broad consequence categories, the impact of CPS repair and recovery times on the RI-ISI analysis is minimal. The licensee stated that subsequent updates of the PRA explicitly address the issue of credit taken for containment performance under hydrogen combustion upon power recovery. The licensee further noted that since a sensitivity study performed for a previous license amendment request indicated that the conditional probability of a large early release given core damage due to a Station Blackout is less than 0.1, the RI-ISI evaluation would be based upon the CDF results and not the LERF results. The licensee also stated that the issue of ex-vessel steam explosions has been addressed in updates of the PRA.

The licensee stated in its submittal dated October 15, 2001, that it maintains and updates its PRA to be representative of the as-built, as-operated plant. The licensee's Project Instructions define the process for updating the PRA to ensure that it represents the as-built, as-operated plant. Additionally, the licensee's Clinton Power Station PRA underwent the Boiling Water Reactors peer review certification in August 2000. The licensee reported that the results of this peer review process indicate that the level of detail and quality of the Clinton Power Station PRA support this risk-informed application.

The approved TR-112657 requires that functions relied upon to mitigate external events and to mitigate transients during operation modes outside the scope of the PRA also be systematically included in the categorization. The licensee reported no deviations from the approved methodology in this area and therefore, the staff finds the evaluation acceptable.

The staff did not review the PRA analysis to assess the accuracy of the quantitative estimates. Quantitative results of the PRA are used, in combination with a quantitative characterization of the pipe segment failure likelihood, to support the assignment of segments into broad safety significance categories reflecting the relative importance of pipe segment failures on CDF and LERF, and to provide an illustrative estimate of the change in risk. Inaccuracies in the models or assumptions large enough to invalidate the analyses developed to support RI-ISI should have been identified in the licensee's or the staff's reviews. Minor errors or inappropriate assumptions will only affect the consequence categorization of a few segments and will not invalidate the general results or conclusions. Furthermore, the continuous use and documented maintenance of the PRA provide further opportunities to identify inaccuracies, if any, in the PRA models and assumptions. The staff finds that the quality of the Clinton PRA is sufficient to support this submittal.

As required by Section 3.7 of TR-112657, the licensee evaluated the change in risk expected from replacing the current ISI program with the RI-ISI program. The analysis estimates the net change in risk due to the positive and negative influence of adding and removing locations from 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 the increase in risk caused by discontinued Section XI inspections in the population of elements excluded from RI-ISI element selection. Therefore, excluding some elements from the population of elements for possible inspection does not affect the change in risk calculations.

The failure frequencies used in the calculation are the frequencies excluding the degradation mechanism addressed by the augmented program. This is consistent with the staff position that the augmented programs adequately control the degradation mechanism and is acceptable.

The licensee used the failure frequencies developed in EPRI Topical Report TR-111880 (Reference 8) to support the estimate for the change in risk. The non-proprietary version of TR-111880 (Ref. 9) illustrates the characteristics and format of the information used, but does not include the calculated parameters. Reference 8 provides failure frequency estimates according to system type and exposure to a degradation mechanism. The method used to develop the frequencies in Reference 8 was reviewed and approved during the approval of TR-112657 although the process to select and to adapt the frequencies from the report for use in the change in risk calculations was not specified. The change in risk is calculated utilizing the Markov model described in EPRI Topical Report TR-111061 (Ref. 10) and described in detail in Reference 1.

The method uses the Markov model to estimate the “inspection effectiveness 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, and the input parameters, is the same as used by the licensee, and approved by the staff in the Dresden RI-ISI submittal (Ref. 11). The staff finds the calculations acceptable to use in support of this RI-ISI submittal.

The licensee estimated the change in CDF and LERF for CPS to be 2.90E-9/yr and 2.22E-10/yr, respectively (Reference 1). The licensee also reported the system level changes for all the systems included in the scope of the submittal. All the estimated changes in risk are below the EPRI guideline criteria for acceptable estimated changes in CDF and LERF. These estimates use the IEF and include the effect of change in POD. Sensitivity studies provided in Reference 1 indicate that bounding estimates are also below the EPRI guideline criteria.

