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10 CFR 50.55a(a)(3)(i)

June 25, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Peach Bottom Atomic Power Station, Units 2 and 3
Facility Operating License Nos. DPR-44 and DPR-56
Docket Nos. 50-277 and 50-278

Subject: Third Ten-Year Interval Inservice Inspection (ISI) Program
Risk-Informed Inservice Inspection Program
Alternative to the ASME Boiler and Pressure Vessel Code
Section XI Requirements for Class 1 and 2 Piping Welds

References:

1. Letter from J. W. Clifford (U.S. Nuclear Regulatory Commission (USNRC)) to J. A. Hutton (PECO Energy Company), "Third 10-Year Interval Inservice Inspection Program Plan Request For Relief Nos. RR-08, RR-10, RR-17, RR-23, RR-24, RR-25, RR-26, RR-27, RR-28, RR-29, RR-30, RR-31, RR-32, and RR-33 for Peach Bottom Atomic Power Station, Units 2 and 3 (TAC Nos. MA4008 and MA4009)," dated July 31, 2000.

2. Letter from J. Doering Jr. (PECO Energy Company) to U.S. Nuclear Regulatory Commission (USNRC), "Submittal of Third 10-Year Interval Inservice Interval (ISI) Program," dated August 13, 1998.

3. Electric Power Research Institute (EPRI) Topical Report (TR) 112657 Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," dated December 1999.

4. Letter from W. H. Bateman (USNRC) to G. L. Vine (EPRI), "Safety Evaluation Report Related to EPRI Risk-Informed Inservice Inspection Evaluation Procedure (EPRI-TR-112657, Revision B, July 1999)," dated October 28, 1999.

Dear Sir/Madam:

In the Reference 1 letter, the U. S. Nuclear Regulatory Commission approved relief requests and alternatives for the update of the Third Ten-Year Interval Inservice Inspection (ISI) Program for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. A copy of the updated ISI Program for PBAPS, Units 2 and 3, was submitted via the Reference 2 letter.

In accordance with 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(i), Exelon Generation Company, LLC (Exelon) is submitting a proposed alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components", requirements for the selection and examination of Class 1 and 2 piping welds. The alternative proposed by PBAPS, Units 2 and 3 uses Reference 3 methodology for a Risk-Informed Inservice Inspection (RISI) program approved by the U. S. Nuclear Regulatory Commission (NRC) to the extent and within the limitations specified in Reference 4.

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Relief Request No. RR-44 (Enclosure 1) and the RISI Program Summary for PBAPS, Units 2 and 3 (Enclosure 2) demonstrate that the proposed alternative would provide an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i). The format of the PBAPS RISI submittal is consistent with the Nuclear Energy Institute (NEI) and industry template developed for applications of the RISI methodology.

As required by Reference 3, Exelon has completed a review of existing relief requests to determine if any should be withdrawn or modified due to changes that occur as a result of implementing the RISI Program. Two approved relief requests are affected.

Relief Request No. RR-28, submitted via Reference 2, requesting approval to perform alternative examination of Category B-J welds where terminal ends are inaccessible, is withdrawn. RR-28 required examination of the next accessible weld in the same section of pipe. The RISI program provides improved methods to select a given population of welds for examination. The EPRI element selection process for Examination Category R-A has allowed for examination of alternate, similarly risk-ranked welds.

Relief Request No. RR-33, submitted via Reference 2, requesting approval to use the alternative requirements of ASME Section XI Code Case N-598, has been modified to clarify applicability to RISI Examination Category R-A piping elements and is submitted herein as Enclosure 3.

The RISI Program will be incorporated during the Third Ten-Year Inservice Inspection Interval for PBAPS, Units 2 and 3, and shall remain in effect until the completion of the Third Inservice Inspection Interval for PBAPS, Units 2 and 3, which are projected to end in 2008. At that time the PBAPS, Units 2 and 3 ISI Programs will require updating for the Fourth Inservice Inspection Interval. Implementation of this RISI program will provide for fewer but more focused ASME Section XI piping weld inspections with little change in the risk to the public, while reducing occupational radiation exposure.

Approval of this proposed alternative is requested by June 27, 2003.

If you have any questions, please contact us.

Very truly yours,

Michael P. Gallagher
Director, Licensing and Regulatory Affairs
Mid-Atlantic Regional Operating Group

Enclosure 1 - Relief Request No. RR-44
Enclosure 2 - Risk-Informed Inservice Inspection Program Summary – Peach Bottom Atomic Power Station, Units 2 and 3
Enclosure 3 - Relief Request No. RR-33

cc: H. J. Miller, Administrator, Region I, USNRC
A. C. McMurtray, USNRC Senior Resident Inspector, PBAPS
J. P. Boska, Senior Project Manager, USNRC

Enclosure 1

Relief Request No. RR-44

RELIEF REQUEST No. RR-44
Revision 0

I. SYSTEM / COMPONENT(S) FOR WHICH RELIEF IS REQUESTED

All American Society of Mechanical Engineers (ASME) Code Class 1 and 2 piping welds under Examination Category B-F, B-J, C-F-1, and C-F-2. The Examination Item Numbers are B5.10, B5.20, B5.130, B5.140, B9.11, B9.12, B9.21, B9.22, B9.31, B9.32, B9.40, C5.11, C5.12, C5.21, C5.22, C5.51, C5.52, C5.61, C5.62, C5.81 and C5.82.

II. CODE REQUIREMENTS FROM WHICH AN ALTERNATIVE IS REQUESTED

ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition, Table IWB 2500-1, Examination Category B-F requires a volumetric and/or surface examination on all piping welds for Item Numbers B5.10, B5.20, B5.130, and B5.140.

Table IWB 2500-1, Examination Category B-J requires a volumetric and/or surface examination on all piping welds for Item Numbers B9.11, B9.12, B9.21, B9.22, B9.31, B9.32 and B9.40.

Table IWC 2500-1, Examination Categories C-F-1 and C-F-2 require volumetric and/or surface examinations for Item Numbers C5.11, C5.12, C5.21, C5.22, C5.51, C5.52, C5.61, C5.62, C5.81 and C5.82.

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 the remaining welds, areas, or parts in the same inspection period and subsequent period. If the additional examinations revealed any indications exceeding the acceptance standards of Table IWB-3410-1, the examination shall be further extended to include additional examinations. The additional examinations shall include all remaining piping welds, areas, or parts of similar design, size and function.

IWC-2430, "Additional Examinations," requires that any indications revealed that exceed the allowable standards of IWC-3000 shall be extended to include an additional number of components (or areas) within the same category, approximately equal to the number of components (or areas) examined initially during the inspection. If the additional examinations detect further indications exceeding the allowable standards of IWC-3000, the remaining number of similar components (or areas) within the same examination category shall be examined.

