Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

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

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Relief Request for Application of an Alternative to the
ASME Boiler and Pressure Vessel Code Section XI Examination
Requirements for Class 1 Piping Welds (RR-ENG-2-16)

Reference: "Safety Evaluation Report Related to EPRI Risk-Informed Inservice Inspection Evaluation Procedure (EPRI TR-112657), NRC to Gary L. Vine, EPRI, dated October 28, 1999

In accordance with the provisions of 10CFR50.55a(a)(3)(i), the South Texas Project requests relief from the ASME Section XI code examination requirements for inservice inspection of Class 1 piping welds (excluding socket welds). The proposed alternative, as described in the attached report, "Risk-Informed Inservice Inspection Program Plan – South Texas Project Units 1 and 2," provides an acceptable level of quality and safety as required by 10CFR50.55a(a)(3)(i).

The South Texas Project risk-informed inservice inspection program has been developed in accordance with the methodology provided in EPRI TR-112657, "Risk-Informed Inservice Inspection Evaluation Procedure," with the exceptions noted in the attached report. EPRI TR-112657 has been reviewed and approved by the Nuclear Regulatory Commission as stated in the correspondence referenced above. The staff found that TR-112657 is acceptable for referencing in licensing applications to the extent and limitations specified. The NRC staff has reviewed previously submitted applications for risk-informed inservice inspection programs from Arkansas Nuclear One, Unit 2, and Vermont Yankee. The format of the South Texas Project RI-ISI plan is consistent with the Nuclear Energy Institute/industry template developed for applications of the RI-ISI methodology. Additional supporting documentation is available at the South Texas Project site for your review.

The South Texas Project requests Nuclear Regulatory Commission approval of this relief request by June 1, 2000. The South Texas Project intends to incorporate this risk-based approach for Class 1 piping weld inspection into the Ten Year Inservice Inspection Plan for the second inspection interval, which begins in the fall of 2000.

If there are any questions, please contact Mr. C. A. Murry at (361) 972-8285 or me at (361) 972-7902.

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PLW/
Attachment: Risk-Informed Inservice Inspection Program Plan - South Texas Project Units 1 and 2

A047

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RISK-INFORMED INSERVICE INSPECTION PROGRAM PLAN - SOUTH TEXAS PROJECT UNITS 1 AND 2

Table of Contents

1. INTRODUCTION / RELATION TO NRC REGULATORY GUIDE RG-1.174

Introduction

Inservice inspections (ISI) for the upcoming second inspection interval will be performed to the requirements of the ASME Boiler and Pressure Vessel Code Section XI, 1989 Edition as required by 10CFR50.55a. The second inspection interval begins for Units 1 and 2 on September 25, 2000, and October 19, 2000, respectively.

The South Texas Project requests approval to use a risk-informed inservice inspection (RI-ISI) program for a subset of Class 1 piping as an alternative to the requirements of the 1989 Edition for the second inspection interval. The risk-informed process used in this submittal is described in EPRI TR-112657, Final Report, "Risk-Informed Inservice Inspection Evaluation Procedure."

As a risk-informed application, this submittal meets the intent and principles of Regulatory Guides 1.174 and 1.178. Further information is provided in Section 3.7 relative to defense-in-depth.

PRA Quality

The South Texas Project (STP) probabilistic risk assessment (PRA) model revision used to evaluate the consequences of pipe rupture for the RI-ISI assessment was the Level 2 Probabilistic Safety Assessment and Individual Plant Examination (IPE) submittal, dated August 1992, supplemented by the current PRA model, STP_1997.

The base core damage frequency (CDF) and base large early release frequency (LERF) from the STP_1997 model are 1.17E-05 per year and 5.50E-07 per year, respectively.

PRA model updates are performed each refueling cycle. The current PRA is scheduled to undergo the Westinghouse Certification process in August 2001. Internal self-assessment and QA review is on-going and is part of the model control programs established at STP to ensure the quality of the PRA model.

It should also be noted that STP received a safety evaluation report (SER) on the Graded QA Program in 1997. NRC acceptance of this program was based largely on their review of the then current PRA model (STP_1996) and the programs in place to control the PRA.

