ENERGY NORTHWEST

P.O. Box 968 ■ Richland, Washington 99352-0968

August 16, 2000
GO2-00-141

Docket No. 50-397

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

Subject: **WNP-2, OPERATING LICENSE NPF-21 REQUEST FOR APPROVAL OF ALTERNATE RISK-INFORMED INSERVICE INSPECTION (RI-ISI) REQUIREMENTS**

References:
1) Letter GO2-94-286, dated December 27, 1994, JV Parrish (SS) to NRC, "Second 10-Year Inservice Inspection Program Plan"

2) US NRC Safety Evaluation Report Revised Risk Informed Inservice Inspection Evaluation Procedure (EPRI TR-112657, Rev B, July 1999), dated October 28, 1999

Section 50.55a of Title 10 of the Code of Federal Regulations requires that Inservice Inspection (ISI) of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 piping be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code. Pursuant to Section 50.55a(a)(3) of 10 CFR, Energy Northwest hereby requests the approval of the proposed partial scope Risk-Informed Inservice Inspection Program (Attached). This is proposed as an alternative to current ASME Section XI inspection requirements in all pressure retaining Class 1 ASME Section XI Examination Category B-J welds in Subarticle IWB-2500 and Table IWB-2500-1; excluding socket welds and piping one inch and smaller.

The RI-ISI Program has been developed in accordance with the NRC Safety Evaluation Report (Reference 2) of the EPRI methodology contained in EPRI TR 112657, Revision B-A, "Risk-Informed Inservice Inspection Evaluation Procedure," Final Report. The attached Risk-Informed Inservice Inspection Program Plan Submittal supports the conclusion that the proposed alternative provides an acceptable level of quality and safety as required by 10 CFR 50.55a(a)(3)(i).

A047

Quality is enhanced because the required inspections are specifically tailored to identified failure mechanisms and, where applicable, utilize existing programs with specified performance standards. Safety of the plant is unchanged. There is no impact on current safety margins from the implementation of this program change. Additional supporting documentation resides at the Energy Northwest offices for your review.

Energy Northwest plans to implement the Risk Informed ISI Program alternative to our Second 10-Year Inservice Inspection Program Plan (Reference 1), during the next refueling outage scheduled for May of 2001, and requests approval of this alternative to meeting ASME Section XI inspection requirements by March 15, 2001.

Energy Northwest considers implementation of the RI-ISI Program to be a Cost Beneficial Licensing Action. This letter contains no new commitments.

A copy of this letter has been provided to the Chief Boiler Inspector of the State of Washington.

Should you have any questions or desire additional information regarding this matter, please contact PJ Inserra at (509) 377-4147.

Respectfully,

R.L. Webring
Vice President, Operations Support/PIO
Mail Drop PE08

Attachments

cc: EW Merschoff - NRC RIV
JS Cushing - NRC NRR
NRC Resident Inspector - 927N
DJ Ross - EFSEC
TC Poindexter -Winston & Strawn
DL Williams - BPA/1399
GM Foster -- ANII
Chief Boiler Inspector State of Washington

ENERGY NORTHWEST

Columbia Generating Station (WNP-2)
Risk-Informed Inservice Inspection Program Submittal

Prepared for

Energy Northwest

By

Battelle

Richland, Washington

July 2000

Authors:
S. R. Gosselin
J. R. Cole

RISK-INFORMED INSERVICE INSPECTION PROGRAM PLAN

Table of Contents

1. INTRODUCTION

1.1 Relation to NRC Regulatory Guide RG-1.174

Inservice inspections (ISI) are currently performed on piping to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 1989 Edition as required by 10CFR50.55a. The unit is currently in the second inspection interval as defined by the Code for Program B.

The objective of this submittal is to request a change to the inservice inspection (ISI) program plan for WNP-2 ASME Section XI Examination Category B-J welds (excluding socket welds and piping 1" NPS and smaller) in accordance the risk-informed process described in EPRI TR 112657, Revision B-A, "Risk-Informed Inservice Inspection (RI-ISI) Evaluation Procedure, (Reference 6.1)."

WNP-2 plans to incorporate the RI-ISI program during the second period of the current inspection interval. The current 10-year inspection interval began on February 10, 1995.

As a risk-informed application, this submittal meets the intent and principles of Regulatory Guide 1.174. Further information is provided in Section 3.8 relative to defense-in-depth.

