



Risk & Performance Initiatives

NRC / EPRI Meeting

Sept 25, 2003



Agenda

- Risk-informed / Safety-based Classification & Treatment (RIS_B)
- Partial Examination Coverage
- Code Case N663
- Discussion on Existing RI-ISI Applications
- Action Items



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EPRI

RIS_B Classification & Treatment

- EPRI TR-112657 and WCAP-14572 approved by USNRC
- EPRI RI-ISI methodology embodied in N560 and N578
- Westinghouse RI-ISI methodology embodied in N577
- Code cases and methodologies integrate classification and treatment requirements



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EPRI

RIS_B Classification & Treatment

- Number of high safety significant (HSS) locations added by plant review
 - VY = zero BWR-N560
 - ANO-1 = zero B&W-N560
 - ANO-2 = zero CE – N578 (fullscope)
 - Fitzpatrick = zero BWR – N578 (fullscope)
 - South Texas 1 & 2 = zero West – N560
- Number of HSS locations added by NRC review
 - VY = zero
 - ANO-1 = zero
 - ANO-2 = zero
 - Fitzpatrick = zero
 - South Texas 1 & 2 = zero



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EPRI

RIS_B Classification & Treatment

Status of RI-ISI Applications (USA)

- Submittals *
 - Total 69
 - N560/N578 49
 - N577 20

- Approved
 - Total 52
 - N560/N578 39
 - N577 13



(*) ~ one half are Class 1 only scope

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EPRI

RIS_B Classification & Treatment

RI- Break Exclusion Requirements (BER/HELB)

- Methodology integrates classification and treatment requirements (EPRI TR-1006937)
- Submitted, Feb 2001
- Approved, June 2002
- NRC Review
 - No Changes RI-BER methodology
 - No Changes to Plant-specific results
 - Implementation via 50.59 procedure



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RIS_B Classification & Treatment

Recent Experiences

– Results of USNRC Review

- Plant A – 70 locations added,
- Plant B – 40 locations added,
- Plant C – 40 locations added,
- Plant D – 17 locations added
- Plant E – 13 locations added



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RIS_B Classification & Treatment

Recent Experiences (cont.)

– RI-ISI Program Updates

- PRA model updates
- Physical plant changes (e.g. power uprate, S/G replacement)
- 400 to 800 mnhrs per period
- Plant-specific results
 - No change in inspection program
 - Segments moved from Low to High/Medium
 - Segments moved from High to Low



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RIS_B Classification & Treatment

ASME Code Cases N660 & N662

- Developed to support USNRC/Industry Option 2 efforts
- Decoupled classification (N660) from treatment (N662)
- N660 founded upon N560/N578 classification criteria, minus failure potential
- Conservative classification scheme due to time constraints and lack of information (e.g. failure probability)
- Costs associated with implementation (e.g.
 - determining classification
 - inconsistent application (e.g. RI-ISI experience)
 - inconsistent application (e.g. NRC review, RAIs, etc.)
 - living program updates
- Burden reduction limited due to:
 - excess conservatisms (e.g. Class 3 systems, "other considerations") – discussion to follow
 - lack of integration between classification and treatment



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RIS_B Classification & Treatment

Summary

- Some applications approved with no changes required
- Some applications are pushing the envelope (i.e. risk-based versus risk-informed)
- Some applications are experiencing difficulty in gaining USNRC approval (e.g. numerous RAIs, re-analysis, changes to program, etc.)
- Costs associated with program updates
- Updates may challenge initial program selections
- Integrating classification and treatment increases success likelihood



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RIS_B Classification & Treatment

- GOAL: Develop a consistent, coherent, generic and integrated set of classification and treatment requirements.
 - Provides a reasonable and balanced approach to classification and treatment requirements
 - Reduces licensee/NRC resource burden
 - Increases consistency of plant specific applications
 - Increases robustness of plant specific applications
 - Provides consistent treatment for Break Exclusion Region (BER/HELB) piping

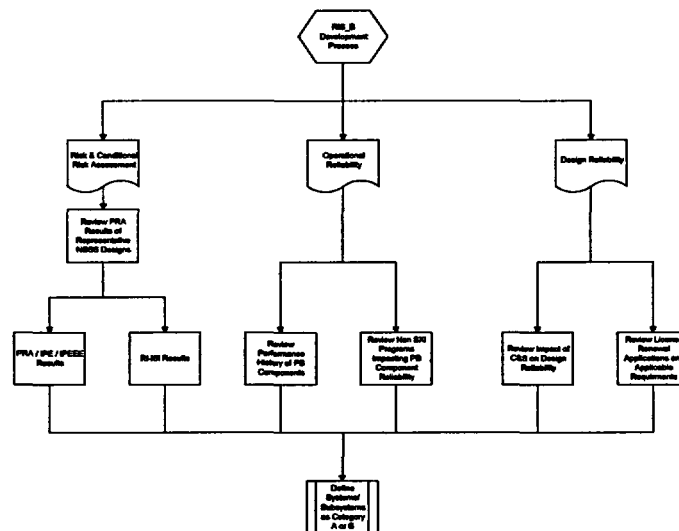


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RIS_B Classification & Treatment