III. BASIS FOR ALTERNATIVE

This relief is requested pursuant to 10CFR50.55a, "Codes and standards", paragraph (a)(3)(i). The proposed alternative of utilizing the examination methodology and selection criteria of Electric Power Research Institute (EPRI) TR-112657, Rev. B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," along with evaluation and sample expansion requirement enhancements identified in ASME Code Case N-578-1, "Risk Informed Requirements for Class 1, 2, and 3 Piping, Method B," will provide an acceptable level of quality and safety.

RELIEF REQUEST No. RR-44
Revision 0, continued

In a letter from W. H. Bateman (USNRC) 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.

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," Peach Bottom Atomic Power Station (PBAPS) will utilize the requirements of Subarticle-2430, "Additional Examinations," which is contained in Code Case N-578-1. 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.

IV. ALTERNATE PROVISIONS

PBAPS proposes to utilize the proposed alternative described in Enclosure 2 to this submittal, "Risk Informed Inservice Inspection Program Summary, Peach Bottom Atomic Power Station, Units 2 and 3."

V. IMPLEMENTATION SCHEDULE

PBAPS will integrate the RISI Program into the ISI Program during the Third Ten-Year Inservice Inspection Interval for PBAPS, Units 2 and 3, and it shall remain in effect until the completion of the Third Inservice Inspection Interval for PBAPS, Units 2 and 3, which is projected to end in 2008. At that time the PBAPS, Units 2 and 3 ISI Programs will require updating for the Fourth Inservice Inspection Interval.

Enclosure 2

Risk Informed Inservice Inspection Program Summary

Peach Bottom Atomic Power Station Units 2 and 3

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

1. INTRODUCTION

The objective of this submittal is to request the use of a risk-informed inservice inspection (RISI) program for Class 1 and Class 2 piping that is currently inspected as part of the ASME Section XI based ISI program. The RISI program is proposed as an alternative to the 1989 Edition of the ASME Section XI requirements for the remainder of the Third Inservice Inspection Interval. The risk-informed process used in this submittal is described in EPRI RISI Topical Report (Reference 1) and the accompanying NRC staff SER on the EPRI method. To strengthen the technical basis for this RISI program beyond the minimum requirements implied by the EPRI RISI Topical Report, a number of enhancements were made to the process that are described in the paragraphs below.

Exelon plans to incorporate the RISI inspection program during the third inspection intervals for Peach Bottom Atomic Power Station (PBAPS) Unit 2 and Unit 3. The Third Inservice Inspection Interval started on November 5, 1998 for PBAPS, Unit 2, and the projected end date is November 4, 2008. The Third Inservice Inspection Interval started on August 15, 1998 for PBAPS Unit 3, and the projected end date is August 14, 2008.

As a risk-informed application, this submittal meets the principles of Regulatory Guides 1.174 and 1.178 as well as those set forth in the EPRI RISI Topical Report and the NRC staff SER on the EPRI RISI method for a partial scope RISI Class 1 and Class 2 piping.

<u>PRA Quality</u>

The PBAPS PRA model used for the risk determinations for this regulatory application is an update to the "Individual Plant Examination (IPE)," submitted to the NRC by letter dated August 26, 1992. The IPE had been accepted by the NRC in a letter dated October 25,1995. The NRC letter noted that the IPE submittal met the intent of Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities – 10 CFR 50.54(f)," dated November 23, 1988.

The PBAPS PRA (Reference 2) used in this analysis represents the second upgrade to that study. The PBAPS PRA addresses internal events at full power, and it includes internal flooding. For the Level 2 analysis (i.e., the containment analysis), a full Level 2 model with 12 different release categories covering various magnitudes and timing of the releases was employed. Large Early Release Frequency (LERF) was calculated from the "High" and "Early" release category from the Level 2 model.

Both the PBAPS PRA model and its supporting bases documentation were reviewed by a BWROG Peer Review/Certification team in 1998. The review was conducted using a team of industry PRA experts. This independent review was performed to evaluate the capability of the PRA and completeness of the PRA documentation.

The PRA certification process assesses a PRA in eleven functional elements. Each element is graded on a scale of 1 to 4. A grade 3 indicates that risk significance determinations made by the PRA are adequate to support regulatory applications, when combined with deterministic insights. A grade of 4 indicates that the PRA "is usable as a primary basis for developing licensing positions", however, it is expected that few PRAs would currently have many elements eligible for this grade. The PBAPS 1998 Certification Team found that the scope of the PRA supports PRA Applications through Grade 3.

Exelon maintains and updates each of its PRA models to be representative of the respective as-built, as-operated plant. A PRA maintenance and update procedure formalizes the PRA update process. The procedure defines the process for regular and interim updates for issues identified as potentially affecting the PRA. This process assures the present PRA reflects the current plant configuration and plant procedures.

Based on the results of past NRC Staff reviews and the BWROG Certification Peer Review, Exelon is confident that the level of detail and capability of the PBAPS PRA fully supports this risk-informed regulatory application.

2. PROPOSED ALTERNATIVE TO CURRENT ISI PROGRAM REQUIREMENTS

2.1 ASME Section XI

ASME Section XI Categories B-F, B-J, C-F-1, and C-F-2 currently contain the requirements for examining these Class 1 and Class 2 piping components via Non Destructive Examination (NDE) methods.

2.2 Alternate RISI Program

The alternative RISI program for piping is described in EPRI RISI Topical Report. The RISI program will be substituted for the 1989 ASME Section XI Code Edition examination program for Class 1 Category B-J and B-F welds and Class 2 Category C-F-1 and C-F-2 welds in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. Other portions of the ASME Section XI Code-imposed inservice inspection program outside of this RISI scope will be unaffected. The EPRI Topical Report provides the requirements for defining the relationship between the risk-informed examination program and the remaining unaffected portions of ASME Section XI.

2.3 Augmented Programs

As discussed in Section 6 of the EPRI Topical Report, certain augmented inspection programs may be integrated into the RISI program. At this time, no augmented programs are subsumed in the RISI program, with the exception of the IGSCC Category A welds. The following augmented programs were not subsumed into the RISI program and remain unaffected:

- IGSCC in BWR Austenitic Stainless Steel Piping (Generic Letter 88-01 and NUREG-0313). Only IGSCC Category A welds will be subsumed into the RISI program.
- Flow Accelerated Corrosion (FAC) (Generic Letter 89-08)

Elements in the scope of this evaluation that were also covered by these augmented programs were included in the consequence assessment, degradation assessment, and risk categorization evaluations, to determine the damage mechanisms at those elements and whether the affected piping was subject to damage mechanisms other than those addressed by the augmented program. If no other damage mechanism was identified, the element was removed from the RISI element selection population and retained in the appropriate augmented inspection program. If another damage mechanism was identified, the element was retained within the scope of consideration for element selection as part of the RISI program. In the Main Feedwater System, many of the elements covered by the FAC program were also assessed for the potential for other damage mechanisms that are evaluated as part of the EPRI RISI methodology. The entire scope of the RISI evaluation including those elements covered by augmented programs and not included in the RISI selection population were included in the risk impact assessment phase of the evaluation described below.