1.2 Individual Plant Examination (IPE) Quality

The consequences of pipe ruptures were evaluated by using the Revision 4.0 (March 2000) of the WNP-2 Level 1 and Level 2 Probabilistic Risk Assessment (PRA) models. The Revision 4.0 model is a modification of the earlier Revision 3, which incorporates some comments from the certification process. Revision 4.0 includes the following:

- Modified Loss of Off-Site Power (LOOP) event tree to include onsite power recovery,
- Adjusted LOOP initiating event frequency,
- Reevaluated flooding analysis,
- Reanalyzed common-cause failure,
- Updated testing/maintenance unavailability using maintenance rule data,
- Updated diesel generator data using plant specific failure data,
- Updated generic data source using the recent General Electric Boiling Water Reactor (GE/BWR) database,
- Included the low frequency Level 1 cut-sets in large early release frequency (LERF) calculation.

A summary of the PRA results and conclusions and how they are used in the evaluation is presented below.

The base core damage frequency from the PRA Revision 4.0 model is 2.36E-05/yr and the base large early release frequency from this version is 1.31E-06/yr. The main contributors to core damage frequency (CDF) are summarized in Table 1.2-1.

Revision 3 of the PRA has undergone the Boiling Water Reactor Owners Group (BWROG) certification process. The results of the certification showed that more than 65% of all the graded sub-elements could be used to support Grade 3 applications, 6% could be used to support Grade 4, and less than 30% of the sub-elements were assessed below Grade 3. The areas that stand out as particularly strong are the following:

- Initiating Event Analysis
- Systems Analyses
- Structural Analysis of Containment
- Maintenance and Update Process

In addition, as stated in the safety evaluation [Docket No. 50-397] from the NRC on April 8, 1997, the following conclusions were made.

1. The WNP-2 IPE is complete with regard to the information requested by Generic Letter (GL) 88-20.
2. The IPE results are reasonable, given WNP-2's design, operation, and history. As a result, the review concluded that the WNP-2 IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities and that the IPE has met the intent of GL 88-20. However, the staff noted that weaknesses in the licensee's evaluation of human errors during severe accidents would limit the use of the IPE for purposes other than GL 88-20 that are sensitive to human error analysis.

The WNP-2 PRA peer review certification report [November 1997] and the safety evaluation entitled "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Individual Plant Examination Washington Public Power Supply System, Nuclear Project No.2, Docket No. 50-397" [April 8, 1997] provide more details on the WNP-2 IPE evaluations.

2. PROPOSED ALTERNATIVE TO ASME SECTION XI ISI PROGRAM

2.1 ASME Section XI

Subsection IWB of ASME Section XI specifies the inservice inspection requirements for Class 1 components in light-water cooled plants. The specific examination and inspection requirements for pressure retaining welds in Class 1 piping are contained in Subarticle IWB-2500 and Table IWB-2500-1 Examination Category B-J.

As an alternative, a risk-informed inservice inspection program will be implemented in accordance with guidance and process procedures described in EPRI TR-112657. The RI-ISI program will be substituted for the current examination program on 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 defining the relationship between the risk-informed examination program and the remaining unaffected portions of ASME Section XI.

2.2 Augmented Programs

At WNP-2, Intergranular Stress Corrosion Cracking (IGSCC) GL 88-01, Flow Accelerated Corrosion (FAC) GL 89-08 and High Energy Line Break (HELB) augmented inspection programs are in-place on various Class 1 piping. Where applicable, WNP-2 augmented inspection programs were credited for element selection in accordance with the guidance contained in Section 3.6.4.1 of EPRI TR-112657 for ASME Code Case N-560 applications. None of the augmented inspections at WNP-2 changed as a result of these selections. WNP-2, Boiling Water Reactor Vessel & Internals Project (BWRVIP) and EPRI are investigating operating experience and material performance with respect to the BWR fleet and IGSCC issues; as such, WNP-2's response to Generic Letter 88-01 (NUREG-0313, Rev 2) and its supplement remain unchanged, at this time.

3. RISK-INFORMED ISI PROCESSES

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

- Scope Definition
- Consequence Evaluation
- Failure Assessment
- Risk Evaluation
- Element Selection
- Program Implementation
- Feedback Loop

There were no significant deviations to the process described in EPRI TR-112657. The only deviation was in the element selection process for the piping in the Reactor Core Isolation Cooling (RCIC) system (See discussion in Section 3.5). The change in risk assessment presented in section 3.8 shows a net reduction in risk with the above taken into consideration.