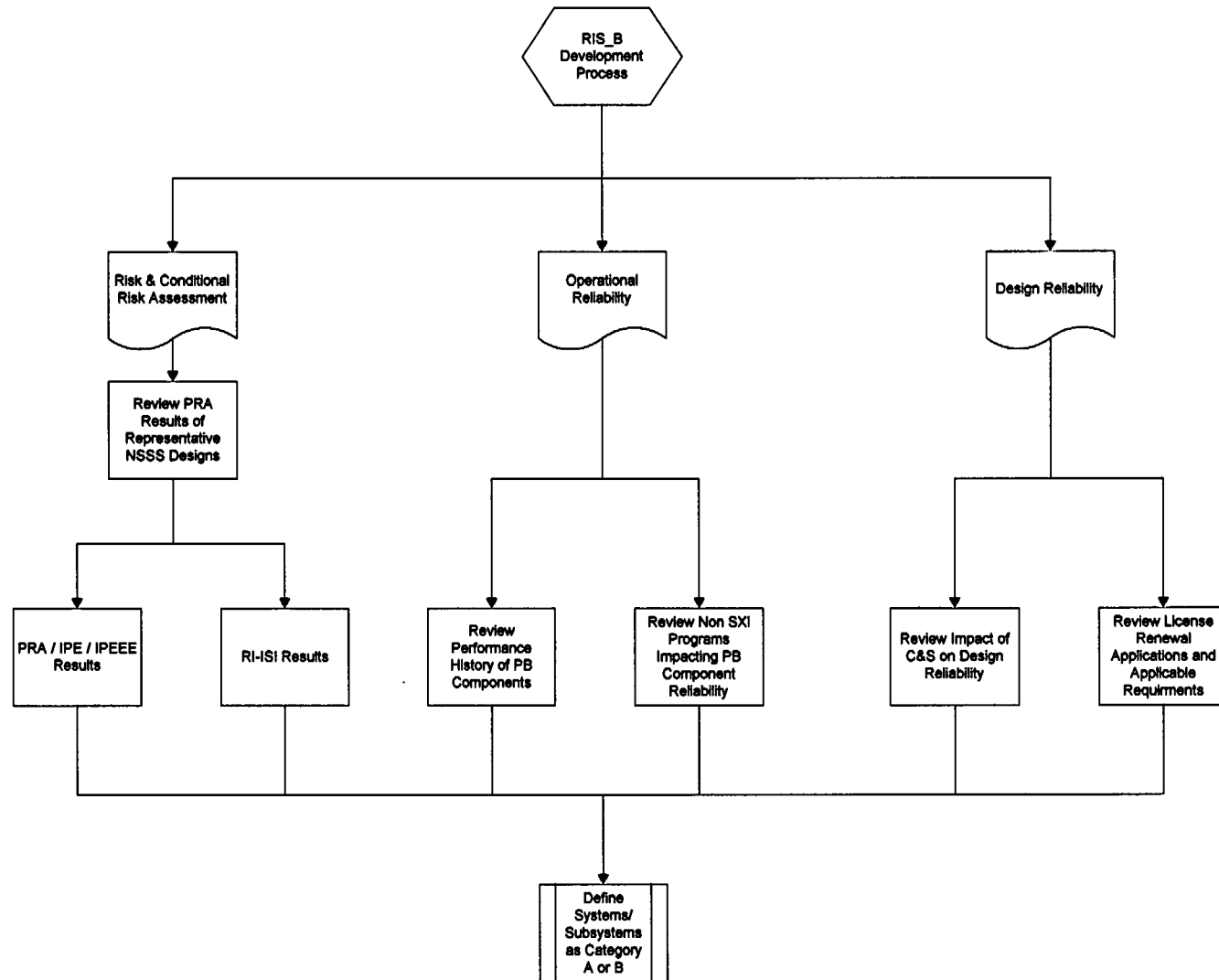


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EPRI

RIS_B Classification & Treatment



RIS_B Classification & Treatment

- ASME Whitepaper 2002-02-01
 - Reviewed over fifty plant-specific RI-ISI applications,
 - Thirty, of which, were Class 1 & 2 or fullscope applications
 - Reviewed a number of industry and USNRC risk assessments
- Action integrates risk assessment, treatment, change control and operating experience requirements into a stable and effective pressure boundary integrity management program



