August 27, 2003

Mr. John L. Skolds, President
and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-E
Kennett Square, PA 19348

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS, BOILER AND PRESSURE VESSEL CODE - RELIEF FOR RISK-INFORMED INSERVICE INSPECTION OF PIPING (TAC NOS. MB5512 AND MB5513)

Dear Mr. Skolds:

By letter dated June 25, 2002, as supplemented by letters dated January 10 and May 30, 2003, Exelon Generation Company, LLC (Exelon or the licensee), submitted proposed alternatives to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, concerning the third 10-year inservice inspection (ISI) programs for Peach Bottom Atomic Power Station, Units 2 and 3 (PBAPS 2 and 3).

Exelon submitted ISI Relief Request RR-44, Revision 0, and the risk-informed ISI (RI-ISI) program summary for PBAPS 2 and 3, in lieu of American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI, requirements for the selection and examination of Class 1 and 2 piping welds. The proposed RI-ISI program was developed in accordance with the methodology contained in the Nuclear Regulatory Commission (NRC)-approved Electric Power Research Institute (EPRI) Topical Report, EPRI TR-112657, Revision B-A. Additionally, Exelon submitted ISI Relief Request RR-33, Revision 1, to allow the licensee to perform up to 50 and 75 percent of the examinations in the first and second period of the inspection interval instead of the Code-allowed maximum of 34 and 67 percent.

As a result of its review of the licensee's submittal, the NRC staff identified certain areas where additional information was needed from the licensee. By letters dated January 10 and May 30, 2003, the licensee provided additional information concerning the use of the proposed alternative.

Based on the information provided by the licensee, the NRC staff concludes that for RR-44 and RR-33, the proposed alternatives will provide an acceptable level of quality and safety. Therefore, the use of the proposed alternatives is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval at each unit. The NRC staff's safety evaluation is enclosed.

If you need clarification of this approval, please contact the project manager, Mr. John P. Boska, at (301) 415-2901.

Sincerely,

/RA/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure: Safety Evaluation

cc w/encl: See next page

If you need clarification of this approval, please contact the project manager, Mr. John P. Boska, at (301) 415-2901.

Sincerely,

/RA/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure: Safety Evaluation

cc w/encl: See next page

DISTRIBUTION:

PUBLIC	PDI-2 R/F	CHolden	JClifford	JBoska	MO'Brien
ACRS	TChan	MRubin	WKoo	SMalik	BPlatchek, RI
GHill (4)	OGC	T. McGinty, EDO Rgn-I			

* SE input provided - no major changes made.
Accession Number: ML032250066 ** See previous concurrence

OFFICE	PDI-2/PM	PDI-2/LA	EMCB/SC*	SPSB/SC*	OGC**	PD1-2/SC
NAME	JBoska	MO'Brien	TChan	MRubin	RHoefling	JClifford
DATE	8/25/03	8/25/03	SE dtd 7/28/03	SE dtd 7/28/03	8/22/03	8/26/03

Official Record Copy

Peach Bottom Atomic Power Station, Units 2 and 3

cc:

Vice President, General Counsel and
Secretary
Exelon Generation Company, LLC
2301 Market Street, S23-1
Philadelphia, PA 19101

Site Vice President
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Plant Manager
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Regulatory Assurance Manager
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Resident Inspector
U.S. Nuclear Regulatory Commission
Peach Bottom Atomic Power Station
P.O. Box 399
Delta, PA 17314

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Roland Fletcher
Department of Environment
Radiological Health Program
2400 Broening Highway
Baltimore, MD 21224

Correspondence Control Desk
Exelon Generation Company, LLC
200 Exelon Way, KSA 1-N-1
Kennett Square, PA 19348

Rich Janati, Chief
Division of Nuclear Safety
Bureau of Radiation Protection
Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 8469
Harrisburg, PA 17105-8469

Board of Supervisors
Peach Bottom Township
545 Broad Street Ext.
Delta, PA 17314-9203

Mr. Richard McLean
Power Plant and Environmental
Review Division
Department of Natural Resources
B-3, Tawes State Office Building
Annapolis, MD 21401

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

Manager-Financial Control & Co-Owner
Affairs
Public Service Electric and Gas Company
P.O. Box 236
Hancocks Bridge, NJ 08038-0236