3.1 Scope of Program

The scope of the RI-ISI evaluation included all ASME Section XI Examination Category B-J welds; (excluding socket welds ,Item Number B9.40, and piping 1" NPS and smaller). The systems included in the risk-informed ISI program are identified in Table 3.1-1. The piping and instrumentation diagrams and additional plant information were used to define system boundaries.

3.2 Consequence Evaluation

The consequences 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.

The consequences of pressure boundary failures were evaluated and ranked based on their impact on conditional core damage probability (CCDP) and conditional large early release probability (CLERP). The impact on these measures due to both direct and indirect effects was determined using the PRA model described in Section 1. Consequence categories (High, Medium or Low) were assigned according to Table 3-1 of EPRI TR-112657. One of the enhancements incorporated into this application of the EPRI RI-ISI methodology was the direct use of the PRA models to support the estimation of CCDP and CLERP values for each pipe element in the scope of the RISI evaluation, in lieu of the consequence tables in EPRI TR-112657. This step was taken to support a more complete and realistic quantification of the risk impacts of the RI-ISI program in comparison with previous applications of this methodology.

For the Class 1 piping outside containment, a system walkdown was conducted to identify indirect effects associated with rupture of the affected piping. The impact of pipe failure and resulting interactions with other components were assessed as part of the consequence evaluation. The objective of the walkdown was to capture subtle interactions that could not be readily identified by reviewing the information contained in the plant design drawings.

In performing this task, various plant locations containing system piping were visited. Pipe breaks at these locations were postulated and the significance of spatial impact due to flooding, spraying, or jet impingement was discussed among the team members. The insights gained during the walkdown were incorporated into the Failure Modes and Effects Analysis (FMEA). The FMEA is used to serve as a base for the CCDP and CLERP estimations.

Indirect/spatial effects associated with pipe ruptures inside containment were based on pipe whip, jet impingement, pressurization, and temperature effect analyses documented in Reference 6.6. There are no indirect/spatial effects associated with flooding caused by pipe ruptures inside containment.

3.3 Failure 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.

Table 3.3-1 summarizes the failure potential assessment by system for each degradation mechanism that was identified as potentially operative.

3.4 Risk Evaluation

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 Tables 3.4-1 and 3.4-2.

3.5 Element Selection

For Code Case N-560 applications, the RI-ISI program shall be based on a total number of inspection elements (i.e., the weld population selected for inclusion in the RI-ISI program) consisting of not less than 10% of the examination category B-J welds (excluding socket welds) in all Class 1 piping larger than 1" NPS. According to the guidance in EPRI TR-112657, the RI-ISI inspection population shall be selected from those piping segments that fall into the high-risk categories. The results of the selection are presented in Table 3.5-1. Once the RI-ISI inspection scope is defined, non-destructive examination (NDE) methods tailored to the applicable degradation mechanism were then defined for each weld. Section 4 of EPRI TR-112657, was used to determine the examination requirements for these locations.

At WNP-2, 830 examination category B-J welds, excluding socket welds, were evaluated. A total of 83 welds (10%) were subsequently selected for inclusion in the RI-ISI program inspection population. With the exception of two medium-risk elements (risk category 5) in the RCIC system, all elements were selected from high-risk pipe segments for inclusion in the program.

In accordance with the selection guidelines in EPRI TR112657, Section 3.6.4.1, less than 50% (i.e., 43%) of the proposed RI-ISI elements selected for inspection were credited from the current WNP-2 IGSCC augmented inspection program. Accordingly, a total of 36 high-risk elements in the RRC system were credited from the WNP-2 IGSCC augmented inspection program.

In the RCIC system, FAC was the only degradation mechanism identified in all the high-risk segments. Both thermal stratification, cycling and striping (TASCS) and thermal transient fatigue degradation mechanisms were identified in three risk category 5 segments. Since check valve RCIC-V-66 had a history of back-leakage problems, the welds upstream of this check valve were considered especially vulnerable to TASCS fatigue. Knowing that all the RCIC high-risk pipe segments are part of the WNP-2 FAC program, two medium risk welds, upstream of check valve RCIC-V-66 were selected.

The remaining 45 welds were selected from high-risk segments in the High Pressure Core Spray (HPCS), Reactor Feedwater (RFW) and Residual Heat Removal (RHR) systems.

Since there were no high-risk segments identified in the Main Steam (MS), Low Pressure Core Spray (LPCS) and the Standby Liquid Control (SLC) systems, no elements in these systems were included in the RI-ISI program volumetric inspection plan.

