Niagara Mohawk

October 16, 2000
NMP2L 1990

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

RE: Nine Mile Point Unit 2
Docket No. 50-410
NPF-69

Subject: ***Request for Authorization to Use Risk-Informed Inservice Inspection Alternative***

Gentlemen:

By the attached request, Niagara Mohawk Power Corporation (NMPC) proposes to use a risk-informed inservice inspection (RI-ISI) program as an alternative to the current requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code for Class 1 and 2 piping at Nine Mile Point Unit 2 (NMP2). The NMP2 RI-ISI program was developed in accordance with the Electric Power Research Institute (EPRI) methodology contained in the NRC-approved EPRI report EPRI-TR 112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Revision B-A and ASME Code Case N-578, "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B Section XI Division 1." The attached request for use of the RI-ISI program has been developed using the Nuclear Energy Institute template submittal format. Supporting documentation is available for review at the plant site.

By letter dated December 14, 1999, the Staff authorized use of Relief Request RR-RI-ISI-1, which allowed NMP2 not to perform certain examinations during Refueling Outage 7 needed to meet Code minimum period percentage requirements. In that letter, the Staff also acknowledged NMPC's plans to submit the NMP2 RI-ISI program for review by October 1, 2000. The revision to NMPC's plans resulting in the delay to the RI-ISI submittal has been previously discussed with the Staff's Project Manager for NMP.

NMPC believes that the proposed risk-informed inservice inspection program provides an acceptable level of quality and safety. Therefore, NMPC requests NRC authorization of the proposed alternative pursuant to 10CFR50.55a(a)(3)(i), to support the operation of NMP2 for the remainder of the second ten-year and all subsequent ISI intervals. The authorization is requested by May 1, 2001, to support planning efforts for the next NMP2 refueling outage.

Very truly yours,

Richard B. Abbott
Vice President Nuclear Engineering

A047

RBA/JJD/kap
Attachment

xc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Ms. M. K. Gamberoni, Section Chief PD-I, Section 1, NRR
Mr. G. K. Hunegs, NRC Senior Resident Inspector
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ATTACHMENT

Risk-Informed Inservice Inspection

Program Plan - Nine Mile Point Unit 2

RR-RI-ISI-2

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1 Introduction

Inservice inspection (ISI) is currently performed on piping to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 1989 Edition (no addendum) as required by 10CFR50.55a. Nine Mile Point Unit 2 (NMP2) is currently in the second inspection interval as defined by ASME Section XI, Program B which ends on April 4, 2008.

1.1 Relation to NRC Regulatory Guide 1.174

The objective of this submittal is to request a change to the ISI program plan for piping through the use of a risk-informed inservice inspection (RI-ISI) program. The risk-informed process used in this submittal is described in the Electric Power Research Institute (EPRI) Topical Report (TR) 112657 Rev. B-A titled "Revised Risk-Informed Inservice Inspection Evaluation Procedure" (Reference 1). This report is referred to as the EPRI TR henceforth.

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" (Reference 2), and Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking Inservice Inspection of Piping" (Reference 3).

1.2 Probabilistic Risk Assessment Quality

The NMP2 Level II Probabilistic Risk Assessment (PRA) model (Reference 4) was used to evaluate the consequences of pipe ruptures during operation. The base core damage frequency (CDF) and base large early release frequency (LERF) from this version of the PRA model are 5.4E-5/yr and 1.5E-6/yr, respectively. The PRA is a consolidation of the Individual Plant Examination (IPE) and Individual Plant Examination External Events (IPEEE) conducted at NMP2. Both of these evaluations received independent and peer reviews per Generic Letter 88-20 and its supporting guidance.

The IPE has undergone the Boiling Water Reactor Owners Group certification process. The certification review results were documented and considered during the PRA update. The items identified from this review were associated with improving guidance, documentation, the clean up of crediting procedures not in place, and pre-initiator human reliability. Overall, the certification provided high technical marks on the PRA and there were no comments that significantly impacted the PRA results.

NRC reviews provide another level of assessment, as documented in the NRC Staff Evaluations on IPE dated August 18, 1994 (TAC No. M74437) and IPEEE dated August 12, 1998 (TAC No. M83646). The NRC concluded that NMPC's process is capable of identifying the most likely severe accidents and no significant impacts on the PRA were identified.

2 Proposed Alternative to Current Inservice Inspection Programs

2.1 ASME Section XI

ASME Section XI Categories B-F, B-J, C-F-1, and C-F-2 currently contain the requirements for examination of piping components via nondestructive examination (NDE). The current program is limited to ASME Class 1 and Class 2 piping systems. The alternative RI-ISI program for piping is described in the EPRI TR. 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. Non-related portions of the ASME Section XI Code will be unaffected by the RI-ISI program. The EPRI TR 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

Niagara Mohawk Power Corporation (NMPC), together with the BWR Vessel & Internals Project and EPRI are investigating operating experience and material performances with respect to the BWR fleet and intergranular stress corrosion cracking (IGSCC) issues. As consistence with the EPRI TR Category A, Generic Letter 88-01 (NUREG-0313, Rev 2) welds are integrated into the RI-ISI program. As such, our response to Generic Letter 88-01 and its supplement remains unchanged for Category B through G at this time. Another augmented inspection program, Generic Letter 89-08 – Flow Accelerated Corrosion Program (FAC), is credited in the RI-ISI program but is not affected or changed by the RI-ISI program. Any other existing augmented inspection programs are unaffected by this submittal.