Manager Licensing-Limerick and Peach
Bottom
Exelon Generation Company, LLC
Nuclear Group Headquarters
Correspondence Control
P.O. Box 160
Kennett Square, PA 19348

Peach Bottom Atomic Power Station, Units 2 and 3

cc:

Director - Licensing
Exelon Generation Company, LLC
Nuclear Group Headquarters
Correspondence Control
P.O. Box 160
Kennett Square, PA 19348

Vice President-Licensing and Regulatory Affairs
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Vice President-Mid-Atlantic Operations
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Senior Vice President, Nuclear Services
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Vice President, Operations Support
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-N
Kennett Square, PA 19348

Chief Operating Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION RELIEF REQUESTS

RR-44 AND RR-33

EXELON GENERATION COMPANY, LLC

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

1.0 INTRODUCTION

By letter dated June 25, 2002 (Reference 1), Exelon Generation Company, LLC (Exelon or the licensee), submitted proposed alternatives to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, concerning the third 10-year inservice inspection (ISI) programs for Peach Bottom Atomic Power Station, Units 2 and 3 (PBAPS 2 and 3).

Exelon submitted ISI Relief Request RR-44, Revision 0, and the risk-informed ISI (RI-ISI) program summary for PBAPS 2 and 3, in lieu of American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI, requirements for the selection and examination of Class 1 and 2 piping welds. By letters dated January 10, 2003 (Reference 2) and May 30, 2003 (Reference 3), Exelon further provided its response to the Nuclear Regulatory Commission (NRC) staff's request for additional information concerning the proposed alternative associated with the RI-ISI program.

The proposed RI-ISI program was developed in accordance with the methodology contained in the NRC-approved Electric Power Research Institute (EPRI) Topical Report (TR), EPRI TR-112657, Revision B-A (Reference 4), which has been previously reviewed and approved by the NRC staff (Reference 5). Additionally, Exelon proposed a revision to the current Relief Request RR-33 to implement the provisions of ASME Code, Section XI, Code Case N-598, "Alternative Requirements to Required Percentages of Examinations," which would allow the licensee to perform up to 50 and 75 percent of the examinations in the first and second period of the inspection interval instead of the Code-allowed maximum of 34 and 67 percent.

2.0 REGULATORY EVALUATION

Section 50.55a(g) requires that ISI of the ASME Code, Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). According to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety or if the specified

requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code, Class 1, 2, and 3 components (including supports) shall meet the requirements set forth in the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components 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. For PBAPS 2 and 3, the applicable edition of Section XI of the ASME Code for the third 10-year ISI interval is the 1989 Edition. RR-44 states that the RI-ISI program will be implemented during the third 10-year ISI interval.

3.0 TECHNICAL EVALUATION

3.1 Summary of Proposed Approach

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

The licensee has proposed to use an RI-ISI program for a subset of ASME Code, Class 1 and 2 piping (Examination Categories B-F, B-J, and C-F) welds, as an alternative to the ASME Code, Section XI requirements. The proposed RI-ISI program follows a previously approved RI-ISI methodology delineated in EPRI TR-112657 (Reference 4).

The licensee has indicated that for the existing augmented ISI program implemented in response to NRC Generic Letter (GL) 88-01, “Intergranular Stress Corrosion Cracking (IGSCC),” Category A welds are integrated into the RI-ISI program. Portions of the program related to Categories B through G welds are credited in the RI-ISI program development, but are not affected or changed by the RI-ISI program. In addition, the existing augmented ISI program implemented in response to GL 89-08, “Flow Accelerated Corrosion (FAC),” is credited in the RI-ISI program, but is not affected or changed by the RI-ISI program. All other existing augmented ISI programs are not affected by the proposed RI-ISI program.

3.2 NRC Staff's Evaluation

Pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff has reviewed and evaluated the licensee’s proposed RI-ISI program, based on guidance and acceptance criteria provided in the following documents: EPRI TR-112657, NRC staff's safety evaluation on EPRI TR-112657, Regulatory Guides (RGs) 1.174 (Reference 6) and 1.178 (Reference 7), and Standard Review Plan (SRP), Chapter 3.9.8 (Reference 8).