Finally, all Class1 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 existing pressure test program, which remains unaffected by the risk-informed inservice inspection program.

3.6 Additional Examinations

Since the risk-informed inspection program may require examinations on a number of elements constructed to lesser pre-service inspection requirements, the program in all cases will determine through an engineering evaluation the root cause of any unacceptable flaw determined to be service related (i.e., fatigue, wall loss, IGSCC, etc.) 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 on the segment or segments are subject to the same root cause and degradation mechanism. Additional examinations will be performed on these elements up to a number equivalent to the number of elements initially required to be inspected on the segment or segments. If unacceptable flaws determined to be service related 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 service related root cause conditions or degradation mechanism.

3.7 Program Relief Requests

Alternate methods are specified to ensure structural integrity in cases where examination methods cannot be applied due to limitations such as inaccessibility or radiation exposure hazard.

A minimum of >90% volume coverage (per Code Case N-460) will be provided, when possible, when performing the risk-informed examinations. 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.

At this time, all the risk-informed examination locations that have been selected are estimated to exceed >90% volume coverage. In instances where a location may be found at the time of the examination that does not meet >90% coverage, the process outlined in EPRI TR 112657, will be followed.

All existing relief requests are unaffected and remain in place.

3.8 Risk Impact Assessment

Change in Risk

The risk-informed ISI program has been conducted in accordance with Regulatory Guide 1.174, 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 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, inspection locations have an expanded volume and the examination is focused to enhance the probability of detection during the inspection process. A comparison of the current Section XI and proposed RI-ISI inspection programs is summarized in Tables 3.8-1 and 3.8-2.

A comprehensive risk impact evaluation was performed in accordance with Section 3.7 of EPRI TR-112657. The risk impact evaluation followed the decision process and evaluation criteria in EPRI TR-112657, Figure 3-6 and included the following elements:

1. A qualitative evaluation of the potential for risk impacts for each pipe segment due to increases and decreases in the number of exams and for expected enhancements to the inspection detection probability due to the implementation of expanded weld inspection volumes prescribed in Section 4.0 of EPRI TR-112567.

2. A conservative quantitative evaluation of the risk impacts for all pipe segments using rupture frequencies from Table A-11 in EPRI TR-111880 (Reference 6-7). No credit was taken for the inspection effectiveness (e.g., probability of detection - POD) associated with either the RI-ISI or Section XI based inspection programs. Also, the evaluation included a consideration for the possible effects of synergy between different damage mechanisms for segments found to be susceptible to two or more ISI amenable damage mechanisms.

Table 3.8-1 presents a summary of the proposed RI-ISI program versus the current Section XI program. These results of the quantitative risk impact evaluation show that the total change in core damage frequency (CDF) and large early release frequency (LERF) associated with the proposed RI-ISI program satisfy the acceptance criteria specified in EPRI TR-112657 that is, ΔCDF < 1E-7 per year and ΔLERF < 1E-8 per year.

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 Revision 1, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds," this method has been ineffective in identifying leaks or failures. EPRI TR-112657, and ASME Code Case N-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 leak or ruptures is increased. Secondly, the consequence assessment effort has a single failure criterion. As such, no matter how unlikely a failure scenario is, it is ranked High in the consequence assessment, and no lower than Medium in the risk assessment (i.e., Risk Category 4), if, as a result of the failure, there is no mitigative equipment available to respond to the event. In addition, the consequence assessment takes into account equipment reliability, with less credit given to less reliable equipment.

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, WNP-2 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 existing ASME Section XI interval. No changes to the Final Safety Analysis Report are necessary for program implementation.

The applicable aspects of the 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 would be retained and would be modified to address the RI-ISI process, as appropriate.

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 CHANGE

A comparison between the RI-ISI program and the current ASME Section XI program requirements for in-scope piping is given in Table 5-1. An identification of piping segments that are part of the plant's augmented programs is also included in Table 5-1.

The initial program will be started in the inspection period current at the time of program approval. For example, the second inspection period of the second inspection interval ends on December 12, 2001. The last refueling outage of this inspection period starts in the spring of 2001. If the program is approved such that a refueling outage remains in the second period, 66% of the required remaining examinations will be performed under the RI-ISI program prior to the end of the inspection interval.

