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Nuclear LLC

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

REQUEST FOR AUTHORIZATION TO USE A RISK-INFORMED INSERVICE INSPECTION ALTERNATIVE TO THE ASME BOILER AND PRESSURE VESSEL CODE SECTION XI REQUIREMENTS FOR CLASS 1 AND 2 PIPING HOPE CREEK GENERATING STATION DOCKET NO. 50-354

In accordance with 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(i), PSEG Nuclear LLC is submitting a proposed alternative to the existing 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 Hope Creek Generating Station (HCGS) uses the methodology contained in the NRC approved Electric Power Research Institute (EPRI) Topical Report (TR) 112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure."

The enclosed Risk-Informed Inservice Inspection (RI-ISI) Program Plan for Hope Creek demonstrates 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 Hope Creek Risk-Informed ISI submittal is consistent with the Nuclear Energy Institute (NEI) and industry template developed for applications of the Risk-Informed ISI methodology.

HCGS plans to start implementing a risk-informed inservice inspection program during the plant's twelfth refueling outage (RFO12), scheduled for Fall 2004, coincident with the third period of the second inservice inspection interval. Subsequent ISI intervals will continue to perform inservice examinations in accordance with the RI-ISI Program.

Approval of this proposed alternative is requested by October 1, 2004 to support the refueling outage scheduled to begin October 13, 2004.

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Should you have any questions concerning this letter, please contact Mr. Carl L. Berger at (856) 339-1432.

Sincerely,

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Enclosure

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RISK-INFORMED INSERVICE INSPECTION PROGRAM PLAN

HOPE CREEK GENERATING STATION

REVISION 0

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1. INTRODUCTION

The Hope Creek Generating Station (HCGS) recently completed the second period of the second inservice inspection (ISI) interval as defined by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Section XI Code for Inspection Program B. The completion of the second period coincided with breaker closure of the plant's eleventh refueling outage (RFO11) on May 14, 2003. HCGS plans to start implementing a risk-informed inservice inspection (RI-ISI) program during the plant's twelfth refueling outage (RFO12) scheduled for Fall 2004. Subsequent ISI intervals will implement 100% of the inspection locations selected for examination per the RI-ISI Program.

References [6.1] and [6.2] document relief requests submitted recently by PSEG Nuclear that address the proposed synchronization of the ten-year ISI intervals for Salem Units 1 and 2 and Hope Creek, respectively. If approved, this would enable the third ISI intervals for Salem Units 1 and 2 to be aligned, and the second ISI interval for Hope Creek to be synchronized with them. As it pertains to Hope Creek specifically, the proposal would allow the second ISI interval to be restarted as of May 14, 2003 to enable the desired synchronization.

The ASME Section XI Code of Record for the second ISI interval at Hope Creek is the 1989 Edition and the examinations performed through the completion of the second period have conformed to these requirements. References [6.3] and [6.4] document relief requests submitted recently by PSEG Nuclear for Salem Unit 1 and Hope Creek, respectively, that propose to update the Code of Record for these Units to the 1998 Edition though 2000 Addenda, which is the current Code of Record for Salem Unit 2.

The interval synchronization and Code consolidation efforts discussed above for Salem Units 1 and 2 and Hope Creek will permit the ISI Programs for these plants to be consistently implemented and maintained.

The objective of this submittal is to request the use of a risk-informed process for the inservice inspection of Class 1 and 2 piping. The RI-ISI process used in this submittal is described in Electric Power Research Institute (EPRI) Topical Report (TR) 112657 Rev. B-A "Revised Risk-Informed Inservice Inspection Evaluation Procedure." The RI-ISI application was also conducted in a manner consistent with ASME Code Case N-578 "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B."

1.1 Relation to NRC Regulatory Guides 1.174 and 1.178

As a risk-informed application, this submittal meets the intent and principles of Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis" and Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking Inservice Inspection of Piping". Further information is provided in Section 3.6.2 relative to defense-in-depth.

1.2 PSA Quality

The original Level I Hope Creek Generating Station Probabilistic Risk Assessment (HCGS PRA) was completed in January 1990. Because GL88-20 and the IPE submittal guidance in NUREG-1335 were not issued until November 1988 and August 1989 respectively, the study was performed and documented in accordance with the guidance provided in NUREG/CR-2300 and the IREP Procedures Guide.

PSE&G responded in writing to Supplement No. 1 to GL88-20 on November 1, 1989. In that letter, PSE&G noted that it had initiated its PRA Program in advance of receiving IPE guidance because of its desire to produce a risk-based tool that could be used during the plant modification process and aid in the prioritization of resources. It also identified its intention to use the Level I PRA to satisfy the front-end analysis requirements of GL88-20.

An update was initiated in August 1990 and completed by the end of the year. The scope of the update included verification that system risk models accurately reflected current configurations, review and revision of scoping assumptions, addition of containment isolation events, and re-quantification of the entire model.

After completing the update of the Level I PRA, a detailed, plant-specific assessment of risk due to Interfacing Systems Loss-of-Coolant Accidents was completed. The results of that study were integrated into the updated Level I PRA.

By the middle of 1991, work was initiated on a Level II PRA to meet the back-end analysis requirements of GL88-20 and performed in accordance with the back-end analysis guidelines of NUREG-1335, and was completed by the end of 1992.

The HCGS IPE was submitted to the NRC in May 1994. On April 25, 1995 the NRC sent a request for additional information containing 38 questions. These questions were answered by PSE&G in a letter dated August 1, 1995. The NRC responded in a letter dated April 23, 1996 and approved the HCGS IPE. This letter contains the following conclusion:

> "Based on the above findings, the staff notes that: (1) the licensee's IPE is complete with regard to the information requested by GL 88-20 (and associated guidance NUREG-1335), and (2) the IPE results are reasonable given the HCGS design, operation, and history. As a result the staff concludes that the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the HCGS IPE has met the intent of GL 88-20."

The initial PRA model has gone through several revisions. PRA model Revision 1.0 addressed the model deficiencies and system modifications identified in the Corrective Action Program from September 1994 through the first quarter of 1999. Data Analysis had been redone using the appropriate methodology for the generic data development, plant specific data analysis, and common cause factors. The Level II analysis had been modified to incorporate a direct interface between the Level I and Level II analysis. LERF (large early release frequency) was obtained directly from the results of Level I analysis. The PRA Revision 1.0 was a major revision and was published in July 1999. Subsequently, three minor revisions were published, Revision 1.1 in March 2000, Revision 1.2 in June 2000, and Revision 1.3 in October 2000. These revisions incorporated the most significant comments made by the pilot and formal peer reviews, recovery of Diesel Generators, success criteria of Safety Auxiliaries Cooling System, and other issues identified during this period. Revision 1.3 contains features necessary to support on-line risk monitoring and is the latest version for production use. A major revision of the PRA, which will result in Revision 2.0, has been completed recently and is currently under review. It was not used for preparation of this submittal.

THOUGHT IT WAS COMPLETE & WE HAVE UPGRADED TO ASME QUALITY? Contractor is complete. We are doing final V&V and tweaking. Their #s are too high. /TKC

A pilot peer review of the Hope Creek PRA was conducted in November 1996 and a formal peer review was conducted in August 1999. Revision 1.0 incorporated the most significant findings from the pilot peer review. Revisions 1.1, 1.2 and 1.3 incorporated most of the significant findings from the formal peer review certification.