3.2.1 Proposed Changes to the ISI Program

The scope of the licensee's proposed RI-ISI program is limited to ASME Code, Class 1 and 2 piping welds for the following Examination Categories: B-F for pressure retaining dissimilar metal welds in vessel nozzles, B-J for pressure retaining welds in piping, C-F-1 for pressure retaining welds in austenitic stainless steel or high alloy piping, and C-F-2 for pressure retaining welds in carbon or low alloy steel piping. The RI-ISI program is proposed as an alternative to the existing ISI requirements of ASME Code, Section XI. A general description of the proposed changes to the ISI program is provided in Sections 3 and 5 of the licensee's submittal (Reference 1).

The licensee stated that the proposed RI-ISI program is consistent with the guidelines contained in EPRI TR-112657, which state in part 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 performed using probabilistic risk assessments to establish safety ranking of piping segments for selecting new inspection locations.

3.2.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178 (References 6 and 7), the licensee provided the results of an engineering analysis of the proposed changes, using a combination of traditional engineering analysis and supporting insights from the probabilistic risk assessment (PRA). The licensee stated that the results of the engineering analysis demonstrate that the proposed changes are consistent with the principles of defense-in-depth. The licensee performed an evaluation to determine susceptibility of components (i.e., a weld on a pipe) to a particular degradation mechanism that may be a precursor to leak or rupture, and then performed an independent assessment of the consequence of a failure at that location.

Augmented programs for IGSCC (GL 88-01) except Category A welds, service water integrity (GL 89-13), and FAC (GL 89-09), are not subsumed into the RI-ISI program and remain unaffected. The applicant indicated in Reference 3 that there are 142 Category A welds at Unit 2 and 152 Category A welds at Unit 3 that are included in the RI-ISI program. These welds are considered to be resistant to IGSCC. Elements that are covered by these augmented programs were included in the consequence assessment, degradation assessment, and risk categorization evaluations to determine whether the affected piping was subject to damage mechanisms other than those addressed by the augmented program. If another damage mechanism was identified, the element was retained within the scope of consideration for element selection as part of the RI-ISI program. When inspections are required under the RI-ISI and augmented programs, all inspection requirements for both RI-ISI and augmented programs are met. If no other damage mechanism was identified, the element was excluded from the RI-ISI element selection population (i.e., not included in the population of elements from which 25 percent or 10 percent must be selected for inspection) and retained in the appropriate augmented inspection program. The licensee's approach deviates from the approved methodology because the methodology in EPRI 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 is acceptable because inspections required only in the augmented programs are not credited as RI-ISI inspections, elements in the augmented programs will continue to be inspected for the appropriate degradation mechanisms, and the RI-ISI program will address other damage mechanisms.

Piping systems within the scope of the RI-ISI program were divided into piping segments. Pipe segments are defined as lengths of pipe whose failure (anywhere within the pipe segment) would lead to the same consequence and which are exposed to the same degradation mechanisms. That is, some lengths of pipe whose failure would lead to the same consequence may be split into two or more segments when two or more regions are exposed to different degradation mechanisms. The licensee also stated that failure potential assessments, presented in Table 2 of the licensee's submittal, were generated utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in EPRI TR-112657. The NRC staff concludes that the licensee has met the SRP 3.9.8 guidelines to confirm that a systematic process was used to identify the component's (i.e., pipe segments) susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture.

Additionally, the licensee stated that the consequences of pressure boundary failures were evaluated and ranked based on their impact on core damage and large early release, and that the impact due to both direct and indirect effects was considered using guidance provided in the EPRI TR-112657. The licensee reported no deviations from the consequence evaluation methodology approved by the staff in the EPRI report. Therefore, the NRC staff considers the consequence evaluation performed by the licensee for this application to be acceptable.

3.2.3 Probabilistic Risk Assessment

The licensee used an updated version of the Individual Plant Examination (IPE) model to evaluate the consequences of pipe rupture for the RI-ISI assessment. This version of the risk model, PBAPS 2 and 3 1999 PRA Model PB299, Revision 1, which represents the second upgrade to the IPE model, is a full level 2 PRA model. It addresses accidents initiated by internal events at full power, internal flooding, and containment response to these accidents. In Reference 2, the licensee stated the baseline core damage frequency (CDF) estimated from this PRA model is 4.48E-6/yr and the baseline large early release frequency (LERF) estimated is 6.17E-8/yr.