6. REFERENCES/DOCUMENTATION

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

6.2 Code Case N-560, "Alternative Examination Requirements for Class 1, Category B-J Piping Welds Section XI, Division 1," ASME Boiler and Pressure Vessel Code, Code Cases for Nuclear Components, 1998 Edition.

6.3 WNP-2 Calculation ME-02-00-05 Revision 0, Risk Informed Inservice Inspection Degradation Mechanism Assessment per EPRI TR-112657, July 2000.

6.4 WNP-2 Calculation NE-02-00-04, Revision 0, Risk Informed Inservice Inspection Risk and Consequence Assessment, June 2000.

6.5 WNP-2 Calculation ME-02-00-06, Revision 0, Risk Informed Inservice Inspection Risk Categorization, Element Selection, and Risk Impact Evaluation per EPRI TR-112657, July 2000.

6.6 WNP-2 FSAR Section 3.6, Amendment 54, April 2000.

6.7 EPRI TR-111880, "Piping System Failure Rates and Rupture Frequencies for Use In Risk Informed In-service Inspection Applications," Final Report, September 1999.

6.8 Initiating Events, Energy Northwest, PSA-2-IE-0001, Revision 1, May 2000

Table 1.2-1 Main Contributors to CDF at WNP-2 (Reference 6.8)

Initiating Event	IE Frequency	CDF	Percent
Station Blackout (T(E)2)	2.91E-04/yr	1.15E-05/yr	48.9%
MSIV Closure (TM1)	6.00E-02/yr	2.19E-06/yr	9.3%
Turbine Trip (TT)	1.71/yr	1.81E-06/yr	7.7%
T(E), Loss of Offsite Power	3.61E-02/yr	1.04E-06/yr	4.4%
Loss of Condenser (TC)	3.00E-02/yr	8.74E-07/yr	3.7%
Loss of RFW (TF)	3.30E-01/yr	8.33E-07/yr	3.5%
Internal Flooding Cat. 8 (FLDR8)	2.72E-05/yr	8.26E-07/yr	3.5%
Manual Shutdown (MS)	7.80E-01/yr	7.93E-07/yr	3.4%
Internal Flooding Cat. 7 (FLDR7)	1.56E-05/yr	4.76E-07/yr	2.0%
Internal Flooding Cat. 6 (FLDR6)	9.60E-06/yr	4.31E-07/yr	1.8%
Internal Flooding Cat. 10 (FLDT1)	5.26E-03/yr	3.59E-07/yr	1.5%
Loss of Division 2 of DC (TDC2)	3.00E-03/yr	2.67E-07/yr	1.1%
ATWS following Loss of RFW(TFC)	3.30E-01/yr	2.39E-07/yr	1.0%
Loss of Division 1 of DC (TDC1)	3.00E-03/yr	1.91E-07/yr	0.8%
IORV/SORV (TI)	5.77E-02/yr	1.74E-07/yr	0.7%
Internal Flooding Cat. 2 (FLDR2)	3.36E-05/yr	1.41E-07/yr	0.6%
Internal Flooding Cat 3. (FLDR3)	2.94E-04/yr	1.37E-07/yr	0.6%
Medium LOCA (S1)	3.26E-03/yr	1.20E-07/yr	0.5%
ATWS following Turbine Trip with Bypass 100% power (TTC)(1)	1.4/yr	1.12E-07/yr	0.5%
Internal Flooding Cat. 4 (FLDR4)	3.20E-06/yr	8.76E-08/yr	0.4%
Instrument Line Break (SR)	1.00E-02/yr	7.81E-08/yr	0.3%
Loss of TSW (TTSW)	1.25E-03/yr	6.93E-08/yr	0.3%
Loss of CAS (TCAS)	1.25E-03/yr	5.88E-08/yr	0.2%
ATWS following MSIV Closure (TMC)	6.00E-02/yr	5.44E-08/yr	0.2%
ATWS following SORV (TIC)	5.77E-02/yr	5.08E-08/yr	0.2%
Steam Line Break Outside Containment (AO)	2.08E-04/yr	4.69E-08/yr	0.2%
Loss of CIA (TIA) - Includes Loss of CN	1.25E-03/yr	3.58E-08/yr	0.2%
ATWS following Loss of Condenser (TCC)	3.00E-02/yr	2.14E-08/yr	0.1%
Large LOCA (A)	4.45E-04/yr	1.25E-08/yr	0.1%
Internal Flooding Cat1 (FLDR1)	3.36E-05/yr	1.04E-08/yr	0.0%

(1) From Plant IPE, Eighty-two percent of turbine trip indicators occur at greater than 25% rated power and therefore, the initiating event frequency is 82% X 1.71 turbine trips per year.