The Risk-Informed Inservice Inspection (RI-ISI) calculations are based on the Hope Creek PRA Revision 1.3. The base case core damage frequency (CDF) is 8.7E-6/year, and the LERF is 1.0E-6/year.

The Summary of Results of the BWROG HCGS PSA Certification published in November 1999 contains the following statements:

- "The PSA can effectively be used to support applications."
- "The Hope Creek PSA Peer Review Certification has examined the key elements of the Hope Creek internal events Level 1 and Level 2 PSA and has found that:
  - The scope of the PSA supports PSA Applications through Grade 3.
  - The level of detail provided in the PSA model is sufficient to support PSA applications through Grade 3.
  - The documentation of the PSA could be enhanced to ensure it supports PSA applications greater than Grade 2 in the future.
  - The PSA is supportive of Grade 2 and higher applications in all areas, and in many areas fully supportive of grade 3 applications."

I WOULD MAKE IT CLEAR THAT ADDITIONAL CHANGES WILL MAKE IT BETTER AND ∴ STILL VALID TO USE. should go w/o saying /TKC

The main comments in the above review were connected with the treatment of the human action dependencies and the Level 2 LERF sequences timing. It is not expected that these issues would impact the consequence rankings established in the RI-ISI analysis, mainly because the risk importance of the systems in the RI-ISI process is dominated by the LOCA events.

Based on the above, it is judged that the current PRA model, used in the RI-ISI evaluation, has an acceptable quality to support this application.

2. PROPOSED ALTERNATIVE TO CURRENT ISI PROGRAMS

2.1 ASME Section XI

ASME Section XI Examination Categories B-F, B-J, C-F-1 and C-F-2 currently contain the requirements for the nondestructive examination (NDE) of Class 1 and 2 piping components. The alternative RI-ISI Program for piping is described in EPRI TR-112657. The RI-ISI Program will be substituted for the current program for Class 1 and 2 piping (Examination Categories B-F, B-J, C-F-1 and C-F-2) in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. Other non-related portions of the ASME Section XI Code will be unaffected. EPRI TR-112657 provides the requirements for defining the relationship between the RI-ISI Program and the remaining unaffected portions of ASME Section XI.

2.2 Augmented Programs

The following plant augmented inspection programs were considered during the RI-ISI application:

- The plant augmented inspection program for flow accelerated corrosion (FAC) per Generic Letter 89-08 is relied upon to manage this damage mechanism but is not otherwise affected or changed by the RI-ISI Program.

- The HCGS is incorporating the guidance contained in BWR Vessel and Internals Project Report No. BWRVIP-75. BWRVIP-75 provides alternative criteria to NRC Generic Letter 88-01 for the examination of welds susceptible to intergranular stress corrosion cracking (IGSCC). Both Generic Letter 88-01 and BWRVIP-75 specify examination extent and frequency requirements for austenitic stainless steel welds that are classified as Categories "A" through "G", dependent upon their susceptibility to IGSCC. In accordance with EPRI TR-112657, piping welds identified as Category "A" are considered resistant to IGSCC and are assigned a low failure potential provided no other damage mechanisms are present. As such, the examination of welds identified as Category "A" inspection locations is subsumed by the RI-ISI Program. The existing plant augmented inspection program for the other piping welds susceptible to IGSCC at the HCGS (Categories "C" and "E") remains unaffected by the RI-ISI Program submittal.

- The plant augmented inspection program for break exclusion region (BER) piping welds as defined by the requirements of Branch Technical Position MEB 3-1 is not affected by the RI-ISI Program application. It should be noted, however, that the BER piping at the HCGS is the subject of separate and independent assessment being conducted in accordance with EPRI Report 1006937 Rev. 0-A "Extension of the EPRI Risk-Informed Inservice Inspection (RI-ISI) Methodology to Break Exclusion Region (BER) Programs".

- The plant augmented inspection program for feedwater nozzle cracking per NUREG 0619 is implemented per the provisions provided in GE-NE-523-A71-0594 and the associated NRC Safety Evaluation. The feedwater nozzle-to-safe end weld locations are included in the scope of both the NUREG 0619 Program and the RI-ISI Program. The plant augmented inspection program requirements for these locations are not affected or changed by the RI-ISI Program.

3. RISK-INFORMED ISI PROCESS

The process used to develop the RI-ISI Program conformed to the methodology described in EPRI TR-112657 and consisted of the following steps:

- Scope Definition
- Consequence Evaluation
- Failure Potential Assessment

- Risk Characterization
- Element and NDE Selection
- Risk Impact Assessment
- Implementation Program
- Feedback Loop

A deviation to the EPRI RI-ISI methodology has been implemented in the failure potential assessment for HCGS. Table 3-16 of EPRI TR-112657 contains criteria for assessing the potential for thermal stratification, cycling and striping (TASCS). Key attributes for horizontal or slightly sloped piping greater than 1" nominal pipe size (NPS) include:

1. Potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or
2. Potential exists for leakage flow past a valve, including in-leakage, out-leakage and cross-leakage allowing mixing of hot and cold fluids, or
3. Potential exists for convective heating in dead-ended pipe sections connected to a source of hot fluid, or
4. Potential exists for two phase (steam/water) flow, or
5. Potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow,

AND

➢ $\Delta T > 50°F$,

AND

➢ Richardson Number > 4 (*this value predicts the potential buoyancy of a stratified flow)*

These criteria, based on meeting a high cycle fatigue endurance limit with the actual ΔT assumed equal to the greatest potential ΔT for the transient, will identify all locations where stratification is likely to occur, but allows for no assessment of severity. As such, many locations will be identified as subject to TASCS where no significant potential for thermal fatigue exists. The critical attribute missing from the existing methodology that would allow consideration of fatigue severity is a criterion that addresses the potential for fluid cycling. The impact of this additional consideration on the existing TASCS susceptibility criteria is presented below.

➢ **Turbulent penetration TASCS**

Turbulent penetration typically occurs in lines connected to piping containing hot flowing fluid. In the case of downward sloping lines that then turn horizontal, significant top-to-bottom cyclic ΔTs can develop in the horizontal sections if the horizontal section is less than about 25 pipe diameters from the reactor coolant piping. Therefore, TASCS is considered for this configuration.

For upward sloping branch lines connected to the hot fluid source that turn horizontal or in horizontal branch lines, natural convective effects combined with effects of turbulence penetration will keep the line filled with hot water. If there is no potential for in-leakage towards the hot fluid source from the outboard end of the line, this will result in a well-mixed fluid condition where significant top-to-bottom ΔTs will not occur. Therefore TASCS is not considered for these configurations. Even in fairly long lines, where some heat loss from the outside of the piping will tend to occur and some fluid stratification may be present, there is no significant potential for cycling as has been observed for the in-leakage case. The effect of TASCS will not be significant under these conditions and can be neglected.

- **Low flow TASCS**

In some situations, the transient startup of a system (e.g., RHR suction piping) creates the potential for fluid stratification as flow is established. In cases where no cold fluid source exists, the hot flowing fluid will fairly rapidly displace the cold fluid in stagnant lines, while fluid mixing will occur in the piping further removed from the hot source and stratified conditions will exist only briefly as the line fills with hot fluid. As such, since the situation is transient in nature, it can be assumed that the criteria for thermal transients (TT) will govern.

- **Valve leakage TASCS**

Sometimes a very small leakage flow of hot water can occur outward past a valve into a line that is relatively colder, creating a significant temperature difference. However, since this is a generally a "steady-state" phenomenon with no potential for cyclic temperature changes, the effect of TASCS is not significant and can be neglected.