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RIS_B Classification & Treatment

Classification Criteria (safety-based / risk-informed)

- Category A
 - Reactor Coolant Pressure Boundary (e.g. Class 1)
 - Shutdown Decay Heat Removal (out to containment isolation)
 - Break Exclusion Region (BER)
 - Main Feedwater from S/Gs to BER
- Category B
 - Remaining items (i.e.
 - other Class 2,
 - all Class 3,
 - all NNS



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RIS_B Classification & Treatment

Treatment Criteria (PSI/ISI)

- Category A
 - NDE population equal to 10%, plus augmented programs
 - NDE locations generally selected based upon postulated susceptibility to degradation mechanisms
 - pressure/leakage testing continues
 - may use existing RI-ISI program, if available
- Category B
 - NDE per augmented programs (e.g. FAC, LC, IGSCC)
 - pressure/leakage testing continues



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RIS_B Classification & Treatment

Treatment Criteria (RRM)

- Category A
 - No change to existing RRM requirements
- Category B
 - Reduced requirements, essentially N662



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RIS_B Classification & Treatment

Additional Requirements

- Risk Assessment per Generic Letter 88-20,
- Augmented inspection programs per Generic Letters 88-01, 89-08 & 89-13,
- Operating experience review program per NUREG-0737,
- Change control program per 10CFR50.59



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RIS_B Classification & Treatment

- Risk Assessment per Generic Letter 88-20
 - Plant specific vulnerability assessment,
 - Avoids typical PRA issues (e.g. conservatisms, relative risk ranking, integration, truncation, HRA, etc.)
- Augmented inspection programs per Generic Letters 88-01, 89-08 & 89-13,
- Operating experience review program per NUREG-0737,
- Change control program per 10CFR50.59



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RIS_B Classification & Treatment

- Whitepaper updated to include discussion/clarification on:
 - Shutdown cooling function
 - “Additional Considerations”
 - Safety margin
 - Defense in depth
 - Use of PRA



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RIS_B Classification & Treatment

- Assessment of the viability of N660
 - Conducted N660 evaluation at three units
 - Service water system at a BWR
 - Service water system at a PWR
 - Independent assessment of a service water system at a second BWR
 - see handout



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RIS_B Classification & Treatment

- Comparison of SXI, RI-ISI and RIS_B for a number of units:
 - Four Units using EPRI RI-ISI methodology
 - Two PWRs (West and CE)
 - Two BWRs (GE)
 - Two Units (or more) using West. RI-ISI methodology
 - PWR(s)
 - BWR(s)
 - Change in risk impact (CDF):
 - conservatively estimated at <3E-08 per unit
 - no credit for increased requirements



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EPRI

PWR-1

System	Code Class	Number of Elements	Traditional SXI	RI-ISI	RISB	AUG
			Number of Inspections	Number of Inspections	Number of Inspections	
RCS	1	307	95	37	31	
HPSI	1	246	64	15	25	
HPSI	2	869	66	0	0	
CVCS	1	114	27	13	12	
CVCS	2	70	0	0	0	
CSS	2	374	21	4	0	
LPSI	1	24	8	3	3	
LPSI	2	350	25	19	6	
EFW	2	93	0	3	0	
EFW	3	476	0	0	0	
MFW	2	65	12	6	7	F
MS	2	124	15	0	5	F
MS	3	68	0	0	0	F
Totals		3180	333	100	89	



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EPRI

PWR-2

System	Code Class	Number of Elements	Traditional SXI	RI-ISI	RISB	AUG
			Number of Inspections	Number of Inspections	Number of Inspections	
CVCS	1	104	27	10	11	
CVCS	2	305	23	0	0	
EF	2	8	3	2	0	
FW	2	74	8	1	8	F
MS	2	143	14	0	11	F
RCS	1	260	96	39	26	
RHR	1	26	4	5	3	
RHR	2	275	15	4	5	
SI	1	369	106	23	37	
SI	2	456	56	9	0	
SP (CBS)	2	247	12	1	0	
SW	2	35	5	0	0	M
Totals		2302	369	94	101	



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EPRI

BWR-1

System	Code Class	Number of Elements	Traditional SXI	RI-ISI	RISB	AUG
			Number of Inspections	Number of Inspections	Number of Inspections	
CRD	2	54	5	0	0	
CS	1	57	16	1	6	I
CS	2	152	11	1	0	
ESW *	3	42	0	1	0	M
FW	1	81	27	8	9	F
FPC	3	30	0	0	0	
HPCI	1	30	8	4	3	
HPCI	2	173	9	2	0	
HPCI	3	9	0	0	0	
MS	1	144	34	7	15	F
RCIC	1	65	7	5	7	
RCIC	2	7	0	0	0	
RCIC	3	30	0	0	0	
RWCU	1	36	8	2	4	I
RWR *	1	142	43	1	15	I
RHR	1	65	18	3	7	I
RHR	2	622	48	5	9	
RHR	3	1	0	0	0	
RHRSW *	3	37	0	0	0	M
Totals		1777	234	40	75	