Table 3.1-1 System Selection and Element Scope

System Description	Number of Segments	Number of Elements
High Pressure Core Spray (HPCS)	4	29
Low Pressure Core Spray (LPCS)	4	28
Main Steam (MS)	12	155
Reactor Core Isolation Cooling (RCIC)	11	94
Reactor Feedwater (RFW)	22	128
Residual Heat Removal (RHR)	18	126
Reactor Pressure Vessel (RPV)	1	3
Reactor Recirculation (RRC)	47	208
Reactor Water Cleanup (RWCU)	3	57
Standby Liquid Control (SLC)	1	2
Total	123	830

Table 3.3-1 Degradation Mechanism Assessment Summary

SYSTEM	Thermal Fatigue		Stress Corrosion Cracking				Local Corrosion			Flow Sensitive	
	TT	TASCS	IGSCC	TGSCC	ECSCC	PWSCC	MIC	PIT	CC	E-Cav	FAC
HPCS		X									
LPCS		X									
MS	X										X
RCIC	X	X									X
RFW	X	X							X		X
RHR	X	X	X								X
RPV											
RRC	X		X								X
RWCU											X
SLC											

HPCS – High Pressure Core Spray, LPCS - Low Pressure Core Spray, MS – Main Steam, RCIC – Reactor Core Isolation Cooling, RFW – Reactor Feedwater, RHR – Residual Heat Removal, RPV - Reactor Pressure Vessel, RRC – Reactor Recirculation, RWCU – Reactor Water Cleanup, SLC – Standby Liquid Control

TT – Thermal Transient, TASCS – Thermal Stratification Cycling and Striping, 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 Cracking, E-Cav -Cavitation, FAC – Flow Accelerated Corrosion.

Table 3.4-1 Number of Segments by Risk Category

System	Risk Category 1	Risk Category 2	Risk Category 3	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
HPCS	0	1	0	3	0	0	0
LPCS	0	0	0	0	1	3	0
MS	0	0	0	4	2	4	2
RCIC	2	0	3	1	3	1	1
RFW	12	0	10	0	0	0	0
RHR	6	2	0	7	1	2	0
RPV	0	0	0	0	0	1	0
RRC	1	24	0	20	0	2	0
RWCU	0	0	3	0	0	0	0
SLC	0	0	0	1	0	0	0
TOTAL	21	27	16	36	7	13	3

Table 3.4-2 Number of Welds by Risk Category

System	Risk Category 1	Risk Category 2	Risk Category 3	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
HPCS	0	3	0	26	0	0	0
LPCS	0	0	0	0	3	25	0
MS	0	0	0	12	12	124	7
RCIC	16	0	23	16	9	28	2
RFW	33	0	95	0	0	0	0
RHR	39	7	0	58	1	21	0
RPV	0	0	0	0	0	3	0
RRC	20	135	0	47	0	6	0
RWCU	0	0	57	0	0	0	0
SLC	0	0	0	2	0	0	0
TOTAL	108	145	175	161	25	207	9

Table 3.5-1 Number of Locations/Inspections by Risk Category

System	Risk Category 1		Risk Category 2		Risk Category 3		Risk Category 4		Risk Category 5		Risk Category 6		Risk Category 7	
	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.	Pop.	Insp.
HPCS	0	0	3	1	0	0	26	0	0	0	0	0	0	0
LPCS	0	0	0	0	0	0	0	0	3	0	25	0	0	0
MS	0	0	0	0	0	0	12	0	12	0	124	0	7	0
RCIC	16	0	0	0	23	0	16	0	9	2	28	0	2	0
RFW (2)	33	23	0	0	95	7	0	0	0	0	0	0	0	0
RHR (1) (2)	39	12	7	2	0	0	58	0	1	0	21	0	0	0
RPV	0	0	0	0	0	0	0	0	0	0	3	0	0	0
RRC (3)	20	0	135	36	0	0	47	0	0	0	6	0	0	0
RWCU	0	0	0	0	57	0	0	0	0	0	0	0	0	0
SLC	0	0	0	0	0	0	2	0	0	0	0	0	0	0

