North Atlantic

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The Northeast Utilities System

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United States Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
Risk-Informed Inservice Inspection Alternative Request

North Atlantic Energy Service Corporation (North Atlantic) is presently performing Inservice Inspection (ISI) activities for the Second Ten-Year Interval in accordance with the 1995 Edition (including the 1996 addenda) of the ASME Boiler and Pressure Vessel Code, Section XI pursuant to the requirements of 10 CFR 50.55a(g). By letter dated May 6, 2000, North Atlantic requested to delay the implementation of certain aspects of the second interval ISI program for a period of two years in order to prepare an alternative piping ISI program based on a risk-informed approach. This request was submitted in accordance with the guidance provided in NRC Information Notice 98-44 "Ten-Year Inservice Inspection (ISI) Program Update for Licensees That Intend to Implement Risk-Informed ISI of Piping." The NRC authorized the two-year extension pursuant to 10 CFR 50.55a(g)(4)(iv) by letter dated August 30, 2000. North Atlantic has recently completed development of a Risk-Informed Inservice Inspection Program for ASME Code Class 1 piping utilizing the approach described in Electric Power Research Institute (EPRI) Topical Report (TR) 112657 Rev. B-A "Revised Risk-Informed Inservice Inspection Evaluation Procedure."

Pursuant to 10 CFR 50.55a(a)(3)(i), North Atlantic hereby requests NRC review and approval of the enclosed Risk-Informed Inservice Inspection (RI-ISI) Plan as an alternative to the current ASME Section XI inspection requirements for Class 1 code category B-F and B-J piping welds. ASME Section XI Examination Categories B-F and B-J currently contain the requirements for the nondestructive examination of Class 1 piping components. The RI-ISI plan will be substituted for the currently approved program for Class 1 piping. The remaining portions of the ISI Program will continue to be performed in accordance with Section XI of the ASME Code and NRC approved alternatives and relief requests. The enclosed RI-ISI Plan is specific to Seabrook Station and provides an acceptable level of quality and safety.

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North Atlantic requests NRC approval of the RI-ISI program by October 31, 2001 to support the implementation of inspection activities during Refueling Outage 08 in 2002. Approval of the RI-ISI program will result in a substantial reduction in the required number of piping weld examinations, which should reduce unnecessary radiation exposure to plant personnel and permit North Atlantic to more efficiently focus ISI program inspection activities. North Atlantic considers the implementation of the RI-ISI program to be a Cost Beneficial Licensing Action.

It should be noted that North Atlantic has chosen to include the four reactor vessel hot leg nozzle to safe end welds in this RI-ISI program in light of the recent issues identified at the V.C. Summer Nuclear Plant.

The NRC has approved the adequacy of the EPRI methodology for developing a RI-ISI program utilizing the guidance provided in EPRI TR-112657 in a letter to EPRI dated October 28, 1999.

Should you have any questions, please contact Mr. James M. Peschel, Manager – Regulatory Programs, at (603) 773-7194.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

T. C. Feigenbaum
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cc: H. J. Miller, NRC Regional Administrator
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NRC Senior Resident Inspector

Enclosure to NYN-01020

RISK-INFORMED INSERVICE INSPECTION PROGRAM PLAN

SEABROOK STATION (REVISION 0)

Table of Contents

1. INTRODUCTION

The Seabrook Station is currently in the second inservice inspection (ISI) interval as defined by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Section XI Code for Program B. Pursuant to 10 CFR 50.55a(g)(4)(ii), the applicable ASME Section XI Code for Seabrook is the 1995 Edition through the 1996 Addenda.

The objective of this submittal is to request the use of a risk-informed inservice inspection (RI-ISI) process for Class 1 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 Seabrook Station Probabilistic Safety Study (SSPSS) is a full scope, Level 3 risk analysis of power operation. The 1999 model update (SSPSS-1999) was used to evaluate the consequences of pipe rupture for the RI-ISI assessment.