The staff finds that the licensee’s process to evaluate the potential change in risk is reasonable because it accounts for the change in the number and location of the elements inspected, recognizes the difference in degradation mechanism related to failure likelihood, and considers the synergistic effects of multiple degradation mechanisms within the same piping segment. The staff finds that redistributing welds to be inspected with consideration of the safety-significance of the segments provides assurance that segments whose failures have a significant impact on plant risk receive an acceptable and often improved level of inspection. Therefore, the staff concludes that implementation of the RI-ISI program as described in the application is acceptable and, based on the reported quantitative results, any increase in risk associated with the implementation of the RI-ISI program is small and is consistent with the intent of the Commission’s Policy Statement, and therefore, is consistent with RG 1.178.

3.4 Integrated Decision-Making

As described in the October 15, 2001, AmerGen submittal, an integrated approach is utilized in defining the proposed RI-ISI program by considering in concert the traditional engineering analysis, risk evaluation, and the implementation and performance monitoring of piping under the program. This is consistent with the guidelines of 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 rankings and other operational considerations. The submittal states that 25 percent of high safety significant (HSS) and 10 percent of medium safety significant (MSS) elements are selected for inspection which is consistent with the EPRI TR. As discussed in the submittal and earlier in this safety evaluation (SE), these percentages are drawn from the population of welds included in the RI-ISI element selection population. The inspections are generally selected on a system-by-system basis. The licensee stated that an attempt is made to ensure that all damage mechanisms and all combinations of damage mechanisms are represented in the elements selected for inspection.

Table 2 of the submittal provides the failure potential assessment summary for CPS Unit 1. Tables 3 and 4 of the submittal identify on a per system basis, the number of elements (welds) and inspections by risk category. Table 5 provides a summary comparing the number of inspections required under the existing ASME Code ISI program with the alternative RI-ISI program for each applicable system and the impact of CDF and LERF. The licensee used the methodology described in TR-112657 to guide the selection of examination elements within high and medium ranked piping segments. The EPRI report describes targeted examination volumes (typically associated with welds) and methods of examination based on the type(s) of degradation expected. The staff has reviewed these guidelines and has determined that, if implemented as described, the RI-ISI examinations should result in improved detection of service-related discontinuities over that currently required by the ASME Code.

The staff finds the location selection process to be acceptable since it is consistent with the process approved in TR-112657, takes into account defense-in-depth, and includes coverage of welds subjected to degradation mechanisms in addition to those covered by augmented inspection programs. As described in Section 3.2 of this SE, excluding elements exposed only to a damage mechanism addressed by an augmented program from the RI-ISI element selection population is an acceptable deviation from the EPRI methodology.

The objective of ISI required by the ASME Code is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. Therefore, the RI-ISI program must meet this objective to be found acceptable for use. Further, since the risk-informed program is based on inspection for cause, element selection should target specific degradation mechanisms. Chapter 4 of TR-112657 provides guidelines for the areas and/or volumes to be inspected as well as the examination method, acceptance standard, and evaluation standard for each degradation mechanism. Based on the review of the cited portion of the EPRI report, the staff concludes that the examination methods are appropriate since they are selected based on specific degradation mechanisms, pipe sizes and materials of concern.

3.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of RG 1.178 and SRP 3.9.8. The objective of Element 3 is to assess the performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. To approve an alternative pursuant to 10 CFR 50.55a(a)(3)(i), 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 stated in its submittal 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 licensee confirmed that the applicable portions of the ASME Code not affected by the change, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements would be retained.

The licensee stated 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 high safety significant piping locations. Such relevant information would include major updates to the CPS Unit 1 PRA models which could impact both the risk characterization and risk impact assessments, any new trends in service experience with piping systems at CPS and across the industry, and new information on element accessibility that will be obtained as the risk informed inspections are implemented. Reference 1 states that as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME interval basis and that significant changes may require more frequent adjustment as directed by an NRC bulletin or generic letter requirements, or by industry or plant-specific feedback.

The licensee’s submittal (Ref. 1) presented the criteria for engineering evaluations and additional examinations if unacceptable flaws or relevant conditions are found during examinations. The submittal stated that in lieu of the evaluation and sample expansion requirements of Section 3.6.6.2 in Reference 3, CPS will utilize the requirements of Subarticle -2430 in Code Case N-578-1. The licensee stated that the additional examinations shall include piping structural elements with the same postulated failure mode and the same or higher failure potential. Reference 1 stated that the number of additional elements shall be the number of piping structural elements with the same postulated failure mode originally scheduled for that fuel cycle. Reference 1 further stated that the scope of the additional examinations may be limited to those HSS piping structural elements (Risk Group Categories 1 through 5) within systems, whose material and service conditions are determined by an evaluation to have the same postulated failure mode as the piping structural element that contained the original flaw or relevant condition. The staff finds the criteria for additional examinations to be acceptable and consistent with the guidelines in Reference 4.