3 Risk-Informed ISI Process

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

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

There were no deviations to the process described in the EPRI TR.

3.1 Scope of Program

The systems included in the RI-ISI program are provided in Table 3.1-1. 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 the 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.

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.

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, risk segments are then defined as 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.

The results of these calculations are presented in Table 3.4-1.

3.5 Element and NDE Selection

In general, the EPRI TR requires 25% of the locations in the high risk regions (i.e., risk categories 1, 2 & 3) and 10% of the locations in the medium risk regions (i.e., risk categories 4 & 5) be selected for inspection and appropriate NDE examination methods. Each of the locations is tailored to the applicable degradation mechanism defined for ASME Code Case N-578 applications. In accordance with Section 3.6.4.2 of the ERPI TR, a review of Class 1 RI-ISI selections was made to ensure that the revised inspection percentage was not significantly reduced below 10 percent of the Class 1 piping population. The results of this review indicate that NMP2's RI-ISI program will be inspecting greater than 10 percent of Class 1 piping systems. The results of the selection are presented in Table 3.5-1.

Section 4 of the EPRI TR 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 NMP2 pressure test program, which remains unaffected by the RI-ISI program.

3.6 Additional Examinations

The RI-ISI program will determine, through an engineering evaluation, the root cause of any unacceptable flaw determined to be service-related (e.g., 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 requiring examinations on the segment or segments initially. 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.

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, 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 provide >90% 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 the EPRI TR will be followed.

Approved NMP2 relief requests for the current interval are identified in a letter dated March 3, 2000, Gamberoni to Mueller, "Nine Mile Point Nuclear Station, Unit No. 2 – Reliefs for the Second 10-Year Inservice Inspection Program Plan, Revision 1 (TAC No. MA6273)," with enclosure of a Safety Evaluation. The specific relief requests in this letter pertaining to the piping systems related to RI-ISI, which are no longer required, are identified below:

RR-IWB-6 - One (1) pressure-retaining weld 2RCS-64-00-SW035, partially inaccessible for a complete surface exam due to interference by a pipe rupture restraint. Weld 2RCS-64-00-SW035 is listed as a Category B-J ASME Class 1 component.

RR-IWC-2 - Twenty (20) pressure retaining welds in austenitic stainless steel piping:

2CSH-25-05-FW012, 013, 014 and 015
2CSH-26-01-FW026, 027, 028, and 035
2RHS-66-13-FW023, 024, 025 and 029
2RHS-66-22-FW021, 022, 023 and 029
2RHS-66-23-FW018, 019, 020 and 022

All welds listed above are Category C-F-1 ASME Class 2 components.

RR-IWC-5 - Twenty-six (26) welds in six Code Categories, subdivided into 3 parts for clarity:

(1) Category C-A examinations (part 1)
(1) Category C-B examinations (part 1)
(3) Category C-C examinations (part 2)
(1) Category C-F-1 examinations (part 2)
(20) Category C-G examinations (part 3)

Note: Only one weld, RHS-66-22-FW019 in part 2, is a Category C-F-1 ASME Class 2 piping weld that pertains to this subject.

All other relief requests remain applicable as they are addressed in the safety evaluation mentioned above.

3.8 Change in Risk

The RI-ISI program has been conducted in accordance with Regulatory Guide 1.174 and the risk from implementation of this program is neutral or decreases 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 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 modification of 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. As an 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.

Two types of evaluations have been conducted to support the conclusion that the NMP2 RI-ISI program results in a risk decrease or is risk neutral. Section 3.8.1 provides the qualitative evaluation while section 3.8.2 provides a quantitative evaluation.

3.8.1 Qualitative Evaluation

Table 3.8-1A presents a summary of the proposed RI-ISI program versus the current Section XI program taking into account FAC and IGSCC degradation mechanisms. The risk ranking provided in this table includes the impact of degradation mechanisms associated with and managed by these augmented inspection programs. These augmented programs have been defined in the EPRI TR as the process for effectively managing the risk associated with these piping segments, unless there is the potential for other degradation mechanism (e.g., thermal fatigue) that would not be appropriately managed by these augmented inspections and are not modified. Table 3.8-1B presents similar information, after performing the risk ranking without the impact of the FAC and IGSCC degradation mechanisms. The final inspection location selection is based upon Table 3.8-1B.

Tables 3.8-1A and 3.8-1B identify on a per system basis:

- The applicable risk category.
- The number of locations.
- The consequence rank and degradation mechanism which supports the risk category.
- The number of locations inspected by the current Section XI program.
- The number of locations proposed for the RI-ISI program, crediting where appropriate, inspections from the augmented inspection programs.
- The increase, decrease or lack of change in the number of locations inspected. This assessment does not credit inspections required by augmented inspection programs unless these inspections are also credited in the Section XI program.
- The number of locations addressed (currently being evaluated) by Augmented Programs (Table 3.8-1A only).
- The number of locations currently being inspected by Augmented Programs.
- The number of locations from Augmented Programs credited in the RI-ISI program (Table 3.8-1B only).
- The risk impact (change in risk) of the RI-ISI program as compared to the Section XI program.

The final column (change in risk) of Table 3.8-1B provides a conclusion as to the impact on the overall risk for the RI-ISI program as compared to the Section XI program. The following discussion explains the terms used in this column.