HAVE OTHERS TAKEN THIS POSITION? THIS WAS NOT ALLOWED FOR SALEM'S 88-05 RESPONSE

- **Convection heating TASCS**

Similarly, there sometimes exists the potential for heat transfer across a valve to an isolated section beyond the valve, resulting in fluid stratification due to natural convection. However, since there is no potential for cyclic temperature changes in this case, the effect of TASCS is not significant and can be neglected.

In summary, these additional considerations for determining the potential for thermal fatigue as a result of the effects of TASCS provide an allowance for the consideration of cycle severity. The above criteria have previously been submitted by EPRI for generic approval (Letters dated February 28, 2001 and March 28, 2001, from P.J. O'Regan (EPRI) to Dr. B. Sheron (USNRC), "Extension of Risk-Informed Inservice Inspection Methodology"). The methodology used in the Hope Creek RI-ISI application for assessing TASCS potential conforms to these updated criteria. Final materials reliability program (MRP) guidance on the subject of TASCS will be incorporated into the Hope Creek RI-ISI application if different than the criteria used. It should be noted that the NRC has granted approval for RI-ISI relief requests incorporating these TASCS criteria at several facilities, including Comanche Peak (SER dated September 28, 2001) and South Texas Project (SER dated March 5, 2002).

OK

ARE THEY THE SAME?

3.1 Scope of Program

The systems included in the RI-ISI Program are provided in Table 3.1. The piping and instrumentation diagrams and additional plant information including the existing plant ISI Program were used to define the Class 1 and 2 piping system boundaries.

3.2 Consequence Evaluation

The consequence(s) of pressure boundary failures were evaluated and ranked based on their impact on core damage and containment performance (i.e., isolation, bypass and large early release). The consequence evaluation included an assessment of shutdown and external events. The impact on these measures due to both direct and indirect effects was considered using the guidance provided in EPRI TR-112657.

3.3 Failure Potential Assessment

Failure potential estimates were generated utilizing industry failure history, plant specific failure history, and other relevant information. These failure estimates were determined using the guidance provided in EPRI TR-112657, with the exception of the previously stated deviation.

Table 3.3 summarizes the failure potential assessment by system for each degradation mechanism that was identified as potentially operative.

3.4 Risk Characterization

In the preceding steps, each run of piping within the scope of the program was evaluated to determine its impact on core damage and containment performance (i.e., isolation, bypass and large, early release) as well as its potential for failure. Given the results of these steps, piping segments are then defined as continuous runs of piping potentially susceptible to the same type(s) of degradation and whose failure will result in similar consequence(s). Segments are then ranked based upon their risk significance as defined in EPRI TR-112657.

The results of these calculations are presented in Table 3.4.

3.5 Element and NDE Selection

In general, EPRI TR-112657 requires that 25% of the locations in the high risk region and 10% of the locations in the medium risk region be selected for inspection using appropriate NDE methods tailored to the applicable degradation mechanism. In addition, per Section 3.6.4.2 of EPRI TR-112657, if the percentage of Class 1 piping locations selected for examination falls substantially below 10%, then the basis for selection needs to be investigated.

For the HCGS, the percentage of Class 1 piping welds selected strictly for RI-ISI purposes was 9.3%. It should be noted that this sampling percentage for Class 1 piping locations includes both socket and non-socket welds. If only non-socket welded locations are considered, the percentage of Class 1 piping welds selected for examination increases to 12%.

The above sampling percentage does not take credit for any inspection locations selected for examination per the plant's augmented inspection program for FAC beyond those selected per the RI-ISI process. It should be noted that no FAC examinations are being credited to satisfy RI-ISI selection requirements. Inspection locations selected for RI-ISI purposes that are in the FAC Program will be subjected to an independent examination to satisfy the RI-ISI Program requirements.

All of the non Category "A" inspection locations selected for examination per the plant's augmented inspection program for IGSCC (five Category "C" and one Category "E") were also selected for RI-ISI purposes, either due to the presence of other damage mechanisms, or to satisfy Risk Category 4 selection requirements.

A brief summary is provided in the following table, and the results of the selections are presented in Table 3.5. Section 4 of EPRI TR-112657 was used as guidance in determining the examination requirements for these locations.

Unit	Class 1 Piping Welds(1)		Class 2 Piping Welds(2)		All Piping Welds(3)	
	Total	Selected	Total	Selected	Total	Selected
1	1004	93	1299	11	2303	104

Notes

1. Includes all Category B-F and B-J locations.
2. Includes all Category C-F-2 locations. There are no Category C-F-1 piping welds at the HCGS.
3. All in-scope piping components, regardless of risk classification, will continue to receive Code required pressure testing, as part of the current ASME Section XI Program. VT-2 visual examinations are scheduled in accordance with the station's pressure test program that remains unaffected by the RI-ISI Program.

3.5.1 Additional Examinations

The RI-ISI Program in all cases will determine through an engineering evaluation the root cause of any unacceptable flaw or relevant condition found during examination. The evaluation will include the applicable service conditions and degradation mechanisms to establish that the element(s) will still perform their intended safety function during subsequent operation. Elements not meeting this requirement will be repaired or replaced.

The evaluation will include whether other elements in the segment or additional segments are subject to the same root cause conditions. Additional examinations will be performed on those elements with the same root cause conditions or degradation mechanisms. The additional examinations will include high risk significant elements and medium risk significant elements, if needed, up to a number equivalent to the number of elements required to be inspected on the segment or segments during the current outage. If unacceptable flaws or relevant conditions are again found similar to the initial problem, the remaining elements identified as susceptible will be examined during the current outage. No additional examinations will be performed if there are no additional elements identified as being susceptible to the same root cause conditions.

3.5.2 Program Relief Requests

An attempt has been made to select RI-ISI locations for examination such that a minimum of >90% coverage (i.e., Code Case N-460 criteria) is attainable. However, some limitations will not be known until the examination is performed, since some locations may be examined for the first time by the specified techniques.

In instances where locations are found at the time of the examination that do not meet the >90% coverage requirement, the process outlined in EPRI TR-112657 will be followed.

None of the existing HCGS relief requests are being withdrawn due to the RI-ISI application.

3.6 Risk Impact Assessment

The RI-ISI Program has been conducted in accordance with Regulatory Guide 1.174 and the requirements of EPRI TR-112657, and the risk from implementation of this program is expected to remain neutral or decrease when compared to that estimated from current requirements.

This evaluation identified the allocation of segments into High, Medium, and Low risk regions of the EPRI TR-112657 and ASME Code Case N-578 risk ranking matrix, and then determined for each of these risk classes what inspection changes are proposed for each of the locations in each segment. The changes include changing the number and location of inspections within the segment and in many cases improving the effectiveness of the inspection to account for the findings of the RI-ISI degradation mechanism assessment. For example, for locations subject to thermal fatigue, examinations will be conducted on an expanded volume and will be focused to enhance the probability of detection (POD) during the inspection process.

3.6.1 Quantitative Analysis

Limits are imposed by the EPRI methodology to ensure that the change in risk of implementing the RI-ISI program meets the requirements of Regulatory Guides 1.174 and 1.178. The EPRI criterion requires that the cumulative change in core damage frequency (CDF) and large early release frequency (LERF) be less than 1E-07 and 1E-08 per year per system, respectively.