2.4 Multiple Damage Mechanisms

The vast majority of pipe elements that were evaluated in the RISI evaluation were found to be susceptible to none of the damage mechanisms addressed in the EPRI RISI methodology. A number of elements were found to be susceptible to one specific damage mechanism, and a relatively small number were identified to be subject to the potential for two or more damage mechanisms. Specific examples are welds in the Main Feedwater and High Pressure Coolant Injection Systems that are subject to both FAC and thermal fatigue, as well as welds in the Main Recirculation, Reactor Pressure Vessel, and Core Spray systems that have the potential for both IGSCC and thermal fatigue. If one of the damage mechanisms was FAC, the element was assigned to the High failure potential category to be consistent with the EPRI Topical Report. If that assignment led to the decision to select that element for inspection in accordance with the 25% sampling requirement, it was retained in the FAC program for inspection for FAC as well as inspected for the remaining damage mechanism as part of the RISI program. The potential for synergy between two or more damage mechanisms working on the same location was considered in the estimation of pipe failure rates and rupture frequencies which was reflected in the risk impact assessment.

3. RISK-INFORMED ISI PROCESS

The process used to develop the RISI program is consistent with the methodology described in the EPRI Topical Report for ASME Code Case N-578-1 (Reference 5) applications. The process involves the following steps:

- Definition of RISI Program Scope
- Consequence Analysis
- Degradation Mechanism Assessment
- Risk Categorization
- Inspection Location Selection and NDE Selection
- Program Relief Requests
- Risk Impact Assessment
- Implementation and Monitoring Program

3.1 Definition of RISI Program Scope

The systems to be included in the RISI program are provided in Table 1. This scope covers ASME Class 1 and 2 piping systems within the scope of the existing ASME Section XI inspection program. The as-built and as-operated isometric and piping and instrumentation diagrams and additional plant information were used to define the system boundaries. The RISI evaluation system boundaries were defined using the system boundaries established in the existing plant ISI program.

3.2 Consequence Analysis

The consequences of pressure boundary failures were evaluated and ranked based on their impact on conditional core damage probability (CCDP) and conditional large early release probability (CLERP). The impact on these measures due to both direct and indirect effects was determined using the PRA model described in Section 1. Consequence categories (High, Medium or Low) were assigned according to Table 3-1 of the EPRI RISI Topical Report. One of the enhancements that was incorporated into this application of the EPRI RISI methodology was the direct use of the PRA models to support the estimation of CCDP and CLERP values for each pipe element in the scope of the RISI evaluation, in lieu of the consequence tables in the EPRI Topical Report. This step was taken to avoid subjective/qualitative assumptions and reduce some of the conservatisms inherent in the consequence tables thus supporting a more complete and realistic quantification of the risk impacts of the RISI program in comparison with previous applications of this methodology. Another motivation was to increase consistency with other risk informed applications at Exelon that directly utilize the plant-specific PRA models.

3.3 Degradation Mechanism Assessment

Failure potential was assessed using the deterministic criteria in the EPRI Topical Report to evaluate the potential for each damage mechanism that an ISI exam could identify, and supported by industry failure history, plant-specific failure history, and other relevant information. These failure estimates were determined using the guidance provided in the EPRI Topical Report.

Table 2 summarizes the degradation mechanism assessment by system for each damage mechanism that was identified as a potential failure cause. In addition, failure rates and rupture frequencies were assessed for each piping element within the scope of the RISI evaluation using information in Reference 6 and described in the Tier 2 documentation (Reference 3).

3.4 Risk Categorization

In the preceding steps, each element within the scope of the RISI program was evaluated to determine the consequences of its failure, as measured by CCDP and CLERP. Each element was considered for pipe rupture based on the potential for degradation mechanisms that were identified. The results of the consequence assessment were then combined with the results of the degradation assessment, using the risk matrix shown in Figure 1. This provides a risk ranking and risk category for each element.

The results of this evaluation in terms of the number of elements in each of the EPRI RISI risk categories per system are summarized in Table 3 and Table 4 for PBAPS Unit 2 and Unit 3, respectively.

POTENTIAL FOR PIPE RUPTURE PER DEGRADATION MECHANISM SCREENING CRITERIA	**CONSEQUENCES OF PIPE RUPTURE** IMPACTS ON CONDITIONAL CORE DAMAGE PROBABILITY AND LARGE EARLY RELEASE PROBABILITY			
	NONE	**LOW**	**MEDIUM**	**HIGH**
HIGH FLOW ACCELERATED CORROSION	**LOW** **Category 7**	**MEDIUM** **Category 5**	**HIGH** **Category 3**	**HIGH** **Category 1**
MEDIUM OTHER DEGRADATION MECHANISMS	**LOW** **Category 7**	**LOW** **Category 6**	**MEDIUM** **Category 5**	**HIGH** **Category 2**
LOW NO DEGRADATION MECHANISMS	**LOW** **Category 7**	**LOW** **Category 7**	**LOW** **Category 6**	**MEDIUM** **Category 4**

Figure 1
EPRI RISI Matrix for Risk Ranking of Pipe Elements (Reference 1)

3.5 Inspection Location Selection and NDE Selection

In general, an ASME Code Case N-578-1 application of RISI, per the EPRI RISI Topical Report, requires that 25% of the elements that are categorized as "High" risk (Risk Category 1, 2, or 3) and 10% of the elements that are categorized as "Medium" risk (Risk Categories 4 and 5) be selected for inspection and appropriate non-destructive examination (NDE). Inspection locations are generally selected on a system-by-system basis, so that each system with "High" risk category elements will have approximately 25% of the system's "High" risk elements selected for inspection and similarly 10% of the elements in systems having "Medium" risk category welds will be selected. During the selection process, damage mechanisms and all combinations of damage mechanisms are represented in the elements selected for inspection. An element ranking process was used to incorporate several factors into the selection of specific elements to satisfy the above sampling percentages. These factors include whether the element has been previously selected for ISI exams, whether previous exams had indications of possible damage, presence of radiation fields in the vicinity of the elements, accessibility of the element for inspection, and numerical estimates of the pipe rupture frequencies at these locations. The results of the selection are presented in Tables 5 and 6 for Units 2 and 3, respectively. Section 4 of the EPRI Topical Report and ASME Code Case N-578-1 (Reference 5) were used as guidance in determining the examination methods and requirements for these locations. From the Class 1 butt welded elements that are considered within the scope of the RISI evaluation at Unit 2, a total of 10.9% are selected for volumetric examination as part of the risk informed inspection program. The corresponding percentage for Unit 3 is 11.0%. The total Class 1 welds selected for RISI evaluation is 11.3% for Unit 2 and 11.4% for Unit 3. As noted above, elements found to be susceptible to two or more damage mechanisms are given enhanced treatment by retaining them within the scope of the augmented programs and in the risk informed program for the applicable damage mechanisms. The percentages show compliance with the EPRI/NRC guidelines for minimum percentage selection of 10% of the Class 1 welds and 10% of the Class 1 butt welds.