In addition, the NRC's review of the IPE identified areas for improvement. These areas and their disposition are as follows:

NRC Recommendation 1 - Implement the RISKMAN 3.0 system conversions for calculating internally generated initiating events (i.e., loss of ECW, loss of CCW, loss of EAB HVAC, loss of control room HVAC, and loss of DC buses).

Plant Response - These items were included in the 1994 model update and are maintained and upgraded in accordance with the PRA control program.

NRC Recommendation 2 - Revise the system analyses and event tree rules to reflect the present plant practice of operating two ECW trains and one standby train instead of one train on, one train off, and one train in standby.

Plant Response - This item was revised in 1994 and expanded to include any possible configuration of operating and standby trains in 1996.

NRC Recommendation 3 - Incorporate new system analyses and split fraction data for new top events.

Plant Response - This information was included in 1994 and is maintained in accordance with the PRA control program.

NRC Recommendation 4 - Consider accident management strategies of intentional primary system depressurization and post core damage recovery (recovery of AC power and introducing firewater into the secondary of a dry steam generator).

Plant Response - The Severe Accident Management Guidelines (SAMGs) were adopted at STP in June 1997 and are included in the current Level 2 Analyses for PRA model, STP_1997.

2. PROPOSED ALTERNATIVE TO CURRENT ISI PROGRAM REQUIREMENTS

2.1 ASME Section XI

ASME Section XI Categories B-F and B-J currently contain the requirements for examining (via NDE) Class 1 piping components. The alternative RI-ISI program for piping is described in EPRI TR-112657. The RI-ISI program will be substituted for the 1989 Section XI Code Edition examination program for Class 1 non-socket-welded piping 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 risk-informed examination program and the remaining unaffected portions of ASME Section XI.

2.2 Augmented Programs

As discussed in Section 6 of EPRI TR-112657, certain augmented inspection programs may be integrated into the RI-ISI program. For the Class 1 piping at STP, the augmented plant inspection program implemented during the first inspection interval in response to NRC Bulletin 88-08 has been subsumed into the RI-ISI program because the potential for thermal fatigue is explicitly considered in the application of the EPRI RI-ISI process. The remaining augmented inspection programs are unaffected.

3. RISK-INFORMED ISI PROCESS

The process used to develop the RI-ISI program is consistent with the methodology described in EPRI TR-112657. The process involves the following steps:

- Definition of RI-ISI Program Scope
- Consequence Evaluation
- Damage Mechanism Evaluation
- Risk Characterization
- Inspection Location Selection and NDE Selection
- Risk Impact Assessment
- Implement Program
- Feedback Loop

Application of RI-ISI under ASME Section XI Code Case N-560 is limited to Class 1, Category B-J non-socket-welded locations per the requirements of the code case, and the EPRI methodology. STP has elected to include Category B-F dissimilar metal weld locations in this application in addition to the non-socket-welded Category B-J locations. This is a deviation from the EPRI methodology described in TR-112657. If an RI-ISI evaluation had been performed on Class 1 piping at STP under ASME Section XI Code Case N-578 instead of N-560, Category B-F welds would have been included in the application scope. As such, for this N-560 application, inspection locations were chosen in such a manner to ensure compliance with N-578 selection criteria. This resulted in additional selections above what would be required by a strict application of the N-560 selection criteria as indicated in the table below.

Comparison of N-560 and N-578 Selection Criteria

	High Risk	Medium Risk		Low Risk		N-560	N-578
	Cat 2 Welds	Cat 4 Welds	Cat 5 Welds	Cat 6 Welds	Cat 7 Welds	Selections Required	Selections Required
Unit 1	152 ($138^{B-J} + 14^{B-F}$)	198 ($190^{B-J} + 8^{B-F}$)	10 (All B-J)	126 (All B-J)	86 (All B-J)	10% of 572 (B-J + B-F) ~ 58	25% of 152 + 10% of 208 ~ 59
Unit 2	147 ($133^{B-J} + 14^{B-F}$)	202 ($194^{B-J} + 8^{B-F}$)	15 (All B-J)	120 (All B-J)	74 (All B-J)	10% of 558 (B-J + B-F) ~ 56	25% of 147 + 10% of 217 ~ 59

As indicated above, to justify inclusion of the Category B-F welds in this N-560 application scope, the number of inspection locations was increased to enable conformance with the selection criteria of N-578. Furthermore, although not a requirement of N-578, if the Category

B-F welds were considered in isolation, a total of five locations (i.e., four high risk and one medium risk) would be selected. For this modified N-560 application, a total of six Category B-F locations have been selected, each of them from the high-risk region. STP believes the above together with the delta risk assessment presented in Section 3.7 provides sufficient justification for the inclusion of the Category B-F locations in this N-560 application scope.