Hope Creek conducted a risk impact analysis per the requirements of Section 3.7 of EPRI TR-112657. The analysis estimates the net change in risk due to the positive and negative influence of adding and removing locations from the inspection program. A risk quantification was performed using the "Simplified Risk Quantification Method" described in Section 3.7 of EPRI TR-112657. The conditional core damage probability (CCDP) and conditional large early release probability (CLERP) used for high consequence category segments was based on the highest evaluated CCDP (1E-03) and CLERP (1E-04), whereas, for medium consequence category segments, bounding estimates of CCDP (1E-04) and CLERP (1E-05) were used. The likelihood of pressure boundary failure (PBF) is determined by the presence of different degradation mechanisms and the rank is based on the relative failure probability. The basic likelihood of PBF for a piping location with no degradation mechanism present is given as x_o and is expected to have a value less than 1E-08. Piping locations identified as medium failure potential have a likelihood of $20x_o$. These PBF likelihoods are consistent with References 9 and 14 of EPRI TR-112657. In addition, the analysis was performed both with and without taking credit for enhanced inspection effectiveness due to an increased POD from application of the RI-ISI approach.

Table 3.6-1 presents a summary of the RI-ISI Program versus 1989 ASME Section XI Code Edition program requirements and identifies on a per system basis each applicable risk category. The presence of FAC and IGSCC was adjusted for in the performance of the quantitative analysis by excluding their impact on the risk ranking. The exclusion of the impact of FAC and IGSCC on the risk ranking and therefore in the determination of the change in risk is performed, because FAC and IGSCC are damage mechanisms managed by separate, independent plant augmented inspection programs. The RI-ISI Program credits and relies upon these plant augmented inspection programs to manage these damage mechanisms. The plant FAC and IGSCC Programs will continue to determine where and when examinations shall be performed. Hence, since the number of FAC and IGSCC examination locations remains the same "before" and "after" and no delta exist, there is no need to include the impact of FAC and IGSCC in the performance of the risk impact analysis. However, in an effort to be as informative as possible, for those systems where FAC or IGSCC is present, Table 3.6-1 presents the information in such a manner as to depict what the resultant risk categorization is both with and without consideration of FAC or IGSCC. This is accomplished by enclosing the FAC or IGSCC damage mechanism, as well as all other resultant corresponding changes (failure potential rank, risk category and risk rank), in parentheses. Again, this has only been done for information purposes, and has no impact on the assessment itself. The use of this approach to depict the impact of degradation mechanisms managed by plant augmented inspection programs on the risk categorization is consistent with that used in the delta risk assessment for the Arkansas Nuclear One, Unit 2 (ANO-2) pilot application. An example is provided below.

System	Risk		Consequence Rank	Failure Potential	
	Category	Rank[1]		DMs	Rank
FW	5 (3)	Medium (High)	Medium	TASCS, TT, (FAC)	Medium (High)

In this example if FAC is not considered, the failure potential rank is "medium" instead of "high" based on the TASCS and TT damage mechanisms. When a "medium" failure potential rank is combined with a "medium" consequence rank, it results in risk category 5 ("medium" risk) being assigned instead of risk category 3 ("high" risk).

In this example if FAC were considered, the failure potential rank would be "high" instead of "medium". If a "high" failure potential rank were combined with a "medium" consequence rank, it would result in risk category 3 ("high" risk) being assigned instead of risk category 5 ("medium" risk).

Note

1. The risk rank is not included in Table 3.6-1 but it is included in Table 5-2.

As indicated in the following table, this evaluation has demonstrated that unacceptable risk impacts will not occur from implementation of the RI-ISI Program, and satisfies the acceptance criteria of Regulatory Guide 1.174 and EPRI TR-112657.

Risk Impact Results

System[1]	$\Delta Risk_{CDF}$		$\Delta Risk_{LERF}$	
	w/ POD	w/o POD	w/ POD	w/o POD
RPV	1.54E-09	1.66E-09	1.54E-10	1.66E-10
BB	1.15E-10	1.15E-10	1.15E-11	1.15E-11
BG	negligible	negligible	negligible	negligible
BD	negligible	negligible	negligible	negligible
FC	-5.40E-11	-3.00E-11	-5.40E-12	-3.00E-12
BC	1.13E-10	1.25E-10	1.13E-11	1.25E-11
BE	-8.00E-11	8.00E-11	-8.00E-12	8.00E-12
BJ	-2.80E-11	-2.00E-11	-2.80E-12	-2.00E-12
FD	negligible	4.00E-11	negligible	4.00E-12
AB	1.25E-10	1.25E-10	1.25E-11	1.25E-11
AE	-5.11E-10	1.37E-09	-5.11E-11	1.37E-10
BF	negligible	negligible	negligible	negligible
BH	-1.00E-11	-1.00E-11	-1.00E-12	-1.00E-12
AP	negligible	negligible	negligible	negligible
Total	**1.21E-09**	**3.45E-09**	**1.21E-10**	**3.45E-10**

Note
1. Systems are described in Table 3.1.

3.6.2 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 Code Case N-578 provide a more robust selection process founded on actual service experience with nuclear plant piping failure data.

This process has two key independent ingredients, that is, a determination of each location's susceptibility to degradation and secondly, 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 at worst 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, and less credit is given to less reliable equipment.

All locations within the Class 1 and 2 pressure boundaries 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 RI-ISI Program, procedures that comply with the guidelines described in EPRI TR-112657 will be prepared to implement and monitor the program. The new program will be integrated into the second inservice inspection interval. No changes to the Technical Specifications or Updated Safety Analysis Report are necessary for program implementation.

The applicable aspects of the ASME Code not affected by this change will 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 will be retained and modified to address the RI-ISI process, as appropriate.

The monitoring and corrective action program will contain the following elements:

A. Identify
B. Characterize
C. (1) Evaluate, determine the cause and extent of the condition identified
   (2) Evaluate, develop a corrective action plan or plans
D. Decide
E. Implement
F. Monitor
G. Trend

The RI-ISI Program is a living program requiring feedback of new relevant information to ensure the appropriate identification of high safety significant piping locations. As a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis. In addition, significant changes may require more frequent adjustment as directed by NRC Bulletin or Generic Letter requirements, or by industry and plant specific feedback.

5. PROPOSED ISI PROGRAM PLAN CHANGE

A comparison between the RI-ISI Program and ASME Section XI 1989 Code Edition program requirements for in-scope piping is provided in Tables 5-1 and 5-2. Table 5-1 provides a summary comparison by risk region. Table 5-2 provides the same comparison information, but in a more detailed manner by risk category, similar to the format used in Table 3.6-1.

HCGS intends to start implementing the RI-ISI Program during the plant's twelfth refueling outage (RFO12) scheduled for Fall 2004. Beginning with RFO12, inspection locations selected per the RI-ISI process will replace those formerly selected per ASME Section XI criteria. By the end of the second period, 64.3% of the piping weld examinations required by ASME Section XI have been completed thus far in the second ISI interval for Examination Categories B-F, B-J and C-F-2. To ensure the performance of 100% of the required examinations during the current ten-year ISI interval, 35.7% of the inspection locations selected for examination per the RI-ISI process will be examined in the next period.

Subsequent ISI intervals will implement 100% of the inspection locations selected for examination per the RI-ISI Program. Examinations shall be performed such that the period percentage requirements of ASME Section XI, paragraphs IWB-2412 and IWC-2412 are met.