The base core damage frequency (CDF) and base large early release frequency (LERF) from SSPSS-1999 are 4.6E-05 per year and 5.0E-08 per year, respectively.

The SSPSS has evolved since the original risk analysis was completed in 1983. The SSPSS has been updated a number of times to reflect changes in plant design and operation, plant-specific data, severe accident research and analysis, and modeling methodology. The major changes are summarized below:

SSPSS-1986 – The first update was made to reflect the plant configuration as of mid-1986. A number of plant changes were modeled, including Tech Spec changes and hardware modifications. A number of modeling changes and analysis updates were made, including use of RISKMAN for systems analysis, expanding common cause modeling, and updated seismic fragility analysis.

SSPSS-1989 – This update included plant changes through July 1989. Data for initiating event frequencies and for common cause and maintenance distributions were updated with additional industry experience. Analyses from the emergency planning optimization studies were used to update the plant and containment models.

SSPSS-1990 – This update included plant changes through July 1990. Changes were made to recovery data and modeling. RISKMAN Release 2 was used to create a fully integrated plant and containment model. This update was the basis for the Individual Plant Examination (IPE) Report submitted in 1991. The NRC Safety Evaluation Report of the IPE submittal did not identify any major concerns.

SSPSS-1993 – The SSPSS was updated to reflect the plant configuration at the end of Cycle 2 (November 1992). This update included plant-specific data for component failure rates and maintenance distributions. This also includes the external hazards analysis updates made for the IPEEE Report (September 1992).

SSPSS-1996 – The SSPSS was updated to reflect the plant configuration at the end of Cycle 4 (January 1996). This update included plant-specific data for initiating events, component failure rates, and maintenance distributions. Model enhancements were made to support on-line maintenance assessments. The plant model was expanded to include realistic operating/standby alignments of components. The system model was expanded to include additional components (e.g., 480V MCCs).

SSPSS-1999 – The current SSPSS has been updated to reflect the plant configuration at the end of Cycle 6 (March 1999). This update included plant-specific data for initiating events, component failure rates, and maintenance distributions. The ATWS analysis was revised to account for the return to an 18-month fuel cycle length, as well as new generic failure rate data. The general transient event tree was modified to explicitly model the size of a reactor coolant pump seal loss of coolant accident (LOCA) and its impact on recovery of primary component cooling, emergency diesel generators, and offsite power.

The North Atlantic Energy Services Corporation (NAESCO) has used the SSPSS for plant applications such as MOV risk ranking and the Maintenance Rule, and has also developed an on-line risk monitor (EOOS) model based on the SSPSS, to support plant operation and maintenance activities. Major model updates will continue to occur approximately every two operating cycles with minor model updates occurring on a continuing basis.

A Westinghouse Owners Group (WOG) Peer Review of the SSPSS was performed in October of 1999. This review was performed on the SSPSS-1999 model update used in the RI-ISI assessment. The WOG Peer Review graded the SSPSS and concluded that it is adequate to support regulatory applications when combined with deterministic insights.

Innovations in the SSPSS were also cited in the WOG Peer Review, which states, "The Seabrook PSS was, at the time it was prepared, a significant PRA milestone, and includes a full level 3 risk assessment. NAESCO has retained much of the capability of the original study in the current models, and routinely calculates CDF and LERF contributions from both internal and external events, which provides a more complete risk profile than is currently available for most plants. The implementation of the "branch everywhere" large event tree logic produces modeling flexibility while providing informative accident sequence information".

2. PROPOSED ALTERNATIVE TO CURRENT ISI PROGRAM REQUIREMENTS

2.1 ASME Section XI

ASME Section XI Examination Categories B-F and B-J currently contain the requirements for the nondestructive examination (NDE) of 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 currently approved program for Class 1 piping (Examination Categories B-F and B-J) 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

No augmented programs were affected by the RI-ISI application on Class 1 piping at the Seabrook Station.