3.1 Definition of RI-ISI Program Scope

The systems to be included in the RI-ISI program are provided in Table 3.1-1. The as-operated piping and instrumentation diagrams and additional plant information were used to define the system boundaries. The N-560 risk-informed evaluation boundaries for the Chemical and Volume Control System (CVCS), Reactor Coolant System (RCS), Residual Heat Removal System (RHRS), and the Safety Injection System (SIS) were defined consistent with the system boundaries established in the existing plant ISI program.

In Table 3.1-1, the system descriptions have been augmented as indicated in the table footnotes. For example, the system boundaries for the RCS extend out to the first isolation valve. As such, certain piping segments that perform CVCS, RHRS and SIS functions are included in the risk-informed evaluation boundaries for the RCS. The footnotes to Table 3.1-1 identify all such cases. This clarification is needed to provide a more accurate representation of the risk-informed evaluation results, and to ultimately demonstrate that inspection locations have been selected in each system.

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 (isolation, bypass and large, early release). The impact on these measures due to both direct and indirect effects was considered using the guidance provided in EPRI TR-112657.

3.3 Degradation Mechanism Evaluation

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.

Table 3.3-1 summarizes the failure potential assessment by system for each potential degradation mechanism.

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 (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 3.4-1.

3.5 Inspection Location Selection and NDE Selection

In general, EPRI TR-112657 requires that 10% of the Category B-J non-socket welded population be selected for inspection, and that appropriate non-destructive examination (NDE) methods tailored to the applicable degradation mechanism be defined for ASME Code Case N-560 applications. Inspection locations are generally selected from the high risk region with some medium risk region locations selected as well to provide a good distribution and to ensure all postulated damage mechanisms are addressed. For this application, as discussed above, Category B-F dissimilar metal weld locations have also been considered. The results of the selection are presented in Table 3.5-1. Section 4 of EPRI TR-112657 was used as guidance in determining the examination requirements for these locations.

In addition, 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, which remains unaffected by the RI-ISI program.

<u>Additional Examinations</u>

The RI-ISI program may require examinations on a number of elements constructed to lesser preservice inspection requirements. Therefore, the 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 a determination of whether other elements in the segment or segments are subject to the same root cause conditions. Additional examinations will be performed on these elements up to a number equivalent to the number of elements required to be inspected on the segment or segments initially. If unacceptable flaws or relevant conditions are again found similar to the initial problem, the remaining elements identified as susceptible will be examined. No additional examinations will be performed if there are no additional elements identified as being susceptible to the same root cause conditions.

3.6 Program Relief Requests

An attempt has been made to provide a minimum of >90% coverage (per Code Case N-460) when performing the risk-informed examinations. However, some limitations will not be known until the examination is performed, because some locations may be examined for the first time by the specified techniques.

At this time, the selected risk-informed examination locations provide >90% coverage. In instances where a location may be found at the time of the examination that does not meet the >90% coverage requirement, the process outlined in EPRI TR-112657 will be followed.

STP has not submitted any relief requests pertaining to limited piping weld examination coverage for the second inspection interval. Consequently, no relief requests need to be withdrawn. All other relief requests remain in place.

3.7 Risk Impact Assessment

The RI-ISI program has been conducted in accordance with Regulatory Guide 1.174 and the EPRI methodology requirements, 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-560 risk ranking matrix, and then determined the inspection changes to be made for each of the locations in each segment. The changes include revising 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.

Limits are imposed by the EPRI methodology (TR-112657) 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 criteria require that the cumulative change in CDF and LERF be less than 1E-7 and 1E-8 per year per system, respectively.