In addition, all in-scope piping components, regardless of risk classification, will continue to receive Code-required pressure and leak testing, as part of the current ASME Section XI program. VT-2 visual examinations are scheduled in accordance with the station's pressure and leak test program, which remains unaffected by the RISI program.

<u>Additional Examinations</u>

Examinations performed that reveal flaws or relevant conditions exceeding the applicable acceptance standards shall be extended to include additional examinations. The additional examinations shall include piping structural elements with the same postulated failure mode and the same or higher failure potential.

(1) 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.

(2) The scope of the additional examinations may be limited to those high safety significant piping structural elements (i.e., 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.

If the additional required examinations reveal flaws or relevant conditions exceeding the referenced acceptance standards, the examination shall be further extended to include additional examinations.

(1) These examinations shall include all remaining piping elements whose postulated failure modes are the same as the piping structural elements originally examined.

(2) An evaluation shall be performed to establish when those examinations are to be conducted. The evaluation must consider failure mode and failure probability.

No additional examinations will be performed if there are no additional elements identified as being susceptible to the same root cause conditions.

For the inspection period following the period in which the original examination discovering the flaw or relevant condition was completed, the examinations shall be performed as originally scheduled.

3.6 Program Relief Requests

As required by Section 6.4 of EPRI TR-112657, Exelon 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 RISI Program.

Relief Request No. RR-28, requesting approval to perform alternative examination of Category B-J welds where terminal ends are inaccessible, is withdrawn. RR-28 required examination of the next accessible weld in the same section of pipe. The RISI program provides improved methods to select a given population of welds for examination. The EPRI element selection process for Examination Category R-A has allowed for examination of alternate, similarly risk-ranked welds.

There are no existing relief requests that are required to be modified due to RISI expansion of the examination volume.

Relief Request No. RR-33, requesting approval to use the alternative requirements of ASME Section XI Code Case N-598, has been modified to clarify applicability to RISI Examination Category R-A piping elements.

In instances where a location is found at the time of the examination that does not meet the >90% coverage requirement, the process outlined in the EPRI Topical Report will be followed.

A new relief request will be generated for any RISI Program piping element selection for which greater than 90% coverage is not achieved.

3.7 Risk Impact Assessment

The RISI program has been conducted in accordance with Regulatory Guides 1.174 and 1.178, and the EPRI Topical Report, which require an evaluation to show that implementation of a risk informed inspection program would result in acceptably small changes, if any, in CDF and LERF.

The risk impact assessment performed in this RISI application included a qualitative evaluation as well as a comprehensive quantitative evaluation of the changes in CDF and LERF due to changes in the ISI program for each piping element in the scope of the RISI evaluation. This is another enhancement that was made that goes well beyond the limited quantitative analyses that are needed to implement the methods described in the EPRI Topical Report.

Individual elements were evaluated for consequence and degradation mechanism and then assigned to a risk category and risk ranking as part of the risk characterization step. The elements were then grouped by system and the changes in risk for each element was summed to provide the change in risk for the system due to increases and decreases in the number of exams and for the potential for increases in the NDE probability of detection where the "inspection for cause" principle was applied.

Per Section 3.7.2 of EPRI TR-112657, the Markov piping reliability analysis method was used to estimate the change in risk due to adding and removing locations from the inspection program. The actual CCDP and CLERP values calculated for each element in the consequence assessment was used in the risk impact calculation. Realistic quantitative estimates of failure frequencies, rupture frequencies, and risk impacts were performed for all elements within the scope of the RISI evaluation, in lieu of the qualitative analysis and bounding risk estimates that are permitted under most circumstances in the EPRI RISI Topical Report.

The changes to the ASME Section XI ISI program include changing the number and location of inspections within the risk segment, and in many cases improving the effectiveness of the inspection to account for the results of the RISI degradation mechanism assessment. For example, for locations subject to thermal fatigue, examinations are to be conducted on an expanded volume and are to be focused to enhance the probability of detection (POD) during the inspection process. For other damage mechanisms, this "inspection for cause" principle is also expected to favorably impact the POD.

Limits are imposed by the EPRI methodology (TR-112657) to ensure that the change in risk of implementing the RISI program meets the requirements of Regulatory Guides 1.174 and 1.178. The criteria established require that the cumulative increase in CDF and LERF be less than $1x10^{-7}$ and $1x10^{-8}$ per year per system, respectively. Meeting these limits is consistent with meeting Regulatory Guide 1.174 risk significant thresholds of $1x10^{-6}$ per year and $1x10^{-7}$ per year for changes in CDF and LERF, respectively, for a full plant scope RISI application.

The technical basis for the Markov model input parameters that were used in this evaluation are documented in the Tier 2 documentation (Reference 3). These parameters include a set of failure rates and rupture frequencies for piping systems in General Electric BWR plants subject to several degradation mechanisms that were identified for these systems as part of the degradation mechanism assessment. The failure rates and rupture frequencies that were used in this evaluation are those developed in Table A-11 in EPRI TR-111880 (Reference 4).

Separate Markov calculations were performed for the change in CDF and the change in LERF. This calculation was performed so that pipe elements whose failure could create a potential containment failure or bypass concern were factored into the LERF evaluation. Unlike previous applications of the EPRI methodology, realistic estimates of CDF and LERF contributions and changes in CDF and LERF due to all changes in the RISI program were quantified for all pipe elements, in addition to a qualitative evaluation that is part of the EPRI procedure.

The results of the risk impact assessment for each system at PBAPS Unit 2 are summarized in Table 7 and key aspects are plotted in Figures 2 and 3 for comparison against the risk significant criteria established in the EPRI RISI Topical Report. A similar set of results is presented in Table 8 and Figures 4 and 5 for Unit 3. As seen in these figures and tables, the HPCI, RCIC, and RHR system groups at Unit 2 and the RCIC and RHR system groups at Unit 3 exhibited small decreases in CDF due to the changes from the RISI program. The HPCI, RCIC and RHR system groups at Unit 2 and the RCIC and RHR system groups at Unit 3 exhibited small decreases in LERF. The remaining systems evaluated across the two reactor units exhibited very small increases in CDF and LERF. In each case in which a risk increase was identified, the estimated increases in CDF and LERF are much smaller than the risk acceptance criteria by a large margin. Each system was found to have a change in LERF that is less than or equal to 10% of the EPRI RISI risk significance threshold of $1x10^{-8}$/system-year, and a change in CDF that is less than 3% of the associated threshold of $1x10^{-7}$/system-year.