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 the Seabrook Station. 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 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 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 facing lines, significant top-to-bottomΔTs can develop in horizontal sections within about 25 pipe diameters, and the conditions can potentially be cyclic. For an upward or horizontal facing branch line connected to the hot fluid source, natural convective effects will fill the line with hot water. In the absence of in-leakage towards the hot fluid source, this will result in a well-mixed fluid condition where significant top-to-bottom ΔTs will not occur. 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. 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 can occur outward past a valve into a line with 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.

- **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.

These additional considerations for determining the potential for thermal fatigue as a result of the effects of TASCS were applied in the failure potential assessment for the Seabrook Station. This constitutes a deviation from the requirements of EPRI TR-112657 since the methodology does not presently provide any allowance for the consideration of cycle severity in assessing the potential for TASCS effects. For the reasons discussed above, this approach is considered technically justifiable. Furthermore, EPRI concurs with this position and intends to address this issue in a future revision to the methodology.

3.1 Scope of Program

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

Table 3.3-1 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 (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 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 Seabrook Station, the percentage of Class 1 welds selected for examination per the RI-ISI process is 9.5%, which is not a significant departure from 10%.

One additional factor that was considered during the evaluation was that the overall percentage of Class 1 selections included both socket and non-socket welds. Therefore, the percentage of Class 1 selections was 9.5% when both socket and non-socket piping welds were considered. This percentage increases to 10.3% when considering only those piping welds that are non-socket welded. It should be noted that non-socket welds are subject to volumetric examination, so this percentage does not rely upon welds that are solely subject to a VT-2 visual examination.

A brief summary is provided below, and the results of the selection process are presented in Table 3.5-1.

Totals	Description
760(1)	Class 1 Piping Welds
72	RI-ISI Program Selections

Notes

1. Includes all non-exempt Examination Category B-F and B-J locations. 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 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.

3.5.2 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.

At this time, the RI-ISI examination locations that have been selected provide >90% coverage in accordance with the Code of record for the First ISI Interval. In instances where locations may be 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 Seabrook Station relief requests are being withdrawn due to the RI-ISI application.

3.6 Risk Impact Assessment

The RI-ISI program evaluation 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.

Seabrook 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 (3E-03) and CLERP (6E-05), 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 ASME Section XI Code 1995 Edition through 1996 Addenda program requirements and identifies on a per system basis each applicable risk category. It should be noted that no degradation mechanisms (e.g., FAC) managed by augmented inspection programs exist in the scope of this Class 1 piping application for Seabrook. As such, no adjustments were required in the performance of the quantitative analysis to account for the impact of augmented inspection program managed degradation mechanisms on the risk ranking.

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.

System(1)	$\Delta Risk_{CDF}$		$\Delta Risk_{LERF}$	
	w/ POD	w/o POD	w/ POD	w/o POD
RC	-3.78E-09	3.54E-09	-7.56E-11	7.08E-11
CS	-6.00E-09	-3.36E-09	-1.22E-10	-6.79E-11
SI	-1.30E-09	2.65E-10	-2.83E-11	3.70E-12
RH	-3.75E-10	5.85E-10	-7.50E-12	1.17E-11
Total	**-1.15E-08**	**1.04E-09**	**-2.33E-10**	**1.83E-11**

Note

1. Systems are described in Table 3.1-1.

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 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 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 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 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. EPRI is currently working within the industry to develop guidelines for reviewing and updating risk-informed programs that have been generated per EPRI TR-112657. Once these guidelines are available, Seabrook will review them and implement applicable criteria. In addition, significant changes may require program adjustments 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 Code 1995 Edition through 1996 Addenda 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.

The Seabrook Station is currently at the start of the first period of its second inservice inspection interval. As such, 100% of the required RI-ISI program inspections will be completed in the second interval. Examinations shall be performed during the interval such that the period examination percentage requirements of ASME Section XI, paragraph IWB-2412 are met.