For locations identified as risk category 6 or 7:

Negligible - As discussed in section 3.7.1 of the EPRI TR the impact on risk of removing inspections from risk category 6 and 7 locations is negligible. Thus, the risk impact will be "Negligible" for category 6 and 7 locations, whenever there is a reduction in the number of locations inspected.

No Change - When there is no change in the number of locations inspected (i.e., the same before, as after), the risk impact will be "No Change."

For locations identified as risk category 1, 2, 3, 4 or 5.

No Change - As with risk category 6 and 7 locations, when there is no change in the number of locations inspected (i.e., the same before, as after), the risk impact is classified as "No Change." This will be conservative when the RI-ISI program calls for a larger inspection volume with its accompanying increase in probability of detection.

Acceptable - This applies to locations that are identified as potentially susceptible to degradation mechanisms that are being addressed by other (non-Section XI) augmented inspection programs. Per the EPRI TR, the number, location and frequency of inspection is to be the same as the augmented program. These augmented inspection programs are specifically geared towards finding the mechanism of interest and are the only relevant means of managing the risk associated with these mechanisms. Random Section XI inspections are not geared toward the mechanism of interest and most likely would not identify the mechanism of interest. As such, reductions in the number of the Section XI inspections for these locations do not impact risk and thus the change in risk are acceptable.

There may be occurrences when the risk ranking shown in Table 3.8-1B requires additional inspection locations beyond the augmented inspection program (e.g., risk category 4). These inspection locations provide an additional level of defense in depth beyond the augmented inspection program.

Improvement - When there is an increase in the number of locations being inspected, there is a resultant decrease in the risk associated with piping failure. Thus, whenever the number of RI-ISI locations exceeds the number of Section XI locations inspected, "Improvement" will be found in the Risk Impact column. This conservatively does not credit the added benefit of increased inspection volumes for applicable degradation mechanisms (e.g., thermal fatigue).

Increase - When there is a decrease in the number of locations being inspected, there is the potential for a resultant increase in the risk associated with piping failure. Thus, for locations not managed by an augmented inspection program, when the number of Section XI locations exceeds the number of RI-ISI locations inspected, "Increase" will be found in the Risk Impact column.

Because locations that are identified as "Improvement," "Acceptable," "Negligible" or "No Change" do not adversely impact the change in risk assessment, only those systems in Table 3.8-1B with a potential "Increase" need to be evaluated quantitatively. The quantitative results of these evaluations are provided in the next section.

3.8.2 Quantitative Evaluation

As discussed above, the RI-ISI program at NMP2 has been developed in accordance with Regulatory Guide 1.174 and the EPRI TR methodology requirements. The risk from implementation of this program has remained risk neutral or decreased when compared to that estimated for current requirements.

Limits are imposed by the EPRI TR methodology to ensure that the change in risk of implementing the RI-ISI program meets the requirements of Regulatory Guide 1.174. The quantitative criteria established in the EPRI TR require that the cumulative change in CDF and LERF be less than 1E-7 and 1E-8 per year per system, respectively or 1E-6 and 1E-7 per year total for all systems (complete RI-ISI Program).

NMPC conducted a risk impact analysis per the requirements of Section 3.7 of the EPRI TR. 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 conducted using the "Simplified Risk Quantification Method" described in Section 3.7.2 of the EPRI TR. The conditional core damage probability and conditional large, early release probability used is based on the consequence analysis results (Reference 6). The likelihood of pressure boundary failure (PBF) is determined by the presence of different degradation mechanisms. The basic likelihood of PBF for a piping location with no degradation mechanism present is noted as x_0, and is expected to have a value lower than 1E-8. Piping locations identified as medium failure potential (i.e., potentially susceptible to thermal fatigue, erosion corrosion, or cavitation corrosion) have a likelihood of $20x_0$. The likelihood of these failures is consistent with References 9 and 14 of Reference 1.

The analysis results are summarized in Tables 3.8-2A and 2B.

The results show that implementation of the RI-ISI program at NMP2 leads to a decrease in the total core damage frequency when crediting an improved probability of detection (POD). Even without crediting an improved POD the results are consistent with Reference 1 CDF and LERF acceptance criteria.

3.8.3 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 referenced in Section 2.3 of the EPRI TR and depicted in the Summary of the ASME White Paper 92-01-01 Rev. 1, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds" (Reference 9), this method has been ineffective in identifying leaks or failures. The EPRI TR 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; a determination of each location's susceptibility to degradation and 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. Second, 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 less reliable equipment.

As a result of the above process, the main reduction in the number of inspections occurs in low risk categories. 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 ASME Section XI, regardless of their risk classification.

3.8.4 Summary

In summary, the NMP2 RI-ISI application credits, where appropriate, existing augmented inspection programs while defining new, additional inspections for those locations potentially susceptible to degradation that are not currently being addressed by the Section XI Inspection Program.

The impact on risk of the NMP2 RI-ISI application has been assessed qualitatively and quantitatively. In each case, the above evaluations demonstrate that unacceptable risk impacts will not occur, and thus implementation of the RI-ISI program satisfies the acceptance criteria of Regulatory Guide 1.174 and the EPRI methodology requirements.

4 Implementation and Monitoring Program

Upon approval of the RI-ISI program, procedures that comply with the guidelines described in the EPRI TR will be prepared to implement and monitor the program. The new program will be integrated into the existing and subsequent ASME Section XI intervals. No changes to the Updated Safety Analysis Report or Technical Specifications are necessary for program implementation.