Per the requirements of paragraph 3.7.2 of EPRI TR-112657, STP conducted a bounding analysis. The calculations estimated the net change in risk due to the positive and negative influence of adding and removing locations from the inspection program. Consistent with the requirements of Section 3.7 of EPRI TR-112657, the conditional core damage probability (CCDP) used for high consequence category segments was based on the highest evaluated CCDP (i.e., Large LOCA), whereas, for medium and low consequence category segments, bounding estimates of CCDP were used. Two sets of piping failure rates were used in the analysis. In the first case, bounding failure rates from the EPRI methodology were used (see paragraph 3.7.2 of TR-112657). The second set of calculations was performed using the best estimate piping failure rates from EPRI TR-111880, "Piping System Failure Rates and Rupture Frequencies for Use in RI-ISI Applications." In addition, the analysis was performed both with and without taking credit for the benefit of enhanced inspection effectiveness due to an increased POD from application of the RI-ISI approach.

None of the segments evaluated in the scope of this application would create a concern for containment isolation or bypass, or adversely impact systems important to LERF should a failure occur. Therefore, the inspection program changes proposed in this risk-informed application will not impact LERF. Hence, any risk impacts that would be expected from any segment evaluated would be confined to possible changes in CDF.

Tables 3.7-1 and 3.7-2 present a summary of the RI-ISI program versus 1989 Section XI Code Edition program requirements and identify on a per system basis each applicable risk category. The results in Table 3.7-1 are based on the bounding piping failure rates from TR-112657, whereas the results in Table 3.7-2 are based on the best estimate piping failure rates from TR-111880. Based on the results presented in these two tables, and the discussion above, the results of the bounding delta risk assessment for Units 1 and 2 show that the change in risk is less than the following:

	$\Delta Risk_{CDF}$ from Table 3.7-1		$\Delta Risk_{CDF}$ from Table 3.7-2	
	No Improved POD	**Improved POD**	**No Improved POD**	**Improved POD**
Unit 1	8.76E-08	-1.06E-07	4.60E-08	9.92E-10
Unit 2	7.62E-08	-1.11E-07	4.06E-08	-1.54E-09

As indicated above, 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 the EPRI methodology requirements.

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-560 provide a more robust selection process founded on actual service experience with nuclear plant piping failure data.

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

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

4. IMPLEMENTATION AND MONITORING PROGRAM

Upon approval of the 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 Updated Final Safety Analysis Report are necessary for program implementation.

The applicable aspects of the ASME Code not affected by this change would 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.

A monitoring and corrective action program will be developed which will contain the following elements:

- Identify
- Characterize
- Evaluate; determine the cause and extent of the condition identified
- Evaluate; develop a corrective action plan or plans
- Decide
- Implement
- Monitor
- 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 1989 ASME Section XI Code Edition program requirements for in-scope piping is provided in Table 5-1.

The RI-ISI program will start in the first inspection period of the second inspection interval.

6. REFERENCES

Revised Risk-Informed Inservice Inspection Evaluation Procedure, EPRI, Palo Alto, CA: 1999. TR-112657.

Piping System Failure Rates and Rupture Frequencies for Use in RI-ISI Applications, EPRI, Palo Alto, CA: 1999. TR-111880.

Consequence Evaluation of Class 1 Piping in Support of ASME Code Case N-560, South Texas Project Electric Generating Station (STPEGS) – Units 1 and 2, Dated June 18, 1999

Calculation No. EPRI-116-330, Rev. 0, Degradation Mechanism Evaluation for the South Texas Project Electric Generating Station (STPEGS) – Units 1 and 2, Dated June 22, 1999

Calculation No. EPRI-116-331, Rev. 0, Degradation Mechanism Evaluation of B-F Welds for the South Texas Project Electric Generating Station (STPEGS) – Units 1 and 2, Dated June 22, 1999

Record of Conversation No. 11-EPRI-001-006, Element Selection Meeting for Application of Code Case N-560 at the South Texas Project Electric Generating Station (STPEGS) – Units 1 and 2, Dated June 24, 1999

Condition Report No. 99-13894, Performance of Plant Specific Service History Review in Support of ASME Code Case N-560 Risk-Informed Inservice Inspection Application at the South Texas Project Electric Generating Station (STPEGS) – Units 1 and 2, Dated October 6, 1999