The original IPE was submitted to the NRC on August 26, 1992. The IPE estimated a CDF of 5.5E-6/year. The NRC staff's evaluation of the IPE, dated October 25, 1995, concluded that the PBAPS 2 and 3 IPE satisfied the intent of GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities." A Boiling Water Reactor Owners Group (BWROG) Probabilistic Safety Assessment (PSA) Peer Review/Certification Review was performed in 1998 on the first upgrade to the IPE model and its supporting documentation and found that the PRA can be used to support regulatory applications when combined with deterministic insights. In Reference 3, the licensee stated that the second upgrade to the PRA model included resolution of many comments provided by the BWROG PSA Peer Review/Certification Review.

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

inappropriate assumptions will affect only the consequence categorization of a few segments and will not invalidate the general results or conclusions.

As required by Section 3.7 of the EPRI TR, the licensee evaluated the change in risk expected from replacing the current ISI program with the RI-ISI program. The calculations estimated the change in risk due to removing locations and adding locations to the inspection program. As discussed in Section 3.2.2 above, the licensee deviated from the EPRI methodology by excluding some elements from the population of elements from which RI-ISI locations for inspection were selected. In Reference 1, the licensee stated that the change in risk estimates included a quantitative evaluation of the change in risk due to changes in the ISI program for each piping element in the scope of the RI-ISI evaluation. Therefore, excluding some elements from the population of elements for possible inspection does not affect the change in risk calculations.

The licensee used the failure frequencies developed in EPRI TR-111880 (Reference 9) to support the estimate for the change in risk. The nonproprietary version of TR-111880 (Reference 10) illustrates the characteristics and format of the information used, but does not include the calculated parameters. The change in risk is calculated utilizing the Markov model described in EPRI TR-110161 (Reference 11) to estimate the "inspection efficiency factor (IEF)." The IEF calculation incorporates the time between ISI inspections and the time between opportunities to detect a leak together with the probability of detection to estimate the reduction in pipe failure frequency arising from including the element in an ISI program. The method is identical to that used by the licensee, and approved by the NRC staff, for the Dresden Nuclear Power Station RI-ISI program (Reference 12). The NRC staff finds this same method appropriate for use in the proposed PBAPS 2 and 3 RI-ISI program.

In Reference 1, the licensee estimated the aggregate change in CDF and large early release frequency (LERF) for both units. These estimates are shown in the table below. A positive aggregate change in CDF and LERF indicates an increase in risk as a result of transitioning from ASME Code, Section XI-based ISI to the RI-ISI program.

Estimated Change in Risk Associated with Replacing the Section XI ISI Program with a Risk-Informed ISI Program		
	ΔCDF	ΔLERF
Unit 2	2.57E-9/yr	7.09E-10/yr
Unit 3	6.23E-9/yr	9.51E-10/yr

The staff finds the licensee's process to evaluate and bound the potential change in risk reasonable because it accounts for the change in the number and location of 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. System level and aggregate estimates of the changes in CDF and LERF are less than the corresponding guideline values in the EPRI TR. The NRC staff finds that re-distributing the welds to be inspected with consideration of the safety significance of the segments provides assurance that segments whose failure have a significant impact on plant

risk receive an acceptable and often improved level of inspection and, therefore, the licensee's process to evaluate the potential change in risk is acceptable.

3.2.4 Integrated Decision Making

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

The selection of pipe segments to be inspected is described in Section 3.5 of the submittal using the results of the risk category ranking and other operational considerations. Tables 3 and 4 of the submittal provide the number of elements (welds) and inspections by risk category for PBAPS 2 and 3, respectively, within the scope of the RI-ISI program. Tables 5 and 6 of the submittal provide a summary table for each unit comparing the number of inspections required under the existing ASME Code, Section XI, ISI program with the alternative RI-ISI program. Tables 7 and 8 of the submittal provide the risk impact analysis results for each system for PBAPS 2 and 3, respectively. The licensee stated that the failure estimates and the selection of examination elements with high- and medium-risk-ranked piping segments were determined using the guidance provided in EPRI TR-112657.