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BWR-2

System	Code Class	Number of Elements	Traditional SXI	RI-ISI	RISB	AUG
			Number of Inspections	Number of Inspections	Number of Inspections	
ASS	2	4	1	0	0	F
HPCS	1	21	5	4	3	
HPCS	2	163	14	0	0	
LPSC	1	18	5	2	2	
LPSC	2	117	10	1	0	
DER	2	3	1	1	0	
FW	1	101	22	15	11	F
RCIC	1	66	13	6	7	
RCIC	2	209	13	3	0	
MS	1	247	91	10	25	F
MS	2	91	5	0	1	F
RCS	1	106	26	11	11	I
CRD	1	2	1	2	1	
CRD	2	74	6	0	0	
RHR	1	163	37	11	17	I
RHR	2	824	80	5	2	
RPV	1	34	33	8	4	I
SLC	1	50	6	4	5	
RWCU	1	157	30	17	16	I
RWCU	3	4	0	0	0	
Totals		2454	399	100	105	



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RIS_B Classification & Treatment

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 - Four Units using EPRI RI-ISI methodology
 - Two PWRs (West and CE)
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 - PWR(s)
 - BWR(s)
 - Change in risk impact (CDF):
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 - no credit for increased requirements



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RIS_B Classification & Treatment

Expectations

- Existing RI-ISI plants will transition to this action
 - cost of implementation less than RI-ISI update requirements
 - half of RI-ISI plants applied RI-ISI to Class 1 only
 - Stability of process
 - additional benefit from RRM application
- Traditional ISI plants will implement this action
 - cost-effective implementation
 - significant dose reduction,
 - Stability of process
 - additional benefit from RRM application



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RIS_B Classification & Treatment

Schedule

- WGIRBE: letter ballot prior to 12/03 Mtg
- SGWCS: ballot after WGIRBE approval
- In parallel with SGWCS ballot:
 - Review and Comment ballot by:
 - SCXI
 - Main Committee
 - BNCS
- NRC input



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Partial Examination Coverage

- RI and traditional Section XI examinations obtaining <90% coverage require a relief request
- Alternative process:
 - Select other locations (i.e. > 90%) where allowed, physically possible and desirable,
 - Review basis for inspection location selection (e.g. type of degradation, severity of degradation),
 - Can be used both pre- and post- inspection,
 - Expect to eliminate many low value-added relief requests



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Partial Examination Coverage

- RI and traditional Section XI examinations obtaining <90% coverage require a relief request (cont.)
- Alternative process:
 - Some piping components still require relief request
 - All non-piping component reduced coverage examinations still require relief request
 - Provides technical basis for acceptable coverage
 - Improvement of existing relief request process



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Partial Examination Coverage

- Partial Exam Whitepaper
 - Provides a process for accepting partial coverage,
 - Provides guidance for use of the process
 - Provides basis for when partial coverage is acceptable (i.e. no relief request required),
 - Identifies situations that still require a relief request,



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Partial Examination Coverage

- Section XI Status
 - Letter balloted March, 2003 (WGIRBE),
 - Five ballots "approve with comments"
 - Editorial, or
 - Whitepaper clarifications
 - Two negatives
 - Presentations to
 - TG ISI Optimization
 - WG ISC
 - New letter ballot issued prior to August mtg (WGIRBE & WG-ISC)



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Partial Examination Coverage

- Section XI Status, cont.
 - August, 2003 Meeting
 - Passed WGIRBE
 - Passed WGISC
 - Presentation made to Subgroup Water Cooled Systems (SGWCS)
 - Letter Ballot to SGWCS Shortly
 - Clean-up of editorial comments
 - Additional NRC Feedback



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EPRI

Code Case N663

- Alternative Surface Examination Requirements
- Approved By ASME Board of Nuclear Codes & Standards (9-17-02)
- Applicable to:
 - Class 1 piping: ≥ 4 inch NPS
 - Class 2 piping: all pipe sizes
- Near term - Relief to be requested via 10CFR50.55a(a)(3)(i)
- Longer term – Adoption in Reg Guide 1.147



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Code Case N663

- **Pilot Plant Application**

- Entergy took lead in submitting a request for alternative to use Code Case N-663
- Request submitted, December 2002
- Staff SE issued, August 2003



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Code Case N663

- **Follow-on Applications**

- Similar to RI-ISI templates submittals
- Any lessons learned
- Updates to future applications
 - Relief request format
 - Relief request content



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Existing Applications

- Status, Process, Feedback
 - RI-ISI Template Submittals
 - Additional Lessons Learned
 - Update to Incoming Submittals?