6. REFERENCES/DOCUMENTATION

6.1 Relief Request SC-13-RR-A14 Synchronization of Salem Units 1 and 2 ISI Programs Ten-Year Inservice Inspection Intervals

6.2 Relief Request HC-12-RR-A20 Synchronization of Hope Creek to Salem Units 1 and 2 ISI Programs Ten-Year Inservice Inspection Intervals

6.3 Relief Request S1-13-RR-A13 Consolidation of ASME XI Code of Records

6.4 Relief Request HC-12-RR-A15 Consolidation of ASME XI Code of Records

Other References

EPRI TR-112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure", Rev. B-A

ASME Code Case N-578, "Risk-Informed Requirements for Class 1, 2, and 3Piping, Method B, Section XI, Division 1"

Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis"

Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking Inservice Inspection of Piping"

Supporting Onsite Documentation

FANP Document 32-5030483-00 "RI-ISI Consequence Evaluation, Class 1 and 2 Piping, Hope Creek Generating Station", September 5, 2003

SI Calculation HC-01-301 "Degradation Mechanism Evaluation for the Class 1, Class 2 and BER Program Piping Welds at Hope Creek Generating Station", Revision 1, August 26, 2003

FANP Document 51-5030482-00 "Hope Creek Generating Station Service History Review", August 22, 2003

FANP Document 51-5035907-00 "Hope Creek Generating Station Risk Ranking", December 19, 2003

SI Meeting Minutes HC-01-01 "Minutes of the Element Selection Meeting for the RI-ISI and RI-BER Project at the Hope Creek Generating Station", Revision 0, September 25, 2003

FANP Document 51-5035908-00 "Hope Creek Generating Station Risk Impact Analysis", December 19, 2003

Table 3.1 System Selection and Segment / Element Definition		
System Description	**Number of Segments**	**Number of Elements**
RPV – Reactor Pressure Vessel System	35	37
BB – Nuclear Boiler and Recirculation System	40	186
BG – Reactor Water Cleanup System	17	130
BD – Reactor Core Isolation Cooling System	3	42
FC – Reactor Core Isolation Cooling Steam System	20	68
BC – Residual Heat Removal System	119	875
BE – Reactor Core Spray System	40	279
BJ – High Pressure Coolant Injection System	13	101
FD – High Pressure Coolant Injection Steam System	12	98
AB – Main Steam System	50	310
AE – Feedwater System	51	109
BF – Control Rod Drive Hydraulic Supply System	4	20
BH – Standby Liquid Control System	5	42
AP – Condensate Transfer and Storage System	1	6
Totals	**410**	**2303**

Table 3.3

Failure Potential Assessment Summary

System[1]	Thermal Fatigue		Stress Corrosion Cracking				Localized Corrosion			Flow Sensitive	
	TASCS	TT	IGSCC	TGSCC	ECSCC	PWSCC	MIC	PIT	CC	E-C	FAC
RPV		X	X						X		
BB											
BG											X
BD											
FC		X									X
BC	X		X								
BE		X									X
BJ		X									
FD		X									
AB											X
AE	X	X									X
BF											
BH											
AP											

Note

1. Systems are described in Table 3.1.

Table 3.4

Number of Segments by Risk Category With and Without Impact of FAC and IGSCC

System[1]	High Risk Region						Medium Risk Region				Low Risk Region			
	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6		Category 7	
	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without
RPV			29[2]	23			6	12						
BB							28	28			11	11	1	1
BG	3[3]	0					10	13					4	4
BD											3	3		
FC					6[4]	0			5	7	8	12	1	1
BC			1[5]	0			15	16	2	2	69	69	32	32
BE			1	1			10	10	2[6]	0	4	4	23	25
BJ							2	2	1	1	10	10		
FD							1	1	2	2	9	9		
AB					2[7]	0	19	19			29	31		
AE	19[8]	0	12	20	1[9]	0	8	19	8	8	3	4		
BF													4	4
BH							2	2			2	2	1	1
AP											1	1		
Total	22	0	43	44	9	0	101	122	20	20	149	156	66	68

Notes

1. Systems are described in Table 3.1.
2. Of these twenty nine segments, thirteen remain Category 2 after IGSCC is removed from consideration due to the presence of other "medium" failure potential damage mechanisms, and six become Category 4 after IGSCC is removed from consideration due to no other damage mechanisms being present. The other ten segments are unaffected since neither FAC nor IGSCC is present.
3. These three segments become Category 4 after FAC is removed from consideration due to no other damage mechanisms being present.
4. Of these six segments, two become Category 5 after FAC is removed from consideration due to the presence of other "medium" failure potential damage mechanisms, and four become Category 6 after FAC is removed from consideration due to no other damage mechanisms being present.

Notes for Table 3.4 (Cont'd)

5. This segment becomes Category 4 after IGSCC is removed from consideration due to no other damage mechanisms being present.
6. These two segments become Category 7 after FAC is removed from consideration due to no other damage mechanisms being present.
7. These two segments become Category 6 after FAC is removed from consideration due to no other damage mechanisms being present.
8. Of these nineteen segments, eight become Category 2 after FAC is removed from consideration due to the presence of other "medium" failure potential damage mechanisms, and eleven become Category 4 after FAC is removed from consideration due to no other damage mechanisms being present.
9. This segment becomes Category 6 after FAC is removed from consideration due to no other damage mechanisms being present.

Table 3.5

Number of Elements Selected for Inspection by Risk Category Excluding Impact of FAC and IGSCC

System[1]	High Risk Region						Medium Risk Region				Low Risk Region			
	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6		Category 7	
	Total	Selected	Total	Selected	Total	Selected	Total	Selected	Total	Selected	Total	Selected	Total	Selected
RPV			23	7[2]			14	2[3]						
BB							134	14			50	0	2	0
BG							118	13					12	0
BD											42	0		
FC									19	3	47	0	2	0
BC							142	16[4]	3	1	485	0	245	0
BE			3	1			73	8			9	0	194	0
BJ							12	2	4	1	85	0		
FD							17	2	22	3	59	0		
AB							102	11			208	0		
AE			44	11			37	5	15	2	13	0		
BF													20	0
BH							16	2			21	0	5	0
AP											6	0		
Total	0	0	70	19	0	0	665	75	63	10	1025	0	480	0

Notes

1. Systems are described in Table 3.1.
2. Four of these seven piping welds have been selected for examination per Hope Creek's augmented inspection program for IGSCC (three Category "C" and one Category "E") and for RI-ISI purposes due to the presence of other damage mechanisms.
3. One of these two piping welds has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.
4. One of these sixteen piping welds has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.