Risk Impact of Proposed Changes in STP Risk-Informed Inservice Inspection Program, Dated October 13, 1999

Table 3.1-1 System Selection and Segment Definition	
System Description[1]	Number of Segments Unit 1 / Unit 2
Chemical and Volume Control System	8 / 8
Chemical and Volume Control System (RCS)[2]	1 / 1
Reactor Coolant System	61 / 56
Reactor Coolant System (CVCS)[3]	8 / 8
Reactor Coolant System (RHRS)[4]	8 / 8
Reactor Coolant System (SIS)[5]	14 / 14
Residual Heat Removal System	3 / 3
Residual Heat Removal System (SIS)[6]	6 / 6
Safety Injection System	13 / 13
Total	122 / 117

1. The N-560 risk-informed evaluation boundaries for the Chemical and Volume Control System (CVCS), Reactor Coolant System (RCS), Residual Heat Removal System (RHRS), and the Safety Injection System (SIS) were defined consistent with the system boundaries established in the existing inservice inspection (ISI) program.

2. The auxiliary spray line piping between the first and second isolation valves was evaluated as part of the CVCS consistent with the system boundaries established in the existing ISI program. One segment per unit could have alternatively been included in the RCS evaluation based on its function.

3. Normal/alternate charging line piping and letdown/alternate letdown line piping between the first isolation valves and the cold legs/crossover legs were evaluated as part of the RCS consistent with the system boundaries established in the existing ISI program. Eight segments per unit could have alternatively been included in the CVCS evaluation based on their function.

4. Residual heat removal suction line piping between the hot legs and first isolation valves was evaluated as part of the RCS consistent with the system boundaries established in the existing ISI program. Eight segments per unit could have alternatively been included in the RHRS evaluation based on their function.

5. High head/low head safety injection line piping (including accumulators) between the first isolation valves and the hot legs/cold legs was evaluated as part of the RCS consistent with the system boundaries established in the existing ISI program. Fourteen segments per unit could have alternatively been included in the SIS evaluation based on their function.

6. High head/low head safety injection (hot legs/cold legs) line piping between the first and second isolation valves was evaluated as part of the RHRS consistent with the system boundaries established in the existing ISI program. Six segments per unit could have alternatively been included in the SIS evaluation based on their function.

Table 3.3-1

Failure Potential Assessment Summary for Unit 1 / Unit 2

System	Thermal Fatigue		Stress Corrosion Cracking				Localized Corrosion			Flow Sensitive	
	TASCS	TT	IGSCC	TGSCC	ECSCC	PWSCC	MIC	PIT	CC	E-C	FAC
CVCS		X / X									
CVCS (RCS)		X / X									
RCS	X / X	X / X				X / X					
RCS (CVCS)	X / X	X / X									
RCS (RHRS)	X / X										
RCS (SIS)	X / X	X / X									
RHRS											
RHRS (SIS)											
SIS		X / X	X / X								

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

Table 3.4-1 Number of Segments by Risk Category for Unit 1 / Unit 2							
System	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Category 7
CVCS						4 / 4	4 / 4
CVCS (RCS)						1 / 1	
RCS		31 / 31		22 / 22	2 / 2	6 / 1	
RCS (CVCS)		5 / 5		1 / 1	2 / 2		
RCS (RHRS)		3 / 3		5 / 5			
RCS (SIS)		11 / 11		3 / 3			
RHRS						3 / 3	
RHRS (SIS)						3 / 3	3 / 3
SIS					1 / 1	9 / 9	3 / 3
TOTAL	0 / 0	50 / 50	0 / 0	31 / 31	5 / 5	26 / 21	10 / 10