6. REFERENCES/DOCUMENTATION

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 3 Piping, 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

Calculation/File No. SNPS-01Q-301, "Degradation Mechanism Evaluation for the Seabrook Nuclear Power Station – Unit 1", Revision 1, dated October 5, 2000

Calculation/File No. SNPS-01Q-302, "Consequence Evaluation for the Seabrook Nuclear Power Station – Unit 1", Revision 0, dated January 29, 2001

Calculation/File No. SNPS-01Q-303, "Seabrook Service History and Susceptibility Review", Revision 0, dated February 15, 2001

Calculation/File No. SNPS-01Q-304, "Risk Ranking for the Seabrook Nuclear Power Station", Revision 0, dated February 15, 2001

Calculation/File No. SNPS-01Q-305, "Risk Impact Analysis for Seabrook", Revision 0, dated February 15, 2001

File No. SNPS-01Q-103, Record of Conversation No. ROC-001, "Minutes of the Element Selection Meeting for the Risk-Informed ISI Project at the Seabrook Nuclear Power Station", Revision 0, dated September 13, 2000

Table 3.1-1

System Selection and Segment / Element Definition

System Description	ASME Code Class	Number of Segments	Number of Elements
RC – Reactor Coolant System	Class 1	72	331
CS – Chemical and Volume Control System	Class 1	14	76
SI – Safety Injection System	Class 1	46	229
RH – Residual Heat Removal System	Class 1	18	124
Totals		**150**	**760**

Table 3.3-1

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
RC	X	X									
CS		X									
SI	X	X	X								
RH	X										

Note

1. Systems are described in Table 3.1-1.

Table 3.4-1

Number of Segments by Risk Category With and Without Impact of FAC[1]

System(2)	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
RC			16	16			50	50			1	1	5	5
CS			3	3			4	4	2	2	1	1	4	4
SI			12	12			6	6	6	6	14	14	8	8
RH			4	4			2	2			12	12		
Total			**35**	**35**			**62**	**62**	**8**	**8**	**28**	**28**	**17**	**17**

Notes

1. The Flow Assisted Corrosion (FAC) Program is not applicable for Class 1 piping at the Seabrook Station. As such, the FAC Program has no impact on the figures shown in the table. The table format and reference to the FAC Program has been retained solely for uniformity purpose with other RI-ISI application template submittals.
2. Systems are described in Table 3.1-1.

Table 3.5-1

Number of Elements Selected for Inspection by Risk Category Excluding Impact of FAC[(1)]

System(2)	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
RC			68	17			233	28			20	0	10	0
CS			34	11			25	3	5	1	4	0	8	0
SI			16	4			21	3	18	2	134	0	40	0
RH			6	2			6	1			112	0		
Total			124	34			285	35	23	3	270	0	58	0

Notes

1. The Flow Assisted Corrosion (FAC) Program is not applicable for Class 1 piping at the Seabrook Station. As such, the FAC Program has no impact on the figures shown in the table. The reference to the FAC Program has been retained solely for uniformity purpose with other RI-ISI application template submittals.
2. Systems are described in Table 3.1-1.