The applicable aspects of the current ASME Section XI program 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 implementing procedures will be 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. Evaluate
    (1) determine the cause and extent of the condition identified
    (2) 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 safety significant piping locations. As a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME Section XI period basis. In addition, significant changes may require more frequent adjustment as identified by NRC Bulletin, Generic Letter, or by industry and plant specific feedback. Changes will be reflected, as appropriate, in the future 10-Year program plan submittals as required by IWA-1400(c).

5 Proposed Inservice Inspection Program Plan 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 current plant augmented programs is also included in Table 5-1.

The initial RI-ISI program will be implemented in the inspection period current at the time of program approval. The RI-ISI program requires 125 weld inspections over the ten year interval. The first inspection period of the second interval ends on April 4, 2001, for NMP2. During the first period, 63 of 407 weld inspections (15%* of the original ASME Section XI piping scope) were completed. A total of 26 of the 63 weld inspections examined in the first period are now part of the RI-ISI program, which equals 20% of the 125 RI-ISI required weld inspections. NMP2 has scheduled the remaining 99 RI-ISI weld inspections (125 – 26) for completion, as mentioned above, by the end of the second interval. By doing this, 100% of the RI-ISI components selected will have been examined by the end of the interval either by Section XI or by RI-ISI requirements. NMP2 plans to examine 30 – 45% of the RI-ISI scope in the second period. This equals 50 – 65% for the interval when adding the 20% from the first period. The remaining inspections are to be conducted in the third period. Succeeding intervals will include 100% of the required risk-informed inspection program with period percentages in accordance with ASME Code requirements. The table below summarizes this discussion for the second interval.

Table of Percentages for Piping Components

2nd Interval	1st Period	2nd Period	3rd Period
Requirements	16 – 34%	50 – 67%	100%
Proposed	20%/Sec. XI	30 – 45% of RI-ISI	45 – 30% of RI-ISI
Completion	20%	50 – 65%	100%

* Relief Request RR-RI-ISI-1 allows NMP2 to complete less than the16% requirement in the first period while the RI-ISI program was being developed.

6 References/Documentation

1. Electric Power Research Institute Topical Report-112657 Rev. B-A titled "Revised Risk-Informed Inservice Inspection Evaluation Procedure"
2. Regulatory Guide 1.174, July 1998, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis"
3. Regulatory Guide 1.178, July 1998, "An Approach for Plant-Specific Risk-Informed Decisionmaking Inservice Inspection of Piping"
4. NMP2 PRA, July 1999 (Model U2PRA98)
5. NER-2A-010, Rev. 0 "NMP2 RI-ISI Degradation Evaluation"
6. NER-2A-009, Rev. 0 "NMP2 RI-ISI Consequence Evaluation"
7. NER-2A-017, Rev. 0 "NMP2 RI-ISI Service History Review"
8. NER-2A-018, Rev. 0 "NMP2 RI-ISI Risk Ranking, Element Selection & Delta Risk"
9. Summary of the ASME White Paper 92-01-01 Rev. 1, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds"

Table 3.1-1 Scope and Number of Welds			
System ID	System Description	Number of Welds	ASME Class
ASS	Auxiliary Steam	4	2
CSH	High Pressure Core Spray	185	1, 2
CSL	Low Pressure Core Spray	136	1, 2
DER	Drain connection to WCS	3	2
FWS	Feedwater	101	1 *
ICS	RCIC	277	1, 2
ISC	Instrumentation	19	1, 2
MSS	Main Steam	340	1, 2
RCS	Reactor Coolant	106	1
RDS	CRD	78	1, 2
RHS	RHR & LPCI A, B & C	988	1, 2
RPV	Reactor Vessel Nozzle	34	1
SLS	Standby Liquid Control	50	1
WCS	Reactor Water Cleanup	161	1 **
-	Total	2482	-

RCIC = Reactor Core Isolation Cooling System
CRD = Control Rod Drives System
RHR = Residual Heat Removal System
LPCI = Low Pressure Coolant Injection Function of RHR
* Two Class 4 welds included from Break Exclusion Region
** Four Class 3 welds included from Break Exclusion Region

Table 3.3-1 Failure Potential Assessment Summary

System[1]	Thermal Fatigue		Stress Corrosion Cracking				Local Corrosion			Flow Sensitive	
	TT	TASCS	IGSCC	TGSCC	ECSCC	PWSCC	MIC	Pitting	CC	EC	FAC
ASS											
CSH		X									
CSL		X									
DER		X									
FWS		X							X		X
ICS	X	X									
ISC		X									
MSS		X									
RCS			X								
RDS									X		
RHS		X								X	X
RPV			X						X		
SLS		X									
WCS		X	X								X

Notes: 1 - Systems are described in Table 3.1-1

TT – Thermal Transient
TASCS – Thermal Stripping, Cycling and Stratification
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
Pitting – Pitting
CC – Crevice Corrosion Cracking
EC – Cavitation
FAC – Flow Accelerated Corrosion

Table 3.4-1 Number of Segments by Risk Category Including FAC and IGSCC

System[1]	Risk Category 1[2]	Risk Category 2	Risk Category 3[2]	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
ASS	0	0	0	0	0	1	0
CSH	0	1	0	2	0	5	1
CSL	0	1	0	2	0	4	1
DER	0	1	0	0	0	0	1
FWS	1	2	0	2	10	4	0
ICS	0	1	0	6	1	10	1
ISC	0	1	0	1	1	2	0
MSS	0	0	0	5	1	12	1
RCS	0	1	0	2	0	0	0
RDS	0	1	0	1	0	1	0
RHS	0	5	5	14	14	23	13
RPV	0	15	0	2	0	1	0
SLS	0	1	0	1	1	1	0
WCS	2	3	2	4	1	2	1
TOTAL	3	33	7	42	29	66	19

Notes: 1 – Systems are described in Table 3.1-1

2 – The welds in these segments are adjusted for element selection into other risk categories consistent with methodology.