The total change in CDF and LERF due to the combined changes in the RISI program for the entire scope of Class 1 and 2 systems is more than two orders of magnitude below the overall risk acceptance criteria.

As a sensitivity case, an evaluation was performed assuming that all NDE exams were removed from the ISI program, indicating that the EPRI RISI risk significance thresholds still would not be exceeded.

As indicated above, the risk impact evaluation has demonstrated that no significant risk impacts will occur from implementation of the RISI program for the entire scope of Class 1 and 2 piping that was included in this evaluation. This satisfies the risk significance criteria of Regulatory Guide 1.174 and the EPRI RISI Topical Report.

Defense-In-Depth

The intent of the inspections mandated by ASME Section XI for piping welds is to identify conditions such as flaws or indications that may be precursors to leaks or ruptures in a system's pressure boundary. Currently, the process for picking inspection locations is based upon structural discontinuity and stress analysis results. As depicted in ASME White Paper 92-01-01 Rev. 1, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds," this method has been ineffective in identifying leaks or failures. EPRI TR-112657 and ASME Code Case N-578-1 provide a more robust selection process founded on actual service experience with nuclear plant piping failure data.

This process has two key independent ingredients: (1) a determination of each location's susceptibility to degradation and (2) an independent assessment of the consequence of the piping failure. These two ingredients assure defense-in-depth is maintained. First, by evaluating a location's susceptibility to degradation, the likelihood of finding flaws or indications that may be precursors to leak or ruptures is increased. Secondly, the consequence assessment effort has a single failure criterion. As such, no matter how unlikely a failure scenario is, it is ranked High in the consequence assessment, and no lower than Medium in the risk assessment (i.e., Risk Category 4), if, as a result of the failure, there is no mitigative equipment available to respond to the event. In addition, the consequence assessment takes into account equipment reliability, with less credit given to less reliable equipment.