Table 3.5-1

Number of Locations/Inspections by Risk Category for Unit 1 / Unit 2

System	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6		Category 7	
	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.
CVCS											8 / 8	0 / 0	47 / 36	0 / 0
CVCS (RCS)											3 / 4	0 / 0		
RCS			75 / 71	22 / 22			173 / 177	9 / 9	4 / 6	1 / 1	8 / 2	0 / 0		
RCS (CVCS)			15 / 15	3 / 3			7 / 7	2 / 2	3 / 6	0 / 0				
RCS (RHRS)			21 / 21	8 / 8			9 / 9	0 / 0						
RCS (SIS)			41 / 40	13 / 13			9 / 9	0 / 0						
RHRS											45 / 43	0 / 0		
RHRS (SIS)											36 / 37	0 / 0	6 / 5	0 / 0
SIS									3 / 3	1 / 1	26 / 26	0 / 0	33 / 33	0 / 0
TOTAL	0 / 0	0 / 0	152 / 147	46 / 46	0 / 0	0 / 0	198 / 202	11 / 11	10 / 15	2 / 2	126 / 120	0 / 0	86 / 74	0 / 0

Table 3.7-1

Bounding Estimate of Risk Impact Based on EPRI TR-112657 Upper Bound Failure Rates for Unit 1 / Unit 2

System	Risk Category	Consequence Rank	Degradation Mechanism	Locations Inspected '89 Code	Locations Inspected RI-ISI	Delta Inspections	CDF Impact Excluding POD	CDF Impact Including POD
CVCS	6	Low	TT	2 / 2	0 / 0	-2 / -2	2.00E-11 / 2.00E-11	6.00E-12 / 6.00E-12
	7	Low	None	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
CVCS (RCS)	6	Low	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS	2	High	PWSCC	12 / 12	6 / 6	-6 / -6	3.60E-08 / 3.60E-08	1.80E-08 / 1.80E-08
	2	High	TASCS, TT	15 / 15	8 / 8	-7 / -7	4.20E-08 / 4.20E-08	-1.62E-08 / -1.62E-08
	2	High	TASCS, TT, PWSCC	1 / 1	0 / 0	-1 / -1	6.00E-09 / 6.00E-09	1.80E-09 / 1.80E-09
	2	High	TT	3 / 3	8 / 8	5 / 5	-3.00E-08 / -3.00E-08	-3.78E-08 / -3.78E-08
	2	High	TT, PWSCC	1 / 1	0 / 0	-1 / -1	6.00E-09 / 6.00E-09	1.80E-09 / 1.80E-09
	4	High	None	49 / 40	9 / 9	-40 / -31	2.40E-08 / 1.86E-08	1.20E-08 / 9.30E-09
	5	Medium	TASCS	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
	5	Medium	TASCS, TT	0 / 0	1 / 1	1 / 1	-1.00E-09 / -1.00E-09	-9.00E-10 / -9.00E-10
	6	Medium	None	0 / NA	0 / NA	0 / NA	No Change / NA	No Change / NA
	6	Low	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS (CVCS)	2	High	TASCS, TT	3 / 5	2 / 2	-1 / -3	6.00E-09 / 1.80E-08	-5.40E-09 / -1.80E-09
	2	High	TT	3 / 0	1 / 1	-2 / 1	1.20E-08 / -6.00E-09	-6.66E-25 / -5.40E-09
	4	High	None	0 / 2	2 / 2	2 / 0	-1.20E-09 / No Change	-6.00E-10 / No Change
	5	Medium	TASCS	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change

Table 3.7-1

Bounding Estimate of Risk Impact Based on EPRI TR-112657 Upper Bound Failure Rates for Unit 1 / Unit 2