Table 3.5-1 Number of Locations/Inspections by Risk Category Without FAC and IGSCC

System[1]	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.
ASS	0	0	0	0	0	0	0	0	0	0	4	0	0	0
CSH	0	0	11	3	0	0	6	1	0	0	164	0	4	0
CSL	0	0	8	2	0	0	10	1	0	0	114	0	4	0
DER	0	0	1	1	0	0	0	0	0	0	0	0	2	0
FWS	0	0	31	8	0	0	47	5	17	2	6	0	0	0
ICS	0	0	9	3	0	0	41	5	3	1	223	0	1	0
ISC	0	0	3	1	0	0	2	1	3	1	11	0	0	0
MSS	0	0	0	0	0	0	84	9	10	1	238	0	8	0
RCS	0	0	0	0	0	0	106	11	0	0	0	0	0	0
RDS	0	0	1	1	0	0	1	1	0	0	76	0	0	0
RHS	0	0	26	7	0	0	77	8	225	23	556	0	104	0
RPV	0	0	21	6	0	0	12	2	0	0	1	0	0	0
SLS	0	0	3	1	0	0	14	2	7	1	26	0	0	0
WCS	0	0	18	5	0	0	89	9	29	3	17	0	8	0

Note: 1 – Systems are described in Table 3.1-1

Pop. – Population, the number of welds in a particular risk category after augmented program adjustments.
Insp. – Inspected, the number of welds selected for inspection.

Table 3.8-1A Risk Categories With FAC and IGSCC

System[1]	Risk Category[2]	Consequence Rank	Degradation Mechanism	Number of Locations	Locations Inspected[3]		Delta Inspections	Augmented Locations[4]	Augmented Inspections[5]	Change in Risk
					SXI	RI-ISI				
ASS	6	Medium	None	4	1	0	-1			Negligible
CSH	2	High	TASCS	11	3	3	0			No Change
	4	High	None	6	3	1	-2			Increase
	6	Medium	None	164	13	0	-13			Negligible
	7	Low	None	4	0	0	0			No Change
CSL	2	High	TASCS	8	3	2	-1			Increase
	4	High	None	10	4	1	-3			Increase
	6	Medium	None	114	8	0	-8			Negligible
	7	Low	None	4	0	0	0			No Change
DER	2	High	TASCS	1	1	1	0			No Change
	7	Low	None	2	0	0	0			No Change
FWS	1	High	FAC	4	0	0	0	4 FAC	4 FAC	Acceptable
	2	High	TASCS	31	10	8	-2			Increase
	4	High	None	43	2	5	+3			Improvement
	5	Medium	CC	2	0	1	+1			Improvement
	5	Medium	TASCS	11	6	1	-5			Increase
	5	Medium	TASCS, CC	4	0	0	0			No Change
	6	Medium	None	6	4	0	-4			Negligible
ICS	2	High	TT, TASCS	9	4	3	-1			Increase
	4	High	None	41	9	5	-4			Increase
	5	Medium	TT, TASCS	3	0	1	+1			Improvement
	6	Medium	None	223	13	0	-13			Negligible
	7	Low	None	1	0	0	0			No Change
ISC	2	High	TASCS	3	1	1	0			No Change
	4	High	None	2	1	1	0			No Change
	5	Medium	TASCS	3	0	1	+1			Improvement
	6	Medium	None	11	10	0	-10			Negligible
MSS	4	High	None	84	44	9	-35			Increase
	5	Medium	TASCS	10	2	1	-1			Increase
	6	Medium	None	238	49	0	-49			Negligible
	7	Low	None	8	1	0	-1			Negligible
RCS	2	High	IGSCC	1	0	1	+1	1 IGSCC-D	1 IGSCC-D	Improvement
	4	High	None	105	26	10	-16			Increase
RDS	2	High	CC	1	0	1	+1			Improvement
	4	High	None	1	1	1	0			No Change
	6	Medium	None	76	6	0	-6			Negligible