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

4.0 CONCLUSION

The staff finds that the results of the different elements of the engineering analysis are considered in an integrated decision-making process. The impact of the proposed change in the ISI program is founded on the adequacy of the engineering analysis and acceptable change in plant risk in accordance with RG 1.174 and RG 1.178 guidelines.

CPS' 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 ASME Class 1, 2, and 3 systems in accordance with the ASME Code program. The RI-ISI program applies the same performance measurement strategies as existing ASME Code requirements and, in addition, increases the inspection volumes at some weld locations.

CPS' methodology provides for conducting an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth and quality are not degraded in that the methodology provides reasonable confidence that any reduction in existing inspections will not lead to degraded piping performance when compared to existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of piping systems.

The licensee has stated that the ASME Code minimum and maximum inspection requirements for Program B will be met and that the RI-ISI inspections and the balance of the inspections will be on the same interval start and end dates. The licensee stated that CPS Unit 1 would continue to submit their 10-year interval ISI programs including the RI-ISI programs every 10 years. The licensee also stated that the RI-ISI program will be maintained as a living program and reviewed and adjusted on an ASME-period basis. The licensee stated that changes that could impact the RI-ISI program include major changes to CPS PRA or changes to weld selection. The staff finds that the CPS Unit 1 RI-ISI program meets the ASME Code requirements for minimum and maximum inspections during inspection periods and intervals. The staff also finds that the CPS Unit 1 RI-ISI program meets the 10 CFR 50.55a requirements for program submittal to the NRC.

In accordance with 10 CFR 50.55a(a)(3)(i), proposed alternatives to regulatory requirements may be used when authorized by the NRC when the applicant demonstrates that the alternative provides an acceptable level of quality and safety. In this case, the licensee's proposed alternative is to use the risk-informed process described in the NRC-approved EPRI TR-112657. Based on the 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 pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to the piping ISI requirements with regard to the number of inspections, locations of inspections, and methods of inspection.

The proposed RI-ISI program is authorized for the second ten-year ISI interval for CPS Unit 1.

5.0 REFERENCES

1. Letter, K. A. Ainger (AmerGen), to U.S. Nuclear Regulatory Commission, Alternative to the ASME Boiler and Pressure Vessel Code, Section XI Requirements for Class 1 and 2 Piping Welds, Risk-Informed Inservice Inspection Program, dated October 15, 2001, (RS-01-219).

2. Letter, K. R. Jury (AmerGen), to U.S. Nuclear Regulatory Commission, Response to Request for Additional Information Regarding Risk Informed Inservice Inspection Program, dated November 20, 2001, (RS-01-259).

3. Letter, K. R. Jury (AmerGen), to U.S. Nuclear Regulatory Commission, Response to Request for Additional Information Regarding Risk-Informed Inservice Inspection Program, dated February 7, 2002, (RS-02-024).

4. Electric Power Research Institute, Revised Risk-Informed Inservice Inspection Evaluation Procedure, EPRI TR-112657, Revision B-A, January, 2000.

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

6. U.S. Nuclear Regulatory Commission, An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping, Regulatory Guide 1.178, September, 1998.

7. U.S. Nuclear Regulatory Commission, Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping, NUREG-0800, SRP Chapter 3.9.8, September, 1998.

8. Electric Power Research Institute, Piping System Failure Rates and Rupture Frequencies for Use in Risk-Informed In-Service Inspection Applications, EPRI TR-111880, September, 1999 (proprietary).

9. Electric Power Research Institute, Piping System Failure Rates and Rupture Frequencies for Use in Risk-Informed In-Service Inspection Applications, EPRI TR-111880-NP, November, 2000 (nonproprietary).

10. Electric Power Research Institute, Piping System Reliability and Failure Rate Estimation Modes for Use in Risk-Informed In-Service Inspection Applications, EPRI TR-110161, December, 1998 (proprietary).

11. Letter, A. Mendiola (U. S. Nuclear Regulatory Commission) to O. D. Kingsley (Exelon Nuclear), Dresden Nuclear Power Station, Units 2 and 3, American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) - Relief for Risk-Informed Inservice Inspection of Piping, dated September 5, 2001.

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