As required by Section 6.4 of the EPRI TR, the licensee has completed an evaluation of existing relief requests to determine if any should be withdrawn or modified due to changes that occur from implementing the RI-ISI program. The licensee has concluded that there is no existing relief request required to be modified due to RI-ISI expansion of the examination volume. The licensee states in their submittal that for any examination location where they can not obtain greater than 90 percent volumetric coverage, they will follow the process outlined in EPRI TR-112657. The licensee withdrew Relief Request RR-28, which requested approval to perform alternative examination of Category B-J welds where terminal ends are inaccessible. Relief Request RR-28 is no longer needed in the RI-ISI program, because the EPRI element selection process for Examination Category R-A has allowed for examination of alternate, similarly risk-ranked welds. However, a new relief request will be generated for any RI-ISI examination location for which greater than 90 percent coverage is not achieved.

Through Relief Request RR-33, Revision 1, the licensee has requested to implement the provisions of ASME Code, Section XI, Code Case N-598, "Alternative Requirements to Required Percentages of Examinations," during each inspection period for components examined within the scope of the ASME Code, Section XI, ISI program and the RI-ISI program as an alternative to the Code requirement. The use of the code case allows the licensee to perform up to 50 and 75 percent of the examinations in the first and second period of the inspection interval instead of the Code examinations allowed maximum of 34 and 67 percent. The licensee's basis for the alternative dwells upon the fact that due to longer fuel cycles one of the inspection periods in the interval may have one refueling outage which may not provide sufficient outage time to complete the Code-required percentage of examinations for the inspection period. However, Code Case N-598 allows taking credit for a greater percentage of examinations than that of the Code and, thereby, provides more flexibility to complete the RI-ISI or the Code-required examinations in a given period. The NRC staff believes that by allowing the maximum percentages of examinations to be 50 percent and 75 percent in the first and the second inspection periods in accordance with Code Case N-598, any degradation or relevant

condition can be detected early in the interval and appropriate corrective measures can be taken to preclude failures of components. Therefore, the implementation of Code Case N-598 would provide an acceptable level of quality and safety and the NRC staff authorizes this alternative pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year interval. In the submittal, the licensee states that this relief request will remain applicable for the current inspection interval.

The methodology described in EPRI TR-112657 requires that existing augmented programs be maintained, with the exception of thermal fatigue and IGSCC Category A piping welds, which the RI-ISI program supersedes. The EPRI TR also describes targeted examination volumes (typically associated with welds) and methods of examination based on the type(s) of degradation expected. The NRC 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 degradations over that currently required by the ASME Code, Section XI.

The objective of the 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. The RI-ISI program is judged to meet this objective. Further, the risk-informed selection process is a technically sound “inspection for cause” program. This way the process not only identifies the risk-important areas of the piping systems, but also defines the appropriate examination methods, examination volumes, procedures, and evaluation standards necessary to address the degradation mechanism(s) of concern and the ones most likely to occur at each location to be inspected. Thus, the location selection process is acceptable since it is consistent with the process described in EPRI TR-112657, which takes into account defense-in-depth and includes coverage of systems subjected to degradation mechanisms in addition to those covered by augmented inspection programs.

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

3.2.5 Implementation and Monitoring

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

The licensee stated 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 EPRI TR provides the relationship between the proposed

risk-informed examination program and the remaining portions of the ASME Code, Section XI, that are unaffected by the proposed RI-ISI program.

The licensee stated in Section 4 of the submittal that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of safety-significant piping locations. The licensee also stated that, as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis and that significant changes may require more frequent adjustment as directed by NRC bulletin or GL requirements, or by industry and plant-specific feedback. In Reference 3, the applicant described the program used at PBAPS 2 and 3 to monitor information that may have an impact on the proposed RI-ISI program. At PBAPS 2 and 3, a formal operating experience program is used to monitor and implement corrective actions. This program consists of review of industry information such as vendor service information letters, Institute of Nuclear Power Operations Significant Operating Experience Reports and NRC Information Notices. Such information will be distributed to the responsible ISI coordinator at each station for further review. When necessary, the station ISI coordinator may initiate a condition report as a means to create corrective actions.

The licensee's submittals (References 1 and 2) addressed additional examinations. Section 3.5 of the initial submittal stated that examinations performed that reveal flaws or relevant conditions exceeding the applicable acceptance standards shall be extended to include additional examinations. These additional examinations shall include piping structural elements with the same postulated failure mode. Additional examinations will be performed on these elements up to a number equivalent to the number of elements with the same postulated failure mode originally scheduled for that fuel cycle. If the additional required examinations reveal flaws or relevant conditions exceeding the acceptance standards, the examinations shall be further extended. Reference 2 provided additional information to address the time frame for the second sample expansion. The licensee stated in Reference 2 that "Exelon will consider all R-A category welds as ASME Class 1, and will follow the provisions of the 1989 ASME Section XI Code, IWB-2430(b), with regard to the second sample expansion. The required additional examinations will be performed during the same outage that the relevant condition was detected." The NRC staff finds the licensee's approach acceptable since the additional examinations, if required, will be performed during the outage in which the indications or relevant conditions are identified.