Table 3.8-1A Risk Categories With FAC and IGSCC

System[1]	Risk Category[2]	Consequence Rank	Degradation Mechanism	Number of Locations	Locations Inspected[3]		Delta Inspections	Augmented Locations[4]	Augmented Inspections[5]	Change in Risk
					SXI	RI-ISI				
RHS	2	High	EC	4	2	1	-1			Increase
	2	High	TASCS	22	9	6	-3			Increase
	3	Medium	FAC	3	0	0	0	3 FAC	3 FAC	Acceptable
	3	Medium	TASCS, FAC	17	0	0	0	17 FAC	17 FAC	No Change
	4	High	None	77	33	8	-25			Increase
	5	Medium	TASCS	208	20	23	+3			Improvement
	6	Low	TASCS	16	0	0	0			No Change
	6	Medium	None	537	40	0	-40			Negligible
	7	Low	None	104	9	0	-9			Negligible
RPV	2	High	CC, IGSCC	21	21	6	-15	20 IGSCC-D 1 IGSCC-E	20 IGSCC-D 1 IGSCC-E	Increase
	2	High	IGSCC	9	9	2	-7	8 IGSCC-D 1 IGSCC-E	8 IGSCC-D 1 IGSCC-E	Acceptable
	4	High	None	3	3	0	-3			Increase
	6	Medium	None	1	0	0	0			No Change
SLS	2	High	TASCS	3	2	1	-1			Increase
	4	High	None	14	1	2	+1			Improvement
	5	Medium	TASCS	7	2	1	-1			Increase
	6	Medium	None	26	1	0	-1			Negligible
WCS	1	High	FAC	4	1	0	-1	4 FAC	4 FAC	Acceptable
	2	High	TASCS	10	2	0	-2			Increase
	2	High	TASCS, IGSCC	8	0	5	+5	8 IGSCC-D	8 IGSCC-D	Improvement
	2	High	IGSCC	10	4	5	+1	10 IGSCC-D	10 IGSCC-D	Improvement
	3	Medium	TASCS, FAC	4	3	0	-3	4 FAC	4 FAC	Increase
	3	Medium	FAC	2	0	0	0	2 FAC	2 FAC	No Change
	4	High	None	75	4	4	0			No Change
	5	Medium	TASCS	25	12	3	-9			Increase
	6	Medium	None	15	4	0	-4			Negligible
	7	Low	None	8	0	0	0			No Change

1. Systems are described in Table 3.1-1
2. Risk ranking includes impact of all degradation mechanism (e.g. FAC and IGSCC)
3. Excludes surface examinations.
4. Included in programs to address FAC and IGSCC, as appropriate.
5. The IGSCC program requirements have been: 100% of category "D" and "E" every 2 refueling cycles. The FAC programs locations are evaluated to determine susceptibility and inspection locations, frequency is based on wear predictions and pervious inspection results.

Table 3.8-1B Risk Categories Without FAC and IGSCC

System[1]	Risk Category[2]	Consequence Rank	Degradation Mechanism	Number of Locations	Locations Inspected[3]		Delta Inspections	Augmented Inspections[4]	Augmented Credit in RI-ISI[5]	Change in Risk
					SXI	RI-ISI				
ASS	6	Medium	None	4	1	0	-1			Negligible
CSH	2	High	TASCS	11	3	3	0			No Change
	4	High	None	6	3	1	-2			Increase
	6	Medium	None	164	13	0	-13			Negligible
	7	Low	None	4	0	0	0			No Change
CSL	2	High	TASCS	8	3	2	-1			Increase
	4	High	None	10	4	1	-3			Increase
	6	Medium	None	114	8	0	-8			Negligible
	7	Low	None	4	0	0	0			No Change
DER	2	High	TASCS	1	1	1	0			No Change
	7	Low	None	2	0	0	0			No Change
FWS	2	High	TASCS	31	10	8	-2			Increase
	4	High	FAC	4	0	0	0	4 FAC	1	No Change
	4	High	None	43	2	5	+3			Improvement
	5	Medium	CC	2	0	1	+1			Improvement
	5	Medium	TASCS	11	6	1	-5			Increase
	5	Medium	TASCS, CC	4	0	0	0			No Change
	6	Medium	None	6	4	0	-4			Negligible
ICS	2	High	TT, TASCS	9	4	3	-1			Increase
	4	High	None	41	9	5	-4			Increase
	5	Medium	TT, TASCS	3	0	1	+1			Improvement
	6	Medium	None	223	13	0	-13			Negligible
	7	Low	None	1	0	0	0			No Change
ISC	2	High	TASCS	3	1	1	0			No Change
	4	High	None	2	1	1	0			No Change
	5	Medium	TASCS	3	0	1	+1			Improvement
	6	Medium	None	11	10	0	-10			Negligible
MSS	4	High	None	84	44	9	-35			Increase
	5	Medium	TASCS	10	2	1	-1			Increase
	6	Medium	None	238	49	0	-49			Negligible
	7	Low	None	8	1	0	-1			Negligible
RCS	4	High	IGSCC	1	0	1	+1	1 IGSCC-D	1 IGSCC-D	Improvement
	4	High	None	105	26	10	-16			Increase
RDS	2	High	CC	1	0	1	+1			Improvement
	4	High	None	1	1	1	0			No Change
	6	Medium	None	76	6	0	-6			Negligible