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Agenda

- Action Items



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EPRI

LETTER BALLOT COMMENT FORM

COMMITTEE: WG / RI

SUBMITTED BY: Syed A. Ali

DATE: 4/1/03

LETTER BALLOT # RI 02-02 SUBJECT: Proposed Code Case for Alternate Requirements for Risk-Informed Classification.

PAGE & PARAGRAPH REFERENCE	D/C	COMMENTS AND/OR RECOMMENDATIONS	DISPOSITION OF COMMENTS
	D	The Case allows 10% examination of category B-F welds. These are dissimilar welds, and are present in vessel nozzles as well as piping. In view of the problems that we are having with this type of welds we don't believe this reduction is appropriate on a generic level.	<p>It is true that there have been several occurrences of nozzle to piping cracking events in dissimilar welds. The industry response to these events is being developed by EPRI-MRP and is scheduled for late 2003/early 2004.</p> <p>This action uses the PWSCC susceptibility criteria defined in the approved RI-ISI process. EPRI has committed to update the RI-ISI methodology to reflect final disposition of PWSCC for these configurations. It is the authors' intent to update this action as well, pending final resolution of this issue.</p> <p>Given the calendar time necessary to obtain code approval, the importance of this action, and its consistency with previously approved RI-ISI process, no change is made at this time.</p>
	D	The Case permits augmented inspections to be counted up to 50% toward the total 10% sample. This is not acceptable because augmented inspection are made to address a specific problem and not to fulfill Section XI ISI requirements.	It is typical practice that when an item is required to be inspected per an augmented program and within the scope of the SXI program, one examination is conducted and it is credited towards both the augmented and SXI program.

KEY: D - SIGNIFIES NEGATIVE COMMENTS

C - SIGNIFIES COMMENTS OTHER THAN NEGATIVES

			The proposed action in some cases may actually require additional inspections beyond current practices. This is because it was felt prudent that for the above described conditions, additional examination should be conducted to provide a robust inspection program supporting defense in depth and component reliability purposes thereby providing a substantive ongoing assessment of the condition of the pressure boundary function. This approach is also consistent with the approved EPRI RI-ISI process.
	D	The Case allows the use of other codes and standards to be used for repair and replacements instead of the original construction Code or later Section III Editions as currently permitted by the regulations. This is not acceptable because of design reconciliation issues.	The treatment portion of this case is consistent with N662, which provides an ASME approved process for RI-repair/replacement practices.
	D	Steam Generator nozzles to Feedwater piping should be Category A item.	The action has been updated to require the portion of the feedwater system (> 4 NPS) from the steam generator nozzle to the outer containment isolation valve/boundary restraint to be classified as Category A. Although, the balloters only requested the nozzles to be added, it was felt to be easier from a program implementation and maintenance perspective, to add the entire run.
	C	It is not clear whether Category A scope as currently defined by the Case is inclusive of all risk important welds that need to be included in the Case.	A review of a large number of USNRC approved RI-ISI has been conducted in support of this action9pls see attached whitepaper). A further review of the remaining applications is ongoing and will be completed shortly. To date, all risk important items are included as category A or a basis for leaving them as category B items is provided. This will be updated once the review has been completed.
	C	The white paper referred to Table 4 that was not included in the package. Is the reference supposed to be Table 3 of the proposed code case?	Yes. The whitepaper has been updated to reflect the correct table numbers.

KEY: D - SIGNIFIES NEGATIVE COMMENTS

C - SIGNIFIES COMMENTS OTHER THAN NEGATIVES

	C	Table 2, Footnote (2) refers to Supplement 1 or 2. Supplements are not provided in this Code Case. Need to fix note reference.	Fixed.
	C	Table 2, Footnote (3) addresses limited examination volume. It requires the user to evaluate for acceptability. No guidance is provided to determine acceptability and only requires the user to document the bases for acceptability; it does not require review and approval by the NRC. Since no guidance is provided, NRC review and approval is warranted for limited examination coverage. (This issue is being addressed in a separate code case Action Item 01-09)	Agreed.
	D	Preservice inspections are necessary to verify acceptable installation and provide a baseline.	First, proper installation is verified by the construction code. For preservice inspection (PSI) purposes, the current requirements are 100% for Class 1, 7.5% for Class 2 and zero % for Class 3. This action maintains the Class 1 and Class 3 requirement. This action reduces PSI on Class 2, category B items but this is offset by the substantial increase in PSI requirements for Class 2, Category A items.
	C	The blending of staff approved risk-informed ISI programs with the proposed code case is unclear. The text appears to say that the approved ISI program should be continued for inspections while the other treatments would be guided by the proposed A/B categorization. If that is the intent, the text should be clearer.	Text has been updated, pls confirm its OK..
	C	The white paper seems to imply that RI-ISI inspections in category B can be counted toward the 10% in category A.	Need to update text? The intent is that if a previously approved RI-ISI application is to be used in conjunction with this action, then any category B inspections, per the approved RI-ISI program may <u>not</u> be discontinued by this action, if these inspections are credited in justifying a reduction below 10% for Class 1 piping.
	D	If there is an approved RI-ISI program, no SCC that is categorized above low-safety-significant (LSS)	This action has reviewed each approved RI-ISI application and reflected the insights from these