System	Risk Category	Consequence Rank	Degradation Mechanism	Locations Inspected '89 Code	Locations Inspected RI-ISI	Delta Inspections	CDF Impact Excluding POD	CDF Impact Including POD
	5	Medium	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS (RHRS)	2	High	TASCS	6 / 7	8 / 8	2 / 1	-1.20E-08 / -6.00E-09	-3.24E-08 / -3.06E-08
	4	High	None	2 / 2	0 / 0	-2 / -2	1.20E-09 / 1.20E-09	6.00E-10 / 6.00E-10
RCS (SIS)	2	High	TASCS	4 / 3	3 / 3	-1 / 0	6.00E-09 / No Change	-9.00E-09 / -1.08E-08
	2	High	TASCS, TT	1 / 2	4 / 4	3 / 2	-1.80E-08 / -1.20E-08	-1.98E-08 / -1.80E-08
	2	High	TT	7 / 6	6 / 6	-1 / 0	6.00E-09 / No Change	-1.98E-08 / -2.16E-08
	4	High	None	1 / 0	0 / 0	-1 / 0	6.00E-10 / No Change	3.00E-10 / No Change
RHRS	6	Medium	None	11 / 11	0 / 0	-11 / -11	1.10E-09 / 1.10E-09	5.50E-10 / 5.50E-10
RHRS (SIS)	6	Medium	None	11 / 7	0 / 0	-11 / -7	1.10E-09 / 7.00E-10	5.50E-10 / 3.50E-10
	7	Low	None	1 / 0	0 / 0	-1 / 0	1.00E-12 / No Change	5.00E-13 / No Change
SIS	5	Medium	TT, IGSCC	2 / 2	1 / 1	-1 / -1	1.00E-09 / 1.00E-09	-3.00E-10 / -3.00E-10
	6	Medium	None	8 / 6	0 / 0	-8 / -6	8.00E-10 / 6.00E-10	4.00E-10 / 3.00E-10
	6	Low	TT, IGSCC	1 / 1	0 / 0	-1 / -1	1.00E-11 / 1.00E-11	3.00E-12 / 3.00E-12
	7	Low	None	7 / 4	0 / 0	-7 / -4	7.00E-12 / 4.00E-12	3.50E-12 / 2.00E-12
TOTAL							8.76E-08 / 7.62E-08	-1.06E-07 / -1.11E-07

Table 3.7-2

Bounding Estimate of Risk Impact Based on EPRI TR-111880 Best Estimate Failure Rates for Unit 1 / Unit 2

System	Risk Category	Consequence Rank	Degradation Mechanism	Locations Inspected '89 Code	Locations Inspected RI-ISI	Delta Inspections	CDF Impact Excluding POD	CDF Impact Including POD
CVCS	6	Low	TT	2 / 2	0 / 0	-2 / -2	9.42E-12 / 9.42E-12	2.83E-12 / 2.83E-12
	7	Low	None	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
CVCS (RCS)	6	Low	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS	2	High	PWSCC	12 / 12	6 / 6	-6 / -6	1.50E-08 / 1.50E-08	7.49E-09 / 7.49E-09
	2	High	TASCS, TT	15 / 15	8 / 8	-7 / -7	5.86E-09 / 5.86E-09	-2.26E-09 / -2.26E-09
	2	High	TASCS, TT, PWSCC	1 / 1	0 / 0	-1 / -1	2.83E-09 / 2.83E-09	8.48E-10 / 8.48E-10
	2	High	TT	3 / 3	8 / 8	5 / 5	-4.19E-09 / -4.19E-09	-5.27E-09 / -5.27E-09
	2	High	TT, PWSCC	1 / 1	0 / 0	-1 / -1	2.83E-09 / 2.83E-09	8.48E-10 / 8.48E-10
	4	High	None	49 / 40	9 / 9	-40 / -31	2.03E-08 / 1.57E-08	1.01E-08 / 7.86E-09
	5	Medium	TASCS	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
	5	Medium	TASCS, TT	0 / 0	1 / 1	1 / 1	-1.40E-10 / -1.40E-10	-1.26E-10 / -1.26E-10
	6	Medium	None	0 / NA	0 / NA	0 / NA	No Change / NA	No Change / NA
	6	Low	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS (CVCS)	2	High	TASCS, TT	3 / 5	2 / 2	-1 / -3	8.37E-10 / 2.51E-09	-7.54E-10 / -2.51E-10
	2	High	TT	3 / 0	1 / 1	-2 / 1	1.67E-09 / -8.37E-10	-9.30E-26 / -7.54E-10
	4	High	None	0 / 2	2 / 2	2 / 0	-1.01E-09 / No Change	-5.07E-10 / No Change
	5	Medium	TASCS	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change

Table 3.7-2

Bounding Estimate of Risk Impact Based on EPRI TR-111880 Best Estimate Failure Rates for Unit 1 / Unit 2