Table 3.8-1B Risk Categories Without FAC and IGSCC

System[1]	Risk Category[2]	Consequence Rank	Degradation Mechanism	Number of Locations	Locations Inspected[3]		Delta Inspections	Augmented Inspections[4]	Augmented Credit in RI-ISI[5]	Change in Risk
					SXI	RI-ISI				
RHS	2	High	EC	4	2	1	-1			Increase
	2	High	TASCS	22	9	6	-3			Increase
	4	High	None	77	33	8	-25			Increase
	5[6]	Medium	TASCS, FAC	17	0	0	0	17 FAC		No Change
	5	Medium	TASCS	208	20	23	+3			Improvement
	6	Medium	FAC	3	0	0	0	3 FAC		No Change
	6	Low	TASCS	16	0	0	0			No Change
	6	Medium	None	537	40	0	-40			Negligible
	7	Low	None	104	9	0	-9			Negligible
RPV	2	High	CC, IGSCC	21	21	6	-15	20 IGSCC-D 1 IGSCC-E	5 IGSCC-D 1 IGSCC-E	Increase
	4	High	None	3	3	0	-3			Increase
	4	High	IGSCC	9	9	2	-7	8 IGSCC-D 1 IGSCC-E	1 IGSCC-D 1 IGSCC-E	Acceptable
	6	Medium	None	1	0	0	0			No Change
SLS	2	High	TASCS	3	2	1	-1			Increase
	4	High	None	14	1	2	+1			Improvement
	5	Medium	TASCS	7	2	1	-1			Increase
	6	Medium	None	26	1	0	-1			Negligible
WCS	2	High	TASCS	10	2	0	-2			Increase
	2	High	TASCS, IGSCC	8	0	5	+5	8 IGSCC-D	5 IGSCC-D	Improvement
	4	High	IGSCC	10	4	5	+1	10 IGSCC-D	5 IGSCC-D	Improvement
	4	High	FAC	4	1	0	-1	4 FAC	1	Acceptable
	4	High	None	75	4	4	0			No Change
	5[6]	Medium	TASCS, FAC	4	3	0	-3	4 FAC		Increase
	5	Medium	TASCS	25	12	3	-9			Increase
	6	Medium	FAC	2	0	0	0	2 FAC		No Change
	6	Medium	None	15	4	0	-4			Negligible
	7	Low	None	8	0	0	0			No Change

1. Systems are described in Table 3.1-1
2. Risk ranking includes impact of all degradation mechanism (e.g. FAC and IGSCC)
3. Excludes surface examinations.
4. Included in programs to address FAC and IGSCC, as appropriate.
5. The IGSCC program requirements has been 100% of category "D" and "E" every 2 refueling cycles. For the FAC program locations are evaluated to determine susceptibility and inspection locations, frequency is based on wear predictions and pervious inspection results.
6. Risk Category 5 ranking is based on TASCS. Removal of TASCS would result in risk Category 6 with no inspections.

Table 3.8-2A – Risk Impact Results with POD Credit							
System	Risk Category	Consequence	Degradation Mechanisms	Inspected Section XI	Inspected RI-ISI	Delta Risk (1/yr) CDF	Delta Risk (1/yr) LERF
CSH – HPCS	2	High	TASCS	3	3	-1.1E-09	-7.2E-12
	4	High	None	3	1	4.5E-12	4.0E-12
Total						**-1.1E-09**	**-3.2E-12**
CSL – LPCS	2	High	TASCS	3	2	-4.3E-11	-9.0E-13
	4	High	None	4	1	4.4E-11	4.4E-11
Total						**1.2E-12**	**4.4E-11**
DER – Drywell Drain	2	High	TASCS	0	1	**-4.1E-11**	**-9.0E-13**
FWS – Feedwater	2	High	TASCS	10	8	-1.9E-10	-4.2E-12
	4	High	None	2	5	-3.5E-12	-7.5E-14
	5	Medium	TASCS	6	1	1.7E-12	1.3E-13
			TASCS,CC	0	0	0	0
			CC	0	1	-1.0E-12	-4.0E-14
Total						**-2.0E-10**	**-4.2E-12**
ICS – RCIC	2	High	TT, TASCS	4	3	-6.9E-11	-1.5E-12
	4	High	None	9	5	1.2E-11	5.7E-12
	5	Medium	TT, TASCS	0	1	-2.4E-11	-9.0E-13
Total						**-8.3E-11**	**3.3E-12**
ISC – Instrumentation	2	High	TASCS	0	1	-4.1E-11	-9.0E-13
	4	High	None	0	1	-1.2E-12	-2.5E-14
	5	Medium	TASCS	0	1	-2.2E-12	-7.2E-13
Total						**-4.5E-11**	**-1.6E-12**
MSS – Main Steam	4	High	None	44	9	4.0E-11	8.8E-13
	5	Medium	TASCS	0	1	-2.2E-12	-7.2E-13
Total						**3.8E-11**	**1.6E-13**
RCS – Reactor Recirc.	4	High	None	26	10	**1.8E-11**	**4.0E-13**
RDS – CRD	2	High	CC	0	1	-2.3E-11	-5.0E-13
	4	High	None	0	1	-1.2E-12	-2.5E-14
Total						**-2.4E-11**	**-5.3E-13**
RHS – RHR	2	High	TASCS	9	6	-1.3E-10	-2.7E-12
			EC	2	1	8.8E-11	8.8E-11
	4	High	None	33	8	2.0E-10	1.8E-10
	5	Medium	TASCS	20	23	-1.5E-10	-6.3E-12
Total						**1.0E-11**	**2.6E-10**
RPV – Vessel Nozzle to pipe	2	High	CC	21	6	6.3E-10	9.0E-12
	4	High	None	2	0	2.3E-12	5.0E-14
Total						**6.3E-10**	**9.1E-12**
SLS – SLC	2	High	TASCS	0	1	-4.1E-11	-9.0E-13
	4	High	None	0	2	-8.8E-12	-8.8E-12
	5	Medium	TASCS	0	1	-2.2E-12	-7.3E-13
Total						**-5.2E-11**	**-1.0E-11**
WCS – RWCU	2	High	TASCS	0	5	-2.1E-10	-4.5E-12
	4	High	None	4	4	1.0E-11	1.0E-11
	5	Medium	TASCS	12	3	1.8E-12	7.2E-14
			TASCS,FAC	3	0	1.8E-12	7.2E-14
Total						**-1.9E-10**	**5.6E-12**
Overall Change in Risk						**-1.0E-09**	**3.0E-10**