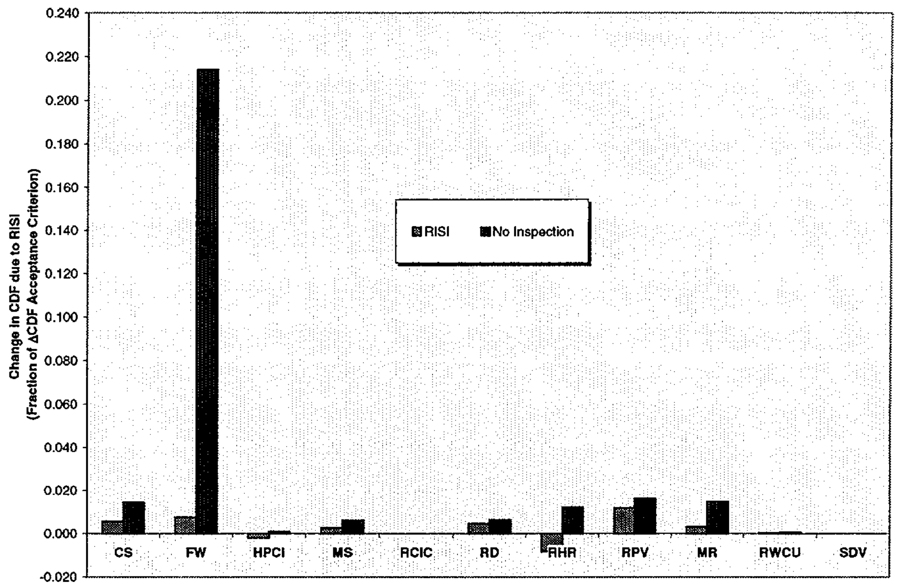

Figure 2
Change in Pipe Rupture CDF for PBAPS Unit 2 Systems

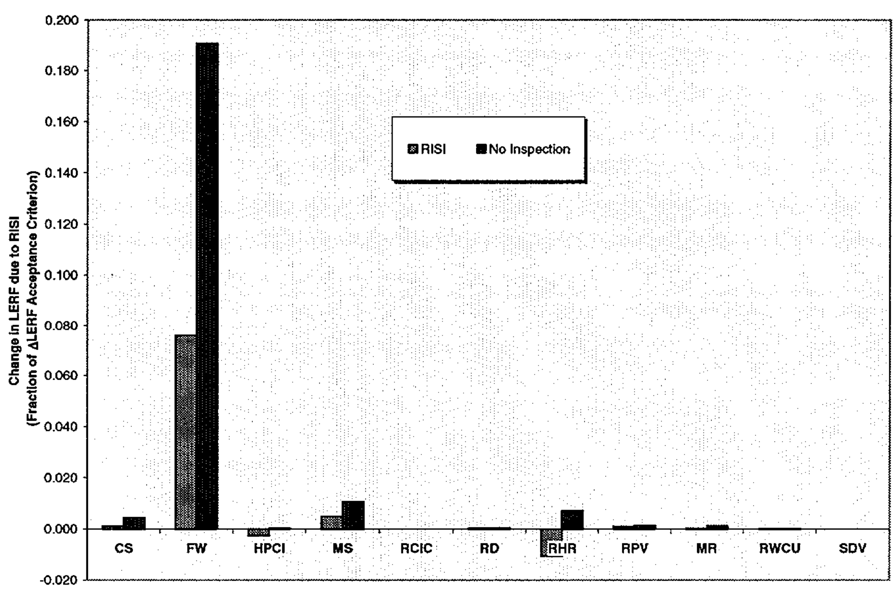

Figure 3
Change in Pipe Rupture LERF for PBAPS Unit 2 Systems

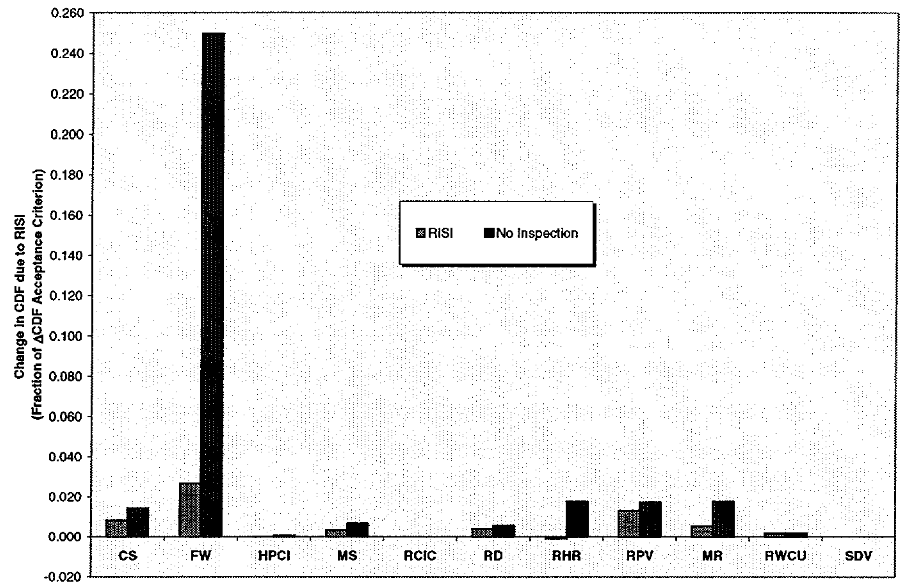

Figure 4
Change in Pipe Rupture CDF for PBAPS Unit 3 Systems

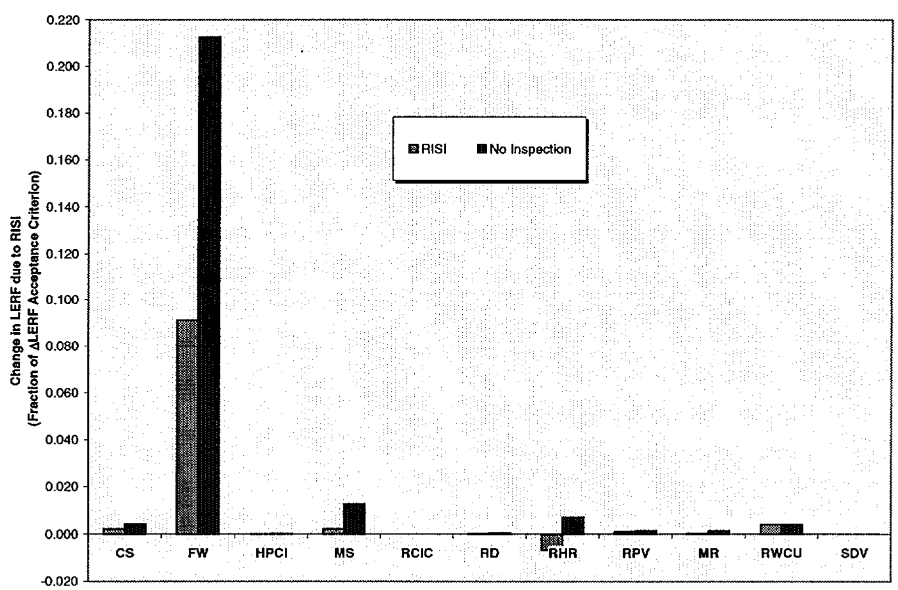

Figure 5
Change in Pipe Rupture LERF for PBAPS Unit 3 Systems

All locations within the reactor coolant pressure boundary will continue to receive a system pressure test and visual VT-2 examination as currently required by the Code regardless of its risk classification.

4. IMPLEMENTATION AND MONITORING PROGRAM

Upon approval of the RISI program, procedures that comply with the guidelines described in EPRI RISI Topical Report will be prepared to implement and monitor the program. The new program will be integrated into the third inservice inspection intervals for PBAPS, Units 2 and 3, respectively. No changes to the Updated Final Safety Analysis Report are necessary for program implementation.

The applicable aspects of the ASME Code not affected by this change are to be retained, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements. Existing ASME Section XI program implementing procedures are to be retained and modified to address the RISI process, as appropriate.

The RISI program is a living program requiring 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 PBAPS Units 2 and 3 PRA models which could impact both the risk characterization and risk impact assessments, any new trends in service experience with piping systems at PBAPS and across the industry, and new information on element accessibility that will be obtained as the risk informed inspections are implemented. As a minimum, risk ranking of piping element selections will be reviewed and adjusted on an ASME ISI interval basis. In addition, changes may occur more frequently as directed by NRC Bulletin or Generic Letter requirements, or by industry and plant-specific service experience feedback.

5. PROPOSED ISI PROGRAM PLAN CHANGE

A comparison between the RISI program and 1989 ASME Section XI Code Edition program requirements for in-scope piping is provided in Table 5 and Table 6 for Unit 2 and Unit 3, respectively. The number of exams at Unit 2 is reduced from 210 Section XI program exams to 103 RISI program exams, a net reduction of 107 exams. An additional 23 Section XI exams were also eliminated because welds having FAC only or IGSCC only damage mechanism were excluded from the RISI selection population. These welds continue to be addressed by the FAC and IGSCC augmented programs. Thus, the total reduction of Section XI exams was 130 exams compared to the 233 Section XI total (56% reduction). Unit 3 is reduced from 247 exams to 107 exams, a net reduction of 140 exams. An additional 16 Section XI exams were also eliminated due to the exclusion of FAC only and IGSCC only welds from the RISI selection population for a total reduction of 156 exams compared to the 263 Section XI total (59% reduction). As shown in Tables 7 and 8, the total change in CDF and LERF due to the net changes in number and location of inspections in all systems that were evaluated in this risk informed evaluation was found to be more than two orders of magnitude less than the risk acceptance criteria. These risk impacts are acceptable in relation to the risk significance thresholds of the EPRI Topical Report and those in Regulatory Guide 1.174.

6. REFERENCES

1. EPRI, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," TR-112657, Rev. B-A, December 1999.
2. Peach Bottom Atomic Power Station 1999 PRA Model PB299, Rev. 1, June 2000.
3. Exelon Risk Informed Inservice Inspection Evaluation, Peach Bottom Atomic Power Station Units 2 and 3 – Final Report.
4. T.J. Mikschl and K.N. Fleming, "Piping System Failure Rates and Rupture Frequencies for Use in Risk informed Inservice Inspection Applications," EPRI TR-111880, 1999, September 1999. *EPRI Licensed Material*
5. ASME Code Case N-578-1, "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1.
6. Exelon Nuclear, "Peach Bottom Atomic Power Station Units 2 and 3 – Individual Plant Examination," August 1992.

Table 1
System Selection for Unit 2 and Unit 3

System Description
Core Spray (CS)
Feedwater (FW)
High Pressure Coolant Injection (HPCI)
Main Recirculation (MR)
Main Steam (MS)
Reactor Core Isolation Cooling (RCIC)
Reactor Drain (RD)
Residual Heat Removal (RHR)
Reactor Pressure Vessel (RPV)
Reactor Water Cleanup System (RWCU)
Scram Discharge Volume (SDV)

NOTES: This table shows the systems that contain welds that are Class 1 or Class 2 category B-J, B-F, C-F-1, or C-F-2.