Table 3.6-1 Risk Impact Analysis Results											
System[1]	Category	Consequence Rank	Failure Potential		Inspections			CDF Impact[4]		LERF Impact[4]	
			DMs	Rank	SXI[2]	RI-ISI[3]	Delta	w/ POD	w/o POD	w/ POD	w/o POD
RPV	2 (2)	High	TT, (IGSCC)	Medium (Medium)	1	1	0	-1.20E-10	no change	-1.20E-11	no change
RPV	2 (2)	High	CC, (IGSCC)	Medium (Medium)	12	3	-9	9.00E-10	9.00E-10	9.00E-11	9.00E-11
RPV	2	High	CC	Medium	10	3	-7	7.00E-10	7.00E-10	7.00E-11	7.00E-11
RPV	4 (2)	High	None (IGSCC)	Low (Medium)	6	1	-5	2.50E-11	2.50E-11	2.50E-12	2.50E-12
RPV	4	High	None	Low	8	1	-7	3.50E-11	3.50E-11	3.50E-12	3.50E-12
RPV Total								**1.54E-09**	**1.66E-09**	**1.54E-10**	**1.66E-10**
BB	4	High	None	Low	37	14	-23	1.15E-10	1.15E-10	1.15E-11	1.15E-11
BB	6a	Medium	None	Low	2	0	-2	negligible	negligible	negligible	negligible
BB	7a	Low	None	Low	0	0	0	no change	no change	no change	no change
BB Total								**1.15E-10**	**1.15E-10**	**1.15E-11**	**1.15E-11**
BG	4 (1)	High	None (FAC)	Low (High)	1	1	0	no change	no change	no change	no change
BG	4	High	None	Low	12	12	0	no change	no change	no change	no change
BG	7a	Low	None	Low	2	0	-2	negligible	negligible	negligible	negligible
BG Total								**negligible**	**negligible**	**negligible**	**negligible**
BD	6a	Medium	None	Low	3	0	-3	negligible	negligible	negligible	negligible
BD Total								**negligible**	**negligible**	**negligible**	**negligible**
FC	5a (3)	Medium	TT, (FAC)	Medium (High)	0	1	1	-1.80E-11	-1.00E-11	-1.80E-12	-1.00E-12
FC	5a	Medium	TT	Medium	0	2	2	-3.60E-11	-2.00E-11	-3.60E-12	-2.00E-12
FC	6a (3)	Medium	None (FAC)	Low (High)	1	0	-1	negligible	negligible	negligible	negligible
FC	6a	Medium	None	Low	7	0	-7	negligible	negligible	negligible	negligible
FC	7a	Low	None	Low	2	0	-2	negligible	negligible	negligible	negligible
FC Total								**-5.40E-11**	**-3.00E-11**	**-5.40E-12**	**-3.00E-12**

Table 3.6-1 (Cont'd)
Risk Impact Analysis Results

System[1]	Category	Consequence Rank	Failure Potential		Inspections			CDF Impact[4]		LERF Impact[4]	
			DMs	Rank	SXI[2]	RI-ISI[3]	Delta	w/ POD	w/o POD	w/ POD	w/o POD
BC	4 (2)	High	None (IGSCC)	Low (Medium)	1	1	0	no change	no change	no change	no change
BC	4	High	None	Low	40	15	-25	1.25E-10	1.25E-10	1.25E-11	1.25E-11
BC	5a	Medium	TASCS	Medium	1	1	0	-1.20E-11	no change	-1.20E-12	no change
BC	6a	Medium	None	Low	41	0	-41	negligible	negligible	negligible	negligible
BC	7a	Low	None	Low	19	0	-19	negligible	negligible	negligible	negligible
BC Total								**1.13E-10**	**1.25E-10**	**1.13E-11**	**1.25E-11**
BE	2	High	TT	Medium	2	1	-1	-6.00E-11	1.00E-10	-6.00E-12	1.00E-11
BE	4	High	None	Low	4	8	4	-2.00E-11	-2.00E-11	-2.00E-12	-2.00E-12
BE	6a	Medium	None	Low	1	0	-1	negligible	negligible	negligible	negligible
BE	7a (5b)	Low	None (FAC)	Low (High)	0	0	0	no change	no change	no change	no change
BE	7a	Low	None	Low	16	0	-16	negligible	negligible	negligible	negligible
BE Total								**-8.00E-11**	**8.00E-11**	**-8.00E-12**	**8.00E-12**
BJ	4	High	None	Low	0	2	2	-1.00E-11	-1.00E-11	-1.00E-12	-1.00E-12
BJ	5a	Medium	TT	Medium	0	1	1	-1.80E-11	-1.00E-11	-1.80E-12	-1.00E-12
BJ	6a	Medium	None	Low	9	0	-9	negligible	negligible	negligible	negligible
BJ Total								**-2.80E-11**	**-2.00E-11**	**-2.80E-12**	**-2.00E-12**
FD	4	High	None	Low	8	2	-6	3.00E-11	3.00E-11	3.00E-12	3.00E-12
FD	5a	Medium	TT	Medium	4	3	-1	-3.00E-11	1.00E-11	-3.00E-12	1.00E-12
FD	6a	Medium	None	Low	5	0	-5	negligible	negligible	negligible	negligible
FD Total								**negligible**	**4.00E-11**	**negligible**	**4.00E-12**
AB	4	High	None	Low	36	11	-25	1.25E-10	1.25E-10	1.25E-11	1.25E-11
AB	6a (3)	Medium	None (FAC)	Low (High)	0	0	0	no change	no change	no change	no change
AB	6a	Medium	None	Low	8	0	-8	negligible	negligible	negligible	negligible
AB Total								**1.25E-10**	**1.25E-10**	**1.25E-11**	**1.25E-11**

Table 3.6-1 (Cont'd)
Risk Impact Analysis Results

System[1]	Category	Consequence Rank	Failure Potential		Inspections			CDF Impact[4]		LERF Impact[4]	
			DMs	Rank	SXI[2]	RI-ISI[3]	Delta	w/ POD	w/o POD	w/ POD	w/o POD
AE	2 (1)	High	TASCS, TT, (FAC)	Medium (High)	0	2	2	-3.60E-10	-2.00E-10	-3.60E-11	-2.00E-11
AE	2 (1)	High	TASCS, (FAC)	Medium (High)	4	1	-3	6.00E-11	3.00E-10	6.00E-12	3.00E-11
AE	2 (1)	High	TT, (FAC)	Medium (High)	0	0	0	no change	no change	no change	no change
AE	2	High	TASCS, TT	Medium	6	3	-3	-1.80E-10	3.00E-10	-1.80E-11	3.00E-11
AE	2	High	TASCS	Medium	14	5	-9	-6.00E-11	9.00E-10	-6.00E-12	9.00E-11
AE	2	High	TT	Medium	0	0	0	no change	no change	no change	no change
AE	4 (1)	High	None (FAC)	Low (High)	9	3	-6	3.00E-11	3.00E-11	3.00E-12	3.00E-12
AE	4	High	None	Low	3	2	-1	5.00E-12	5.00E-12	5.00E-13	5.00E-13
AE	5a	Medium	TASCS, TT	Medium	2	1	-1	-6.00E-12	1.00E-11	-6.00E-13	1.00E-12
AE	5a	Medium	TASCS	Medium	2	1	-1	-6.00E-12	1.00E-11	-6.00E-13	1.00E-12
AE	5a	Medium	TT	Medium	1	0	-1	6.00E-12	1.00E-11	6.00E-13	1.00E-12
AE	6a (3)	Medium	None (FAC)	Low (High)	0	0	0	no change	no change	no change	no change
AE	6a	Medium	None	Low	2	0	-2	negligible	negligible	negligible	negligible
AE Total								**-5.11E-10**	**1.37E-09**	**-5.11E-11**	**1.37E-10**
BF	7a	Low	None	Low	2	0	-2	negligible	negligible	negligible	negligible
BF Total								**negligible**	**negligible**	**negligible**	**negligible**
BH	4	High	None	Low	0	2	2	-1.00E-11	-1.00E-11	-1.00E-12	-1.00E-12
BH	6a	Medium	None	Low	0	0	0	no change	no change	no change	no change
BH	7a	Low	None	Low	0	0	0	no change	no change	no change	no change
BH Total								**-1.00E-11**	**-1.00E-11**	**-1.00E-12**	**-1.00E-12**
AP	6a	Medium	None	Low	1	0	-1	negligible	negligible	negligible	negligible
AP Total								**negligible**	**negligible**	**negligible**	**negligible**
Grand Total								**1.21E-09**	**3.45E-09**	**1.21E-10**	**3.45E-10**