Table 3.8-2B – Risk Impact Results without POD Credit							
System	Risk Category	Consequence	Degradation Mechanisms	Inspected Section XI	Inspected RI-ISI	Delta Risk (1/yr) CDF	Delta Risk (1/yr) LERF
CSH – HPCS	2	High	TASCS	3	3	0.0	0.0
	4	High	None	3	1	4.5E-12	4.0E-12
Total						**4.5E-12**	**4.0E-12**
CSL – LPCS	2	High	TASCS	3	2	2.4E-11	5.0E-13
	4	High	None	4	1	4.4E-11	4.4E-11
Total						**6.8E-11**	**4.5E-11**
DER – Drywell Drain	2	High	TASCS	0	1	**-2.3E-11**	**-5.0E-13**
FWS – Feedwater	2	High	TASCS	10	8	4.6E-11	1.0E-12
	4	High	None	2	5	-3.5E-12	-7.5E-14
	5	Medium	TASCS	6	1	4.8E-12	3.0E-13
			TASCS,CC	0	0	0	0
			CC	0	1	-1.0E-12	-4.0E-14
Total						**4.6E-11**	**1.2E-12**
ICS – RCIC	2	High	TT, TASCS	4	3	2.3E-11	5.0E-13
	4	High	None	9	5	1.2E-11	5.7E-12
	5	Medium	TT, TASCS	0	1	-1.4E-11	-5.0E-13
Total						**2.1E-11**	**5.7E-12**
ISC – Instrumentation	2	High	TASCS	0	1	-2.3E-11	-5.0E-13
	4	High	None	0	1	-1.2E-12	-2.5E-14
	5	Medium	TASCS	0	1	-1.2E-12	-4.0E-13
Total						**-2.5E-11**	**-9.3E-13**
MSS – Main Steam	4	High	None	44	9	4.0E-11	8.8E-13
	5	Medium	TASCS	0	1	-1.2E-12	-4.0E-13
Total						**3.9E-11**	**4.8E-13**
RCS – Reactor Recirc.	4	High	None	26	10	**1.8E-11**	**4.0E-13**
RDS – CRD	2	High	CC	0	1	-2.3E-11	-5.0E-13
	4	High	None	0	1	-1.2E-12	-2.5E-14
Total						**-2.4E-11**	**-5.3E-13**
RHS – RHR	2	High	TASCS	9	6	7.2E-11	1.5E-12
			EC	2	1	8.8E-11	8.8E-11
	4	High	None	33	8	2.0E-10	1.8E-10
	5	Medium	TASCS	20	23	-1.9E-11	-5.0E-14
Total						**3.4E-10**	**2.7E-10**
RPV – Vessel Nozzle to pipe	2	High	CC	21	6	6.3E-10	9.0E-12
	4	High	None	2	0	2.3E-12	5.0E-14
Total						**6.3E-10**	**9.1E-12**
SLS – SLC	2	High	TASCS	0	1	-2.3E-11	-5.0E-13
	4	High	None	0	2	-8.8E-12	-8.8E-12
	5	Medium	TASCS	0	1	-1.2E-12	-4.0E-13
Total						**-3.3E-11**	**-9.7E-12**
WCS – RWCU	2	High	TASCS	0	5	-1.2E-10	-2.5E-12
	4	High	None	4	4	1.0E-11	1.0E-11
	5	Medium	TASCS	12	3	9.0E-12	3.6E-13
			TASCS,FAC	3	0	3.0E-12	1.2E-13
Total						**-9.3E-11**	**8.0E-12**
Overall Change in Risk						**9.7E-10**	**3.3E-10**

Table 5-1 Comparison of ASME XI Requirements

System[1]	Number of High/Medium Risk Region Segments[2]	RI-ISI Inspection Locations				ASME Section XI 1989 Edition Examination Requirements				Number of H/M Segments Credited in Augmented Programs[3]
		Class 1	Class 2	Class 3	NNS	B-F	B-J	C-F-1	C-F-2	
ASS	0/0	0	0	0	0	0	0	0	1	0
CSH	1/2	4	0	0	0	0	5	2	12	0
CSL	1/2	2	1	0	0	0	5	2	8	0
DER	1/0	1	0	0	0	0	1	0	0	0
FWS	3/12	15	0	0	0	0	22	0	0	2
ICS	1/7	6	3	0	0	0	13	0	13	0
ISC	1/2	3	0	0	0	10	2	0	0	0
MSS	0/6	10	0	0	0	0	91	0	5	0
RCS	1/2	11	0	0	0	0	26	0	0	1
RDS	1/1	2	0	0	0	0	1	0	6	0
RHS	10/28	11	27	0	0	0	37	13	63	5
RPV	15/2	8	0	0	0	33	0	0	0	15
SLS	1/2	4	0	0	0	0	6	0	0	0
WCS	7/5	17	0	0	0	0	30	0	0	6
TOTAL	43/71	94	31	0	0	43	239	17	108	29

1. Systems are described in Table 3.1-1
2. High Risk = Categories 1, 2 and 3
   Medium Risk = Categories 4 and 5
   Ranking includes impact of all degradation mechanisms (e.g., FAC, IGSCC, TASCS, etc.)
3. Includes programs to address Generic Letter 89-08 (FAC) and Generic Letter 88-01 (IGSCC in BWRs)