Table 3.6-1

Risk Impact Analysis Results

System(1)	Category	Consequence Rank	Failure Potential		Inspections			CDF Impact(3)		LERF Impact(3)	
			DMs	Rank	Section XI(2)	RI-ISI	Delta	w/ POD	w/o POD	w/ POD	w/o POD
RC	2	High	TASCS, TT	Medium	6	6	0	-2.16E-09	no change	-4.32E-11	no change
RC	2	High	TASCS	Medium	6	4	-2	-1.08E-09	6.00E-10	-2.16E-11	1.20E-11
RC	2	High	TT	Medium	15	7	-8	-1.08E-09	2.40E-09	-2.16E-11	4.80E-11
RC	4	High	None	Low	64	28	-36	5.40E-10	5.40E-10	1.08E-11	1.08E-11
RC	6	Medium	None	Low	0	0	0	no change	no change	no change	no change
RC	7	Low	None	Low	0	0	0	no change	no change	no change	no change
RC Total								**-3.78E-09**	**3.54E-09**	**-7.56E-11**	**7.08E-11**
CS	2	High	TT	Medium	0	11	11	-5.94E-09	-3.30E-09	-1.19E-10	-6.60E-11
CS	4	High	None	Low	0	3	3	-4.50E-11	-4.50E-11	-9.00E-13	-9.00E-13
CS	5	Medium	TT	Medium	0	1	1	-1.80E-11	-1.00E-11	-1.80E-12	-1.00E-12
CS	6	Low	TT	Medium	0	0	0	no change	no change	no change	no change
CS	7	Low	None	Low	0	0	0	no change	no change	no change	no change
CS Total								**-6.00E-09**	**-3.36E-09**	**-1.22E-10**	**-6.79E-11**
SI	2	High	TASCS, TT	Medium	0	2	2	-1.08E-09	-6.00E-10	-2.16E-11	-1.20E-11
SI	2	High	TT	Medium	5	2	-3	-1.80E-10	9.00E-10	-3.60E-12	1.80E-11
SI	4	High	None	Low	2	3	1	-1.50E-11	-1.50E-11	-3.00E-13	-3.00E-13
SI	5	Medium	TT, IGSCC	Medium	0	1	1	-1.80E-11	-1.00E-11	-1.80E-12	-1.00E-12
SI	5	Medium	IGSCC	Medium	0	1	1	-1.00E-11	-1.00E-11	-1.00E-12	-1.00E-12
SI	6	Medium	None	Low	12	0	-12	negligible	negligible	negligible	negligible
SI	7	Low	None	Low	0	0	0	no change	no change	no change	no change
SI Total								**-1.30E-09**	**2.65E-10**	**-2.83E-11**	**3.70E-12**

Table 3.6-1

Risk Impact Analysis Results

System[1]	Category	Consequence Rank	Failure Potential		Inspections			CDF Impact[3]		LERF Impact[3]	
			DMs	Rank	Section XI[2]	RI-ISI	Delta	w/ POD	w/o POD	w/ POD	w/o POD
RH	2	High	TASCS	Medium	4	2	-2	-3.60E-10	6.00E-10	-7.20E-12	1.20E-11
RH	4	High	None	Low	0	1	1	-1.50E-11	-1.50E-11	-3.00E-13	-3.00E-13
RH	6	Medium	None	Low	28	0	-28	negligible	negligible	negligible	negligible
RH Total								**-3.75E-10**	**5.85E-10**	**-7.50E-12**	**1.17E-11**
Grand Total								**-1.15E-08**	**1.04E-09**	**-2.33E-10**	**1.83E-11**

Notes

1. Systems are described in Table 3.1-1.
2. Only those ASME Section XI Code inspection locations that received a volumetric examination in addition to a surface examination are included in this count. Inspection locations previously subjected to a surface examination only are not considered in accordance with Section 3.7.1 of EPRI TR-112657.
3. 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. Hence, the word “negligible” is given in these cases in lieu of values for CDF and LERF Impact. In those cases where no inspections were being performed previously via Section XI, and none are planned for RI-ISI purposes, “no change” is listed instead of “negligible”.

Table 5-1

Inspection Location Selection Comparison Between ASME Section XI Code, 1995 Edition through 1996 Addenda and EPRI TR-112657 by Risk Region

System[1]	Code Category[2]	High Risk Region					Medium Risk Region					Low Risk Region				
		Weld Count	ASME Section XI		EPRI TR-112657		Weld Count	ASME Section XI		EPRI TR-112657		Weld Count	ASME Section XI		EPRI TR-112657	
			Vol/Sur	Sur Only	RI-ISI	Other[3]		Vol/Sur	Sur Only	RI-ISI	Other[3]		Vol/Sur	Sur Only	RI-ISI	Other[3]
RC	B-F	2	2	0	0		20	20	0	4						
	B-J	66	25	2	17		213	44	32	24		30	0	10	0	
CS	B-J	34	0	5	11		30	0	8	4		12	0	2	0	
SI	B-J	16	5	2	4		39	2	4	5		174	12	30	0	
RH	B-J	6	4	0	2		6	0	0	1		112	28	0	0	
Total	B-F	2	2	0	0		20	20	0	4						
	B-J	122	34	9	34		288	46	44	34		328	40	42	0	