KEY: D - SIGNIFIES NEGATIVE COMMENTS

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		should be placed in category B. This would still not comport with the (approved?) repair/replacement code case and the approved special treatment requirement exemptions for STP because the RI-ISI categorization places more SSCs into LSS than the exemption categorization.	application and reflected the insights from these applications into the action. This includes adding items to category A (e.g. feedwater connection to steam generators) and identifying appropriate treatment for category B items (e.g. FAC and localized corrosion programs). This may be updated pending completion of the review of the remaining applications, but given the number reviewed to date, no additional changes are expected.
	D	The (approved?) repair/replacement code case and the approved special treatment requirement exemptions for STP place fewer SSCs in LSS than the RI-ISI categorization. The RI-ISI categorization experience used to support the proposed code case is therefore not directly applicable to the categorization for repair/replacement.	It is agreed that the approved RI-ISI process is not, in and of itself, sufficient for determining risk significance and more importantly treatment requirements. This action uses insights from the RI-ISI process as well as other programs outside the traditional SXI scope including IPEs, IPE-EEs, break exclusion programs, flow accelerated corrosion and localized corrosion to defined categorization and more importantly treatment requirements. See comment about plant specific PRA below.
	D	The proposed Code Case is based, in part, on proposed 10 CFR 50.69 (Risk-Informed Option 2 rulemaking) and thus pre-supposes the level of treatment which will be found to be acceptable for low risk (Category B in this Code Case) components.	The treatment aspects of this action are identical to that of N662 (RI-repair/replacement code case). These treatments assure that category B items will continue to maintain their structural integrity and thus are acceptable and appropriate for low risk components.
	D	A plant-specific PRA is necessary to appropriately categorize components for the subject applications. The proposed risk-informed Code Case does not require that a plant-specific PRA be used or maintained.	Agreed. The action has been updated to require that a plant-specific evaluation be conducted consistent with the intent of Generic Letter 88-20 and that plant changes identified by this process (i.e. the IPE) be maintained.
	D	There are already approved ASME risk-informed Code Cases to address two of the three areas addressed by this Code Case (i.e., ISI and RRM).	It is true that there are codes cases, which have not been approved by NRC, that address RI-ISI. There are also two "for trail use" cases developed for RI-repair/replacement. These code cases were developed to support industry/NRC efforts on Option 2 but were not

KEY: D - SIGNIFIES NEGATIVE COMMENTS

C - SIGNIFIES COMMENTS OTHER THAN NEGATIVES

			<p>subjected to formal technical review by ASME.</p> <p>Regardless of the above, this action is responding to the need to streamline RI technology development, application and maintenance. This action is the next logical step in cost-effective utilization of this important technology.</p>
	D	<p>Categorization can or should be used to identify candidates for reduce testing and inspections but it should not be used to totally eliminate testing or inspections (e.g., the proposed Code Case does not require any pre-service inspection for Category B items), even for components categorized as low.</p>	<p>See previous response on PSI. In addition, this action provides a more conservative inspection population as compared to traditional RI- and SXI practices. For example, a number of RI-ISI applications allow for < 10% of the RCPB to be inspected. While this action requires at least 10% be inspected. Section XI only requires 7.5% of the Class 2 portions of the feedwater, SDC and BER scope be inspected while this action requires 10% be inspected.</p> <p>The reasoning for these additional requirements is that this action is based on insights from past RI-ISI applications (from multiple methodologies) other risk insights including N660, N662, NRC approval of break exclusion regions (BER/HELB) and other PRA applications. Thus, this action provides a conservative, balanced, and integrated risk-informed (versus risk-based) process for cost-effectively assuring pressure boundary integrity.</p>
	C	<p>The proposed Code Case and associated White Paper are riddled with vagaries and editorial errors.</p>	<p>The code case and whitepaper have been updated.</p>
	C	<p>In the White Paper associated with the proposed Code Case, the responses to Additional Considerations for addressing SSCs not explicitly modeled in the plant PRA, are often identical and inadequate.</p>	<p>The whitepaper has been updated. It should be also noted that part of the basis for this action (RI-ISI evaluations) contain the exact (quantitative) analysis that would make these Additional Considerations irrelevant. That is, many of these "not modeled" components/effects are explicitly evaluated during the RI-ISI process.</p>