System	Risk Category	Consequence Rank	Degradation Mechanism	Locations Inspected '89 Code	Locations Inspected RI-ISI	Delta Inspections	CDF Impact Excluding POD	CDF Impact Including POD
	5	Medium	TT	0 / 0	0 / 0	0 / 0	No Change / No Change	No Change / No Change
RCS (RHRS)	2	High	TASCS	6 / 7	8 / 8	2 / 1	-1.67E-09 / -8.37E-10	-4.52E-09 / -4.27E-09
	4	High	None	2 / 2	0 / 0	-2 / -2	1.01E-09 / 1.01E-09	5.07E-10 / 5.07E-10
RCS (SIS)	2	High	TASCS	4 / 3	3 / 3	-1 / 0	8.37E-10 / No Change	-1.26E-09 / -1.51E-09
	2	High	TASCS, TT	1 / 2	4 / 4	3 / 2	-2.51E-09 / -1.67E-09	-2.76E-09 / -2.51E-09
	2	High	TT	7 / 6	6 / 6	-1 / 0	8.37E-10 / No Change	-2.76E-09 / -3.01E-09
	4	High	None	1 / 0	0 / 0	-1 / 0	5.07E-10 / No Change	2.54E-10 / No Change
RHRS	6	Medium	None	11 / 11	0 / 0	-11 / -11	9.30E-10 / 9.30E-10	4.65E-10 / 4.65E-10
RHRS (SIS)	6	Medium	None	11 / 7	0 / 0	-11 / -7	9.30E-10 / 5.92E-10	4.65E-10 / 2.96E-10
	7	Low	None	1 / 0	0 / 0	-1 / 0	8.45E-13 / No Change	4.23E-13 / No Change
SIS	5	Medium	TT, IGSCC	2 / 2	1 / 1	-1 / -1	4.71E-10 / 4.71E-10	-1.41E-10 / -1.41E-10
	6	Medium	None	8 / 6	0 / 0	-8 / -6	6.76E-10 / 5.07E-10	3.38E-10 / 2.54E-10
	6	Low	TT, IGSCC	1 / 1	0 / 0	-1 / -1	4.71E-12 / 4.71E-12	1.41E-12 / 1.41E-12
	7	Low	None	7 / 4	0 / 0	-7 / -4	5.92E-12 / 3.38E-12	2.96E-12 / 1.69E-12
TOTAL							4.60E-08 / 4.06E-08	9.92E-10 / -1.54E-09

Table 5-1

Inspection Location Selection Comparison Between '89 Code and N-560 by Risk Region for Unit 1 / Unit 2

System	Code Category	Total Weld Count	High Risk Region			Medium Risk Region			Low Risk Region		
			Weld Count	Inspection Locations		Weld Count	Inspection Locations		Weld Count	Inspection Locations	
				'89 Code	N-560		'89 Code	N-560		'89 Code	N-560
CVCS	B-J	55 / 44							55 / 44	2 / 2	0 / 0
CVCS (RCS)	B-J	3 / 4							3 / 4	0 / 0	0 / 0
RCS	B-F	22 / 22	14 / 14	14 / 14	6 / 6	8 / 8	8 / 8	0 / 0			
	B-J	238 / 234	61 / 57	18 / 18	16 / 16	169 / 175	41 / 32	10 / 10	8 / 2	0 / 0	0 / 0
RCS (CVCS)	B-J	25 / 28	15 / 15	6 / 5	3 / 3	10 / 13	0 / 2	2 / 2			
RCS (RHRS)	B-J	30 / 30	21 / 21	6 / 7	8 / 8	9 / 9	2 / 2	0 / 0			
RCS (SIS)	B-J	50 / 49	41 / 40	12 / 11	13 / 13	9 / 9	1 / 0	0 / 0			
RHRS	B-J	45 / 43							45 / 43	11 / 11	0 / 0
RHRS (SIS)	B-J	42 / 42							42 / 42	12 / 7	0 / 0
SIS	B-J	62 / 62				3 / 3	2 / 2	1 / 1	59 / 59	16 / 11	0 / 0
TOTAL	B-F	22 / 22	14 / 14	14 / 14	6 / 6	8 / 8	8 / 8	0 / 0			
TOTAL	B-J	550 / 536	138 / 133	42 / 41	40 / 40	200 / 209	46 / 38	13 / 13	212 / 194	41 / 31	0 / 0