Notes

1. Systems are described in Table 3.1.

Notes for Table 3.6-1 (Cont'd)

2. Only those ASME Section XI Code inspection locations that received a volumetric examination in addition to a surface examination are included in the count. Inspection locations previously subjected to a surface examination only were not considered in accordance with Section 3.7.1 of EPRI TR-112657.
3. Inspection locations selected for RI-ISI purposes that are in the plant's augmented inspection programs for flow accelerated corrosion (FAC) and intergranular stress corrosion cracking (IGSCC) are subject to the following requirements dependent upon risk categorization:
   i. Risk Categories 2 (1) and 5 (3) – these inspection locations are susceptible to medium failure potential damage mechanisms in addition to FAC. In these cases, inspection locations selected for examination by both the FAC and RI-ISI Programs may be included in the RI-ISI count, provided the ultrasonic thickness measurement performed for FAC is judged inadequate to have detected the other damage mechanisms subsequently identified by the RI-ISI Program. For the Hope Creek RI-ISI application, the inspection locations selected for examination per the plant's augmented inspection program for FAC that were selected for RI-ISI purposes were not credited in detecting the presence of other damage mechanisms (e.g., thermal fatigue).
   ii. Risk Categories 2 (2) and 5 (5) – these inspection locations are susceptible to other medium failure potential damage mechanisms in addition to IGSCC. In these cases, inspection locations selected for examination by both the IGSCC and RI-ISI Programs should be included in both counts, but only those locations that were previously being credited in the Section XI Program and are now being credited in the RI-ISI Program. The examination performed for IGSCC is judged adequate to have detected the other damage mechanisms subsequently identified by the RI-ISI Program. For the Hope Creek RI-ISI application, four risk category 2 (2) inspections locations were selected for examination per the plant's augmented inspection program for IGSCC and for RI-ISI purposes due to the presence of other damage mechanisms. These inspection locations were previously credited in the Section XI Program.
   iii. Risk Category 4 (1) – these inspection locations are susceptible to FAC only. In these cases, inspection locations selected for examination by both the FAC and RI-ISI Programs should not be included in the RI-ISI count since they do not represent additional examinations. For the Hope Creek RI-ISI application, no inspection locations selected for examination per the plant's augmented inspection program for FAC are being credited for RI-ISI purposes.
   iv. Risk Category 4 (2) – these inspection locations are susceptible to IGSCC only. In these cases, inspection locations selected for examination by both the IGSCC and RI-ISI Programs should be included in both counts, but only those locations that were previously credited in the Section XI Program and are now being credited in the RI-ISI Program. For the Hope Creek RI-ISI application, two risk category 4 (2) inspections locations were selected for examination per the plant's augmented inspection program for IGSCC and are being credited for RI-ISI purposes. These inspection locations were previously credited in the Section XI Program.
4. Per Section 3.7.1 of EPRI TR-112657, the contribution of low risk categories 6 and 7 need not be considered in assessing the change in risk. They are excluded from analysis because they have an insignificant impact on risk. Hence, the word "negligible" is given in these cases in lieu of values for CDF and LERF Impact. For those cases in high, medium or low risk region piping where no impact to CDF or LERF exists, "no change" is listed.

Table 5-1

Inspection Location Selection Comparison Between ASME Section XI Code and EPRI TR-112657 by Risk Region

System[1]	Code Category	High Risk Region					Medium Risk Region					Low Risk Region				
		Weld Count	Section XI		EPRI TR-112657		Weld Count	Section XI		EPRI TR-112657		Weld Count	Section XI		EPRI TR-112657	
			Vol/Sur	Sur Only	RI-ISI	Other[2]		Vol/Sur	Sur Only	RI-ISI	Other[2]		Vol/Sur	Sur Only	RI-ISI	Other[2]
RPV	B-F	13	13	0	4[3]		6	6	0	1[4]						
	B-J	10	10	0	3		8	8	0	1						
BB	B-F											1	0	1	0	
	B-J						134	37	4	14		51	2	24	0	
BG	B-F						2	2	0	0						
	B-J						116	11	7	13		12	2	0	0	
BD	C-F-2											42	3	0	0	
FC	B-F											2	2	0	0	
	B-J											22	5	0	0	
	C-F-2						19	0	0	3		25	3	0	0	
BC	B-F						4	4	0	3[5]						
	B-J						110	34	1	13		43	3	0	0	
	C-F-2						31	4	0	1		687	57	0	0	
BE	B-J	3	2	0	1		32	2	1	7		11	1	0	0	
	C-F-2						41	2	0	1		192	16	0	0	
BJ	C-F-2						16	0	0	3		85	9	0	0	
FD	B-F						2	2	0	0						
	B-J						15	6	0	2		3	0	0	0	
	C-F-2						22	4	0	3		56	5	0	0	
AB	B-J						102	36	0	11		171	3	8	0	
	C-F-2											37	5	0	0	
AE	B-J	44	24	0	11		45	16	1	7						
	C-F-2						7	1	0	0		13	2	0	0	

Table 5-1 (Cont'd)

Inspection Location Selection Comparison Between ASME Section XI Code and EPRI TR-112657 by Risk Region

System[1]	Code Category	High Risk Region					Medium Risk Region					Low Risk Region				
		Weld Count	Section XI		EPRI TR-112657		Weld Count	Section XI		EPRI TR-112657		Weld Count	Section XI		EPRI TR-112657	
			Vol/Sur	Sur Only	RI-ISI	Other[2]		Vol/Sur	Sur Only	RI-ISI	Other[2]		Vol/Sur	Sur Only	RI-ISI	Other[2]
BF	C-F-2											20	2	0	0	
BH	B-J						16	0	11	2		26	0	20	0	
AP	C-F-2											6	1	0	0	
Total	B-F	13	13	0	4		14	14	0	4		3	2	1	0	
	B-J	57	36	0	15		578	150	25	70		339	16	52	0	
	C-F-2						136	11	0	11		1163	103	0	0	

Notes

1. Systems are described in Table 3.1.
2. The column labeled "Other" is generally used to identify plant augmented inspection program locations credited per Section 3.6.5 of EPRI TR-112657. The EPRI methodology allows plant augmented inspection program locations to be credited if the inspection locations selected strictly for RI-ISI purposes produce less than a 10% sampling of the overall Class 1 weld population. As stated in Section 3.5 of this template, the HCGS achieved a 9.3% sampling without relying on plant augmented inspection program locations beyond those selected for RI-ISI purposes either due to the presence of other damage mechanisms, or to satisfy Risk Category 4 selection requirements. The "Other" column has been retained in this table solely for uniformity purposes with the other RI-ISI application template submittals.
3. These four piping welds have been selected for examination per Hope Creek's augmented inspection program for IGSCC (three Category "C" and one Category "E") and for RI-ISI purposes due to the presence of other damage mechanisms.
4. This piping weld has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.
5. One of these three piping welds has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.