Pop. - Population, the number of welds in each risk category
Insp. - Inspected, the number of welds in each risk category selected for inclusion in the RI-ISI program
(1) Inspections in RI-ISI program are in addition to IGSCC augmented program examinations
(2) Inspections in RI-ISI program are in addition to FAC augmented program examinations
(3) Inspections in RI-ISI program are credited from IGSCC augmented inspection program

Table 3.8-1 Summary of Proposed RI-ISI and ASME Section XI Programs

SYSTEM	RISK CATEGORY	CONSEQUENCE RANK	DAMAGE MECHANISM	SECTION XI EXAMS	RI-ISI EXAMS	DELTA INSPECTIONS	AUGMENTED PROGRAMS	QUALITATIVE RISK IMPACT [4]	QUANTITATIVE RISK IMPACT [NO POD CREDIT]	
									ΔCDF	ΔLERF
HPCS	2	HIGH	TASCS	2	1	-1		INCREASE [1]	2.4E-11	5.8E-15
	4	HIGH	NONE	5	0	-5		INCREASE [1]	6.3E-11	3.3E-12
LPCS	5	MEDIUM	TASCS	3	0	-3		INCREASE [1]	1.3E-11	1.7E-14
	6	LOW	NONE	9	0	-9		NEGLIGIBLE	1.6E-11	2.7E-13
MS	4	HIGH	NONE	6	0	-6	HELB	INCREASE [1]	1.3E-10	3.8E-11
	5	LOW	TT,FAC	0	0	0	FAC	NO CHANGE	0.0E+00	0.0E+00
	6	MEDIUM	NONE	31	0	-31	HELB	NEGLIGIBLE	5.2E-10	8.3E-13
	7	LOW	NONE	2	0	-2		NEGLIGIBLE	6.1E-13	6.5E-14
RCIC	1	HIGH	FAC,WH	11	0	-11	FAC,HELB	INCREASE [1]	1.0E-10	3.0E-11
	3	MEDIUM	FAC,WH	7	0	-7	FAC,HELB	INCREASE [1]	1.5E-11	2.3E-14
	4	HIGH	NONE	3	0	-3		INCREASE [1]	1.9E-10	2.2E-12
	5	MEDIUM	TT	2	0	--2		INCREASE [1]	9.5E-12	2.0E-12
	5	MEDIUM	TT,TASCS	2	2	0		DECREASE [2]	-1.5E-12	1.5E-12
	6	MEDIUM	NONE	0	0	0		NO CHANGE	0.0E+00	0.0E+00
	7	LOW	NONE	0	0	0		NO CHANGE	0.0E+00	0.0E+00

Table 3.8-1 Summary of Proposed RI-ISI and ASME Section XI Programs (continued)

SYSTEM	RISK CATEGORY	CONSEQUENCE RANK	DAMAGE MECHANISM	SECTION XI EXAMS	RI-ISI EXAMS	DELTA INSPECTIONS	AUGMENTED PROGRAMS	QUALITATIVE RISK IMPACT [4]	QUANTITATIVE RISK IMPACT [NO POD CREDIT]	
									ΔCDF	ΔLERF
RFW	1	HIGH	FAC	11	11	0	HELB	NO CHANGE	0.0E+00	0.0E+00
	1	HIGH	TASCS,FAC	2	2	0	FAC,HELB	NO CHANGE	0.0E+00	0.0E+00
	1	HIGH	TASCS,TT,FAC	6	6	0	FAC,HELB	NO CHANGE	0.0E+00	0.0E+00
	1	HIGH	TT,CC,FAC	2	2	0	FAC,HELB	NO CHANGE	0.0E+00	0.0E+00
	1	HIGH	TT,FAC	2	2	0	FAC,HELB	NO CHANGE	0.0E+00	0.0E+00
RFW	3	MEDIUM	FAC	24	0	-24	FAC	INCREASE [1]	2.8E-09	4.5E-12
	3	MEDIUM	TASCS,FAC	8	7	-1	FAC	INCREASE [1]	1.3E-10	2.1E-13
RHR	1	HIGH	FAC	9	0	-9	FAC	INCREASE	1.0E-09	5.0E-11
	1	HIGH	TT,FAC	9	12	3	FAC	DECREASE	-3.4E-10	-1.3E-11
	2	HIGH	TASCS, TT,IGSCC	4	2	-2	IGSCC	INCREASE [1]	-6.6E-11	3.5E-14
	4	HIGH	NONE	9	0	-9		INCREASE [1]	4.7E-10	9.9E-12
	5	MEDIUM	TASCS, IGSCC	1	0	-1	IGSCC	INCREASE [1]	1.1E-11	1.7E-14
	6	MEDIUM	NONE	0	0	0		NO CHANGE	0.0E+00	0.0E+00