Notes

1. Systems are described in Table 3.1-1.
2. The ASME Code Category is based on the 1995 Edition through 1996 Addenda of the ASME Section XI Code.
3. The column labeled "Other" is generally used to identify augmented inspection program locations that are credited beyond those locations selected per the RI-ISI process, as addressed in Section 3.6.5 of EPRI TR-112657. This option was not applicable for the Seabrook Station RI-ISI application. The "Other" column has been retained in this table solely for uniformity purposes with other RI-ISI application template submittals.

Table 5-2

Inspection Location Selection Comparison Between ASME Section XI Code, 1995 Edition through 1996 Addenda and EPRI TR-112657 by Risk Category

System(1)	Risk		Consequence Rank	Failure Potential		Code Category	Weld Count	ASME Section XI		EPRI TR-112657	
	Category	Rank		DMs	Rank			Vol/Sur	Sur Only	RI-ISI	Other(2)
RC	2	High	High	TASCS, TT	Medium	B-J	15	6	0	6	
RC	2	High	High	TASCS	Medium	B-J	16	6	0	4	
RC	2	High	High	TT	Medium	B-F	2	2	0	0	
						B-J	35	13	2	7	
RC	4	Medium	High	None	Low	B-F	20	20	0	4	
						B-J	213	44	32	24	
RC	6	Low	Medium	None	Low	B-J	20	0	9	0	
RC	7	Low	Low	None	Low	B-J	10	0	1	0	
CS	2	High	High	TT	Medium	B-J	34	0	5	11	
CS	4	Medium	High	None	Low	B-J	25	0	6	3	
CS	5	Medium	Medium	TT	Medium	B-J	5	0	2	1	
CS	6	Low	Low	TT	Medium	B-J	4	0	2	0	
CS	7	Low	Low	None	Low	B-J	8	0	0	0	
SI	2	High	High	TASCS, TT	Medium	B-J	8	0	2	2	
SI	2	High	High	TT	Medium	B-J	8	5	0	2	
SI	4	Medium	High	None	Low	B-J	21	2	4	3	
SI	5	Medium	Medium	TT, IGSCC	Medium	B-J	12	0	0	1	
SI	5	Medium	Medium	IGSCC	Medium	B-J	6	0	0	1	
SI	6	Low	Medium	None	Low	B-J	134	12	18	0	
SI	7	Low	Low	None	Low	B-J	40	0	12	0	

Table 5-2

Inspection Location Selection Comparison Between ASME Section XI Code, 1995 Edition through 1996 Addenda and EPRI TR-112657 by Risk Category

System	Risk		Consequence Rank	Failure Potential		Code Category	Weld Count	ASME Section XI		EPRI TR-112657	
	Category	Rank		DMs	Rank			Vol/Sur	Sur Only	RI-ISI	Other(2)
RH	2	High	High	TASCS	Medium	B-J	6	4	0	2	
RH	4	Medium	High	None	Low	B-J	6	0	0	1	
RH	6	Low	Medium	None	Low	B-J	112	28	0	0	

Notes

1. Systems are described in Table 3.1-1.
2. The column labeled "Other" is generally used to identify augmented inspection program locations that are credited beyond those locations selected per the RI-ISI process, as addressed in Section 3.6.5 of EPRI TR-112657. This option was not applicable for the Seabrook Station RI-ISI application. The "Other" column has been retained in this table solely for uniformity purposes with other RI-ISI application template submittals.