Table 5-2
Inspection Location Selection Comparison Between ASME Section XI Code and EPRI TR-112657 by Risk Category

System[1]	Risk		Consequence Rank	Failure Potential		Code Category	Weld Count	Section XI		EPRI TR-112657	
	Category	Rank		DMs	Rank			Vol/Sur	Sur Only	RI-ISI	Other[2]
RPV	2 (2)	High (High)	High	TT, (IGSCC)	Medium (Medium)	B-F	1	1	0	1[3]	
RPV	2 (2)	High (High)	High	CC, (IGSCC)	Medium (Medium)	B-F	12	12	0	3[4]	
RPV	2	High	High	CC	Medium	B-J	10	10	0	3	
RPV	4 (2)	Medium (High)	High	None (IGSCC)	Low (Medium)	B-F	6	6	0	1[5]	
RPV	4	Medium	High	None	Low	B-J	8	8	0	1	
BB	4	Medium	High	None	Low	B-J	134	37	4	14	
BB	6a	Low	Medium	None	Low	B-F	1	0	1	0	
						B-J	49	2	24	0	
BB	7a	Low	Low	None	Low	B-J	2	0	0	0	
BG	4 (1)	Medium (High)	High	None (FAC)	Low (High)	B-J	5	1	1	1	
BG	4	Medium	High	None	Low	B-F	2	2	0	0	
						B-J	111	10	6	12	
BG	7a	Low	Low	None	Low	B-J	12	2	0	0	
BD	6a	Low	Medium	None	Low	C-F-2	42	3	0	0	
FC	5a (3)	Medium (High)	Medium	TT, (FAC)	Medium (High)	C-F-2	3	0	0	1	
FC	5a	Medium	Medium	TT	Medium	C-F-2	16	0	0	2	
FC	6a (3)	Low (High)	Medium	None (FAC)	Low (High)	C-F-2	8	1	0	0	
FC	6a	Low	Medium	None	Low	B-F	2	2	0	0	
						B-J	20	3	0	0	
						C-F-2	17	2	0	0	
FC	7a	Low	Low	None	Low	B-J	2	2	0	0	

Table 5-2 (Cont'd)
Inspection Location Selection Comparison Between ASME Section XI Code and EPRI TR-112657 by Risk Category

System[1]	Risk		Consequence Rank	Failure Potential		Code Category	Weld Count	Section XI		EPRI TR-112657	
	Category	Rank		DMs	Rank			Vol/Sur	Sur Only	RI-ISI	Other[2]
BC	4 (2)	Medium (High)	High	None (IGSCC)	Low (Medium)	B-F	1	1	0	1[6]	
BC	4	Medium	High	None	Low	B-F	3	3	0	2	
						B-J	110	34	1	13	
						C-F-2	28	3	0	0	
BC	5a	Medium	Medium	TASCS	Medium	C-F-2	3	1	0	1	
BC	6a	Low	Medium	None	Low	B-J	6	0	0	0	
						C-F-2	479	41	0	0	
BC	7a	Low	Low	None	Low	B-J	37	3	0	0	
						C-F-2	208	16	0	0	
BE	2	High	High	TT	Medium	B-J	3	2	0	1	
BE	4	Medium	High	None	Low	B-J	32	2	1	7	
						C-F-2	41	2	0	1	
BE	6a	Low	Medium	None	Low	B-J	9	1	0	0	
BE	7a (5b)	Low (Medium)	Low	None (FAC)	Low (High)	C-F-2	4	0	0	0	
BE	7a	Low	Low	None	Low	B-J	2	0	0	0	
						C-F-2	188	16	0	0	
BJ	4	Medium	High	None	Low	C-F-2	12	0	0	2	
BJ	5a	Medium	Medium	TT	Medium	C-F-2	4	0	0	1	
BJ	6a	Low	Medium	None	Low	C-F-2	85	9	0	0	
FD	4	Medium	High	None	Low	B-F	2	2	0	0	
						B-J	15	6	0	2	
FD	5a	Medium	Medium	TT	Medium	C-F-2	22	4	0	3	
FD	6a	Low	Medium	None	Low	B-J	3	0	0	0	
						C-F-2	56	5	0	0	

Table 5-2 (Cont'd)
Inspection Location Selection Comparison Between ASME Section XI Code and EPRI TR-112657 by Risk Category

System[1]	Risk		Consequence Rank	Failure Potential		Code Category	Weld Count	Section XI		EPRI TR-112657	
	Category	Rank		DMs	Rank			Vol/Sur	Sur Only	RI-ISI	Other[2]
AB	4	Medium	High	None	Low	B-J	102	36	0	11	
AB	6a (3)	Low (High)	Medium	None (FAC)	Low (High)	B-J	5	0	2	0	
AB	6a	Low	Medium	None	Low	B-J	166	3	6	0	
						C-F-2	37	5	0	0	
AE	2 (1)	High (High)	High	TASCS, TT, (FAC)	Medium (High)	B-J	3	0	0	2	
AE	2 (1)	High (High)	High	TASCS, (FAC)	Medium (High)	B-J	7	4	0	1	
AE	2 (1)	High (High)	High	TT, (FAC)	Medium (High)	B-J	2	0	0	0	
AE	2	High	High	TASCS, TT	Medium	B-J	10	6	0	3	
AE	2	High	High	TASCS	Medium	B-J	18	14	0	5	
AE	2	High	High	TT	Medium	B-J	4	0	0	0	
AE	4 (1)	Medium (High)	High	None (FAC)	Low (High)	B-J	23	9	0	3	
AE	4	Medium	High	None	Low	B-J	14	3	1	2	
AE	5a	Medium	Medium	TASCS, TT	Medium	B-J	4	2	0	1	
						C-F-2	1	0	0	0	
AE	5a	Medium	Medium	TASCS	Medium	B-J	4	2	0	1	
						C-F-2	1	0	0	0	
AE	5a	Medium	Medium	TT	Medium	C-F-2	5	1	0	0	
AE	6a (3)	Low (High)	Medium	None (FAC)	Low (High)	C-F-2	1	0	0	0	
AE	6a	Low	Medium	None	Low	C-F-2	12	2	0	0	
BF	7a	Low	Low	None	Low	C-F-2	20	2	0	0	
BH	4	Medium	High	None	Low	B-J	16	0	11	2	
BH	6a	Low	Medium	None	Low	B-J	21	0	19	0	
BH	7a	Low	Low	None	Low	B-J	5	0	1	0	
AP	6a	Low	Medium	None	Low	C-F-2	6	1	0	0	

Notes
1. Systems are described in Table 3.1.

Notes for Table 5-2 (Cont'd)

2. The column labeled "Other" is generally used to identify plant augmented inspection program locations credited per Section 3.6.5 of EPRI TR-112657. The EPRI methodology allows plant augmented inspection program locations to be credited if the inspection locations selected strictly for RI-ISI purposes produce less than a 10% sampling of the overall Class 1 weld population. As stated in Section 3.5 of this template, the HCGS achieved a 9.3% sampling without relying on plant augmented inspection program locations beyond those selected for RI-ISI purposes either due to the presence of other damage mechanisms, or to satisfy Risk Category 4 selection requirements. The "Other" column has been retained in this table solely for uniformity purposes with the other RI-ISI application template submittals.
3. This piping weld has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and for RI-ISI purposes due to the presence of other damage mechanisms.
4. These three piping welds have been selected for examination per Hope Creek's augmented inspection program for IGSCC (two Category "C" and one Category "E") and for RI-ISI purposes due to the presence of other damage mechanisms.
5. This piping weld has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.
6. This piping weld has been selected for examination per Hope Creek's augmented inspection program for IGSCC (Category "C") and is being credited for RI-ISI purposes.