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

PBAPS 2 and 3 are currently in the second period of the third interval. The PBAPS 2 and 3 RI-ISI program will be integrated into the third 10-year ISI inspection interval, starting from the second period of the interval for both units. For those welds inspected during the first period of the third 10-year interval, a credit of 31 welds for Unit 2 and 51 welds for Unit 3 will be taken for risk significant ISI examinations in accordance with the guidance in EPRI TR-112657, Revision B-A. The RI-ISI program requires examination of 103 welds in Unit 2 and 107 welds in Unit 3 over the current ISI interval. Therefore, for the remaining periods of the third interval, 72 welds

and 56 welds will be performed for Units 2 and 3, respectively. Hence, all examinations of the required RI-ISI locations will be completed within the current interval.

4.0 CONCLUSION

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

In accordance with the guidelines of RGs 1.174 and 1.178, the elements of traditional engineering analysis and PRA are part of an integrated decision making process to develop an RI-ISI program and to assess the acceptability of the program. The primary objective of this process is to confirm that the proposed program change will not compromise defense-in-depth, safety margins, and other key principles described in these RGs. The EPRI TR-11256 RI-ISI methodology is a process-driven approach, that is, the process identifies high risk-significant pipe segment locations to be inspected. The PBAPS 2 and 3 RI-ISI program demonstrates that unacceptable risk impacts will not occur, and thus, implementation of the RI-ISI program satisfies the acceptance guideline of RG 1.174.

The PBAPS 2 and 3 methodology also considers implementation and performance monitoring strategies. Inspection strategies ensure that failure mechanisms of concern have been addressed and there is adequate assurance of detecting damage before structural integrity is affected. The risk significance of piping segments is taken into account in defining the inspection scope for the RI-ISI program.

System pressure tests and visual examination of piping structural elements will continue to be performed on all Class 1, 2, and 3 systems in accordance with ASME Code, Section XI. The RI-ISI program applies the same performance measurement strategies as the existing ASME Code requirements and, in addition, increases the inspection volumes at weld locations that are susceptible to thermal fatigue.

The PBAPS 2 and 3 methodology includes an engineering analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth quality is not degraded, in that, the methodology provides reasonable assurance that any reduction in inspections will not lead to degraded piping performance when compared to the existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of system piping.

The NRC staff concludes that the licensee's proposed RI-ISI program is an acceptable alternative to the current ISI program for Class 1 and 2 piping welds at PBAPS 2 and 3, and therefore, the proposed alternatives of Relief Requests RR-44 and RR-33, Revision 1, are authorized for the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the alternatives will provide an acceptable level of quality and safety.

5.0 REFERENCES

1. Exelon Generation Company, LLC, letter, dated June 25, 2002, from Michael P. Gallagher, Director, Licensing and Regulatory Affairs, to U.S. Nuclear Regulatory Commission, *Third Ten-Year Interval Inservice Inspection (ISI) Program Risk-Informed Inservice Inspection*.

2. Exelon Generation Company, LLC, letter, dated January 10, 2003, from Michael P. Gallagher, Director, Licensing and Regulatory Affairs, to U.S. Nuclear Regulatory Commission, *Proposed Alternative Associated with the Risk-Informed Inservice Inspection Program*.

3. Exelon Generation Company, LLC, letter, dated May 30, 2003, from Michael P. Gallagher, Director, Licensing and Regulatory Affairs, to U.S. Nuclear Regulatory Commission, *Response to Request for Additional Information Concerning a Proposed Alternative Associated with the Risk-Informed Inservice Inspection Program*.

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

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

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

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

8. NRC NUREG-0800, Chapter 3.9.8, *Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping,* September 1998.

9. 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).

10. 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.

11. 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).

12. Letter dated September 5, 2001, from A. Mendiola, U. S. Nuclear Regulatory Commission, to O. V. 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*.

Principal Contributors: W. Koo
S. Malik

Date: August 27, 2003