Table 3.8-1 Summary of Proposed RI-ISI and ASME Section XI Programs (continued)

SYSTEM	RISK CATEGORY	CONSEQUENCE RANK	DAMAGE MECHANISM	SECTION XI EXAMS	RI-ISI EXAMS	DELTA INSPECTIONS	AUGMENTED PROGRAMS	QUALITATIVE RISK IMPACT [4]	QUANTITATIVE RISK IMPACT [NO POD CREDIT]	
									ΔCDF	ΔLERF
RPV	6	MEDIUM	NONE	3	0	-3		NEGLIGIBLE	2.5E-10	5.2E-11
RRC	1	HIGH	FAC	8	0	-8		INCREASE [1]	3.8E-08	1.8E-09
	2	HIGH	IGSCC	14	36	22	IGSCC	DECREASE [3]	-2.8E-08	-2.2E-10
	2	HIGH	TT,IGSCC	15	0	-15	IGSCC	INCREASE [1]	6.3E-08	1.5E-11
	4	HIGH	NONE	18	0	-18		INCREASE [1]	1.6E-08	1.8E-12
	6	MEDIUM	NONE	0	0	0		NO CHANGE	0.0E+00	0.0E+00
RWCU	3	HIGH	FAC	2	0	-2	FAC	INCREASE [1]	1.9E-10	4.0E-11
SLC	4	HIGH	NONE	0	0	0		NO CHANGE	0.0E+00	0.0E+00
			Totals	*230*	*83*	*-147*			*9.6E-08*	*1.8E-09*

(1) Increase due to reduced inspections.
(2) Decrease due to expanded weld inspection volume in RI-ISI program.
(3) Decrease due to increase number of inspections.
(4) Per EPRI TR-112657, the contribution to risk from Category 6 and 7 locations is negligible.

Table 3.8-2 Change in Inspection Summary

Risk Region	Risk Category	System	Inspections(1)			Expanded Volume
			Added	Deleted	Change	
HIGH	1	RCIC (2)			0	
	1	RFW			0	12
	1	RHR		6	-6	12
	1	RRC		8	-8	
	2	HPCS		1	-1	1
	2	RHR (3)			0	2
	2	RRC (3)			0	
	3	RCIC (2)			0	
	3	RFW		1	-1	7
	3	RWCU		2	-2	
HIGH	***1,2,3***	***TOTAL***			***-18***	***34***
MEDIUM	4	HPCS		5	-5	
	4	MS (2)			0	
	4	RCIC		3	-3	
	4	RHR		9	-9	
	4	RRC		18	-18	
	4	SLC		2	-2	
	5	LPCS		3	-3	
	5	MS			0	
	5	RCIC			0	2
	5	RHR			0	
MEDIUM	***4,5***	***TOTAL***			***-40***	***2***

(1) Net inspections added or deleted considering current Section XI, HELB, IGSCC, and RI-ISI selections
(2) All welds inspected as part of the plant HELB program
(3) All welds inspected as part of the plant IGSCC program

Table 5-1 Inspection Location Selections Comparison to ASME Section XI 1989 Edition Requirements

System	Number of High/ Medium Risk Region Segments (1)		ASME Section XI 1989 Edition Examination Requirements (2) (3)	RI-ISI Inspection Locations	Number of High/Medium Risk Segments Included in Augmented Programs		
	HIGH RISK	MEDIUM RISK	B-J	Class1	HELB	IGSCC(4)	FAC
HPCS	1	3	7	1			
LPCS	0	1	3	0			
MS	0	6	6	0	8		2
RCIC	5	5	25	2	5		5
RFW	22	0	55	30	14		22
RHR	8	7	32	14		3	6
RPV	0	0	0	0			
RRC	25	20	55	36		24	1
RWCU	3	0	2	0	1		3
SLC	0	1	0	0			
TOTAL	64	43	185	83	28	27	39

(1) HIGH RISK = Category 1, 2 & 3 MEDIUM RISK = Category 4 & 5. Ranking includes impact of all degradation mechanisms.

(2) Number of ASME Section XI program inspection population in High and Medium risk segments

(3) Total ASME Section XI program inspection population for all High, Medium, and Low risk segments is 230 welds

(4) GL-81-01 Category A IGSCC pipe segments not included.