Table 2
Failure Potential Assessment Summary for PBAPS Unit 2 and Unit 3

	Thermal Fatigue		Stress Corrosion Cracking				Localized Corrosion			Flow Sensitive	
System	**TASCS**	**TT**	**IGSCC**	**TGSCC**	**ECSCC**	**PWSCC**	**MIC**	**PIT**	**CC**	**E-C**	**FAC**
CS	X		X								
FW	X	X									X
HPCI		X									X
MR	X		X								
MS											
RCIC	X	X									
RD											X
RHR	X									X	
RPV	X		X								
RWCU			X								X
SDV											

TASCS – thermal stratification, cycling and stripping, TT – thermal transients, IGSCC – intergranular stress corrosion cracking, TGSCC – transgranular stress corrosion cracking, ECSCC – external chloride stress corrosion cracking, PWSCC – primary water stress corrosion cracking, MIC – microbiologically influenced corrosion, PIT – pitting, CC – crevice corrosion, E-C – erosion-cavitation, FAC – flow accelerated corrosion

NOTE: This table shows the assessed failure mechanisms for each system. The RISI Program addresses the cumulative impact of all mechanisms that were identified in each system.

Table 3
Number of Elements (Welds) by Risk Category for PBAPS Unit 2

System	High Risk[1]			Medium Risk[1]		Low Risk[1]	TOTAL
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**	**Category 6 or 7**	**All Categories**
CS		4		49		181	234
FW	96		2				98
HPCI			20	20	10	94	144
MR		12		62			74
MS				275		4	279
RCIC					6	2	8
RD	12			27			39
RHR		28		191		256	475
RPV		5		29			34
RWCU			3	9	6	13	31
SDV						78	78
TOTAL	108	49	25	662	22	628	1494

1. See Figure 1 for definition of EPRI Risk Categories.

NOTE: This table shows the results of the Risk Categorization for Unit 2. The risk categories are defined in Figure 3-4 of EPRI TR-112657 (Reference 1). This table includes 71 welds that have IGSCC only or FAC only degradation mechanism that are excluded from the element selection population as indicated in Table 6-3 (Reference 3).

Table 4
Number of Elements (Welds) by Risk Category for PBAPS Unit 3

System	High Risk[1]			Medium Risk[1]		Low Risk[1]	TOTAL
	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6 or 7	All Categories
CS		2		50		176	228
FW	99		2				101
HPCI			21	20	8	103	152
MR		10		74			84
MS				300		4	304
RCIC					6	1	7
RD	7			27			34
RHR		23		189		263	475
RPV		2		30			32
RWCU			4	8	5	15	32
SDV						57	57
TOTAL	106	37	27	698	19	619	1506

1. See Figure 1 for definition of EPRI Risk Categories.

NOTE: This table shows the results of the Risk Categorization for Unit 3. The risk categories are defined in Figure 3-4 of EPRI TR-112657 (Reference 1). The minor differences are due to slight differences in the number of welds in these systems. This table includes 61 welds that have IGSCC only or FAC only degradation mechanism that are excluded from the element selection population as indicated in Table 6-3 (Reference 3).

Table 5
Number of Inspections by Risk Category for PBAPS Unit 2

	High Risk[1]						Medium Risk[1]				Low Risk[1]		All Risk Categories	
System	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6 or 7			
	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI
CS			2	1			6	5			18	0	26	6
FW	26	13				1							26	14
HPCI					4	5	4	2	1	1	12	0	21	8
MR			6	3			10	7					16	10
MS							48	28					48	28
RCIC										1	2	0	2	1
RD	3	0					8	3					11	3
RHR			4	7			23	20			17	0	44	27
RPV			4	1			19	3					23	4
RWCU					2	1	2	1	6				10	2
SDV											6	0	6	0
TOTAL	29	13	16	12	6	7	120	69	7	2	55	0	233	103

1. See Figure 1 for definition of EPRI RISI risk categories.

NOTE: This table provides a comparison of the RISI element selection to the original ASME Section XI program. The total number of inspections is significantly lower for the RISI program. Some RISI inspection locations are new when compared to the Section XI program, i.e., they were previously not addressed.

Table 6
Number of Inspections by Risk Category for Unit 3

System	High Risk[1]						Medium Risk[1]				Low Risk[1]		All Risk Categories	
	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6 or 7			
	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI	Sec. XI	RISI
CS			2	1			12	5			16	0	30	6
FW	29	14				1							29	15
HPCI					4	8	3	2			13	0	20	10
MS							53	30					53	30
RCIC									1	1	1	0	2	1
RD	1	0					9	3					10	3
RHR			6	6			20	19			24	0	50	25
RPV			2	1			23	3					25	4
MR			4	3			17	8					21	11
RWCU					2	1	6	1	5	0	4	0	17	2
SDV											6	0	6	0
TOTAL	30	14	14	11	6	10	143	71	6	1	64	0	263	107

1. See Figure 1 for definition of EPRI RISI Risk Categories.

NOTE: This table provides the same information for Unit 3 that Table 5 provides for Unit 2.

Table 7
Impact of RISI and No Inspections on CDF and LERF Due to Pipe Ruptures for PBAPS Unit 2 Systems

System	System CDF Events/Reactor-Year			Δ CDF Events/Reactor-Year			Δ LERF Events/Reactor-Year		
	Section XI	RISI	No Inspection	RISI	No Inspection	Acceptance Criterion	RISI	No Inspection	Acceptance Criterion
CS	8.28E-09	8.86E-09	9.72E-09	5.77E-10	1.44E-09	<1.00E-07	1.12E-11	4.35E-11	<1.00E-08
FW	1.06E-07	1.07E-07	1.27E-07	7.63E-10	2.14E-08	<1.00E-07	7.60E-10	1.91E-09	<1.00E-08
HPCI	2.29E-09	2.10E-09	2.39E-09	-1.88E-10	1.01E-10	<1.00E-07	-2.45E-11	3.93E-12	<1.00E-08
MR	8.66E-09	8.98E-09	1.01E-08	3.16E-10	1.47E-09	<1.00E-07	2.77E-12	1.29E-11	<1.00E-08
MS	4.82E-09	5.07E-09	5.44E-09	2.51E-10	6.19E-10	<1.00E-07	4.88E-11	1.05E-10	<1.00E-08
RCIC	1.44E-11	1.32E-11	1.51E-11	-1.17E-12	7.19E-13	<1.00E-07	-2.91E-14	8.63E-15	<1.00E-08
RD	3.44E-09	3.90E-09	4.08E-09	4.68E-10	6.43E-10	<1.00E-07	4.11E-12	5.65E-12	<1.00E-08
RHR	2.39E-08	2.30E-08	2.51E-08	-8.32E-10	1.21E-09	<1.00E-07	-1.05E-10	7.12E-11	<1.00E-08
RPV	2.42E-09	3.61E-09	4.04E-09	1.19E-09	1.61E-09	<1.00E-07	1.04E-11	1.42E-11	<1.00E-08
RWCU	4.46E-10	4.72E-10	4.95E-10	2.61E-11	4.93E-11	<1.00E-07	1.56E-12	1.95E-12	<1.00E-08
SDV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<1.00E-07	0.00E+00	0.00E+00	<1.00E-08
TOTAL	1.60E-07	1.63E-07	1.89E-07	2.57E-09	2.85E-08	<1.00E-06	7.09E-10	2.17E-09	<1.00E-07

Table 8
Impact of RISI and No Inspections on CDF and LERF due to Pipe Ruptures for PBAPS Unit 3 Systems

System	System CDF Events/Reactor-Year			Δ CDF Events/Reactor-Year			Δ LERF Events/Reactor-Year		
	Section XI	RISI	No Inspection	RISI	No Inspection	Acceptance Criterion	RISI	No Inspection	Acceptance Criterion
CS	6.82E-09	7.65E-09	8.25E-09	8.27E-10	1.43E-09	<1.00E-07	2.31E-11	4.33E-11	<1.00E-08
FW	1.09E-07	1.11E-07	1.34E-07	2.69E-09	2.50E-08	<1.00E-07	9.12E-10	2.13E-09	<1.00E-08
HPCI	2.32E-09	2.34E-09	2.39E-09	2.04E-11	7.66E-11	<1.00E-07	8.95E-13	2.98E-12	<1.00E-08
MR	9.42E-09	9.97E-09	1.12E-08	5.50E-10	1.76E-09	<1.00E-07	4.83E-12	1.55E-11	<1.00E-08
MS	5.07E-09	5.40E-09	5.74E-09	3.34E-10	6.71E-10	<1.00E-07	2.29E-11	1.26E-10	<1.00E-08
RCIC	8.49E-12	8.01E-12	1.17E-11	-4.80E-13	3.24E-12	<1.00E-07	-1.25E-14	6.18E-14	<1.00E-08
RD	2.97E-09	3.38E-09	3.56E-09	4.09E-10	5.85E-10	<1.00E-07	3.60E-12	5.14E-12	<1.00E-08
RHR	2.11E-08	2.10E-08	2.29E-08	-8.02E-11	1.77E-09	<1.00E-07	-6.82E-11	7.10E-11	<1.00E-08
RPV	2.10E-09	3.40E-09	3.83E-09	1.31E-09	1.73E-09	<1.00E-07	1.15E-11	1.52E-11	<1.00E-08
RWCU	2.63E-10	4.37E-10	4.60E-10	1.74E-10	1.97E-10	<1.00E-07	4.08E-11	4.12E-11	<1.00E-08
SDV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<1.00E-07	0.00E+00	0.00E+00	<1.00E-08
TOTAL	1.59E-07	1.65E-07	1.92E-07	6.23E-09	3.32E-08	<1.00E-06	9.51E-10	2.45E-09	<1.00E-07

Enclosure 3

Relief Request No. RR-33

REQUEST NUMBER: RR-33
REVISION 1

COMPONENT IDENTIFICATION

Code Classes:	1, 2 and 3
References:	Tables IWB-2412-1, IWC-2412-1, IWD-2412-1 and Code Case N-491-1 Table -2410-2 Code Case N-598
Examination Categories:	Not Applicable
Item Numbers:	Not Applicable
Description:	Alternative Requirements to Required Percentages of Examinations
Component Numbers:	All Class 1, 2 and 3 Components and Supports Subject to Inservice Inspection and Risk-Informed Inservice Inspection.

CODE REQUIREMENTS

ASME, Section XI, Tables IWB-2412-1, IWC-2412-1, IWD-2412-1, and Code Case N-491-1, Table -2410-2, list the required percentages of examinations that must be performed per period in accordance with Inspection Program B. These tables do not apply to those examinations that may be deferred until the end of the inspection interval as allowed by the Code. Per these tables, the number of examinations to be completed during the first period shall be between 16% and 34%. For the second period, the total number of examinations to be completed shall be between 50% and 67%, and by the end of the third period, 100% of the examinations for the interval shall be completed.

Class 1 and 2 piping elements included in the risk-informed section of the Peach Bottom Atomic Power Station ISI Program are identified in this request for alternative since the examinations of Examination Category R-A components are required to be completed in accordance with percentage requirements of ASME Section XI Table IWB-2412-1. Code Case N-491-1, Table -2410-2, is being referenced because this Code Case is being implemented during the third interval for the examination of supports. The percentages stated in Code Case N-491-1, Table -2410-2, are identical to those stated in Tables IWB-2412-1, IWC-2412-1, and IWD-2410-2.

BASIS FOR ALTERNATIVE

Pursuant to 10CFR50.55a(a)(3)(i), relief is requested on the basis that the proposed alternatives provide an acceptable level of quality and safety.

REQUEST NUMBER: RR-33
REVISION 0

The ASME Code and Code Case N-491-1 tables referenced above were originally established such that approximately one third of the non-deferred examinations would be performed each period. Over the past 20 years, it has become increasingly more difficult to meet these percentages. The emergence of longer fuel cycles increases the likelihood that one of the periods will only have one refueling outage in it. In addition, efforts to shorten refueling outages have limited the amount of time available to perform examinations. These factors have made it difficult to complete the Code required percentages of examinations in the allotted time.

Code Case N-598 was developed to address this issue. It expands the range of examination completion percentages to allow examinations to be distributed more evenly between outages. This minimizes the need to schedule an excessive number of examinations during one outage just to meet the percentages required by ASME, Section XI, Tables IWB-2412-1, IWC-2412-1, IWD-2412-1, and Code Case N-491-1, Table -2410-2. In addition, Code Case N-598 allows for a more uniform distribution between outages that is more conducive to performing quality examinations.

During the development of Code Case N-598, two additional factors were considered when evaluating the impact of the Code Case on plant safety. The first was that the existing tables allow up to 50% of the examinations to be performed in the second and third periods, but only 34% can be performed in the first period. Therefore, the Inspection Plan B schedule is biased towards delaying examinations until the end of the interval. The more flexible percentages stated in Code Case N-598 allow for more examinations to be performed earlier in the interval. This should improve safety because any problems, should they exist, would be detected earlier in the interval.

The second factor that was considered when developing Code Case N-598 was that some minimum amount of examinations should be required in each period. To address this consideration, the Code Case, including Note (1), is structured such that examinations will be required during all three periods.

Due to the factors documented above, Exelon Generation Company, LLC (Exelon) considers that the alternative criteria of Code Case N-598 provide an acceptable, or improved, level of quality and safety.

REQUEST NUMBER: RR-33
REVISION 0

PROPOSED ALTERNATIVE CRITERIA

Peach Bottom Atomic Power Station, Units 2 and 3, will use Code Case N-598 for the required percentages of examinations for all Class 1, 2, and 3 components and supports. Although Code Case N-598 also addresses Class MC components, containment issues are being addressed in Specification NE-291, and therefore are not being requested in this Request for Alternative.

APPLICABLE TIME PERIOD

Relief is requested for the third ten-year interval of the Peach Bottom Atomic Power Station Inservice Inspection Program, beginning November 5, 1998, for Unit 2, and August 15, 1998, for Unit 3.