KEY: D - SIGNIFIES NEGATIVE COMMENTS

C - SIGNIFIES COMMENTS OTHER THAN NEGATIVES

	D	The criterion for ISI of Category B items conflicts with the proposed Pressure Testing Code Case.	The categorization portion of the proposed pressure testing code case is being withdrawn.
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KEY: D - SIGNIFIES NEGATIVE COMMENTS

C - SIGNIFIES COMMENTS OTHER THAN NEGATIVES

PWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
SW-C-01A	Service Water Pump 2P-4A Discharge		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-01B	Service Water Pump 2P-4C Discharge		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-01C	Service Water Pump 2P-4B Discharge		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-02A	Cross-tie between Service Water Pumps 2P-4A and 2P-4B		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-02B	Cross-tie between Service Water Pumps 2P-4C and 2P-4B		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-03	Cross-tie Supply to Auxiliary Cooling Water		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-04A	Service Water Supply Header #1		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-04B	Service Water Supply Header #2		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-05A	Service Water Supply Header #1		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-05B	Service Water Supply Header #2		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-06A	Service Water Supply Header #1		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-06B	Service Water Supply Header #2	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-07	Common Component Cooling Water Supply	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH

PWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
SW-C-08	Common Component Cooling Water		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-09	Common Component Cooling Water Return		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-10	Common Component Cooling Water and Auxiliary Cooling Water Return	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-11	Cooling Tower Makeup and Auxiliary Cooling Water Return		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-12A	Service Water Return Header #1	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-12B	Service Water Return Header #2	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-13-1	Common Service Water Return	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-13-2	Common Service Water Return	✓			✓		✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
SW-C-14A	Service Water Supply Header #1 to Shutdown Cooling		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-14B	Service Water Supply Header #2 to Shutdown Cooling		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-15A	Shutdown Cooling to Service Water Return Header #1		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-15B	Shutdown Cooling to Service Water Return Header #2		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH

PWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
SW-C-16A	Service Water Supply Header #1 to Containment Coolers		✓		✓		✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-16B	Service Water Supply Header #2 to Containment Coolers		✓		✓		✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-17	Service Water Supply Header #1 to Containment Coolers		✓		✓		✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-18A	Service Water Supply Header #1 to Containment Coolers		✓				✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-18B	Service Water Supply Header #2 to Containment Coolers		✓				✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-19A	Service Water Supply Header #1 to Containment Coolers			✓						✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-19B	Service Water Supply Header #2 to Containment Coolers			✓						✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-20A	Containment Coolers to Service Water Return Header #1		✓				✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-20B	Containment Coolers to Service Water Return Header #2		✓				✓	✓	✓	✓	✓	✓		✓	MIC, PIT	HIGH
SW-C-21A	Service Water Supply Header #1 to Emergency Diesel Generator "A"		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH

PWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
SW-C-21B	Service Water Supply Header #2 to Emergency Diesel Generator "B"		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-22A	Emergency Diesel Generator "A" to Service Water Return Header #1		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-22B	Emergency Diesel Generator "B" to Service Water Return Header #2		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-23A	Emergency Diesel Generator "A" to Service Water Return Header #1		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-23B	Emergency Diesel Generator "B" to Service Water Return Header #2		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-24A	Emergency Diesel Generator "A" to Service Water Return Header #1		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-24B	Emergency Diesel Generator "B" to Service Water Return Header #2		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-25A	Service Water Supply Header #1 to Fuel Pool Cooling		✓		✓		✓	✓	✓	✓		✓	✓	✓	MIC, PIT	HIGH
SW-C-25B	Service Water Supply Header #2 to Fuel Pool Cooling		✓		✓		✓	✓	✓	✓		✓	✓	✓	MIC, PIT	HIGH
SW-C-26	Common Fuel Pool Cooling to Service Water Return Headers #1 and #2		✓		✓		✓	✓	✓	✓		✓	✓	✓	MIC, PIT	HIGH

PWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
SW-C-27	Auxiliary Cooling Water to Service Water Return Headers #1 and #2		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-30A	Service Water Supply Header #1 to Emergency Feedwater Pump 2P-7B		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-30B	Service Water Supply Header #2 to Emergency Feedwater Pump 2P-7A		✓		✓		✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-31	Service Water Suction from Emergency Cooling Pond	✓					✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
SW-C-32	Service Water Return to Emergency Cooling Pond			✓						✓		✓		✓	MIC, PIT	HIGH

BWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
ESW-C-01A_1	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01A_2	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01A_3	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01A_4	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-01A_5	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-01A_6	ESW Pump 2A		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-01B_1	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01B_2	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01B_3	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT, E-C	HIGH
ESW-C-01B_4	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-01B_5	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-01B_6	ESW Pump 2B		✓				✓	✓	✓	✓		✓		✓	MIC, PIT	HIGH
ESW-C-02A	EDG A & C Supply in East Cable Tunnel		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH

BWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
ESW-C-02B	EDG B & D Supply in East & West Cable Tunnel		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-03	EDG A & C Supply in EDG Pipe Chase	✓					✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-04	EDG B & D Supply in EDG C Room	✓					✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_1	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-05A_2	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-05A_3	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_4	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_5	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_6	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_7	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_8	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05A_9	EDG A & C Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH

BWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
ESW-C-05B_1	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-05B_2	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-05B_3	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_4	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_5	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_6	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_7	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_8	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-05B_9	EDG B & D Supply & Discharge		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-06A_1	EDG A & C Discharge in EDG B Room & EDG Pipe Chase	✓					✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH

BWR – Emergency Service Water System Results

Consequence Segment		RI-ISI Consequence Rank			Other Consequence Considerations ⁽¹⁾										Known Active DM	N660 Rank
ID	Description	High	Medium	Low	i	ii	iii	iv	v	vi	vii	viii	ix	x		
ESW-C-06A_2	EDG A & C Discharge in EDG B Room & EDG Pipe Chase	✓					✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-06B_1	EDG B & D Discharge in EDG Pipe Chase		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-06B_2	EDG B & D Discharge in EDG Pipe Chase		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-06B_3	EDG B & D Discharge in EDG Pipe Chase		✓				✓	✓	✓	✓		✓			MIC, PIT	HIGH
ESW-C-07A_1	EDG A & C Discharge in East cable Tunnel & Screenwell		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-07A_2	EDG A & C Discharge in East Cable Tunnel & Screenwell		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH
ESW-C-07B	EDG B & D Discharge in East Cable Tunnel & Screenwell		✓				✓	✓	✓	✓		✓			MIC, PIT, E-C	HIGH

PWR & BWR – Service Water System Results

Footnotes:

- (1) For SSCs that are not explicitly modeled in the PRA or when external event initiators or the low power and shutdown plant operating modes are not modeled, the IDP shall assess the safety significance of these SSCs by determining if:
 - (i) Failure of the SSC will significantly increase the frequency of an initiating event, including those initiating events originally screened out in the PRA. *For purposes of this evaluation, assuming a failure frequency of 1/yr, segments were checked off if the CDF would be greater than 1E-6/yr.*
 - (ii) Failure of the SSC will compromise the integrity of the reactor coolant pressure boundary. It is expected that a sufficiently robust categorization process would result in the reactor coolant pressure boundary being categorized as HSS [RISC-1].
 - (iii) Failure of the SSC will fail a safety function, including SSCs that are assumed to be inherently reliable in the PRA (e.g., piping and tanks) and those that may not be explicitly modeled (e.g., room cooling systems, and instrumentation and control systems). For example, it is expected for PWRs that a sufficiently robust categorization process would categorize high energy ASME Section III Class 2 piping of the main steam and feedwater systems as HSS or MSS.
 - (iv) The SSC supports important operator actions required to mitigate an accident, including the operator actions taken credit for in the PRA.
 - (v) Failure of the SSC will result in failure of safety significant SSCs (e.g., through spatial interactions).
 - (vi) Failure of the SSC will impact the plant's capability to reach and/or maintain safe shutdown conditions.

In addition to being safety significant (HSS/MSS) in terms of their contribution to CDF or LERF, SSCs can also be safety significant (HSS/MSS) in terms of other risk metrics or conditions. Therefore, when an SSC is not identified as safety significant (HSS/MSS) by the PRA, the IDP must establish its safety significance by determining if:

- (vii) The SSC is a part of a system that acts as a barrier to fission product release during severe accidents. It is expected that a sufficiently robust categorization process would result in fission product barriers (e.g., the containment shell or liner) being categorized as at least MSS [RISC-1].
- (viii) The SSC is depended upon in the Emergency Operating Procedures or the Severe Accident Management Guidelines.
- (ix) Failure of the SSC will result in unintentional releases of radioactive material even in the absence of severe accident conditions.
- (x) The SSC is relied upon to control or to mitigate the consequences of transients and accidents.

PWR & BWR – Service Water System Results

If any of the above ten conditions are true, the IDP should use a qualitative evaluation process to determine the impact of relaxing requirements on SSC reliability and performance. This evaluation should include identifying the functions being supported by SSC operation, the relationship between the SSC's failure modes and the functions being supported, the SSC failure modes for which the failure rate may increase, and the SSC failure modes for which detection could become more difficult. The IDP can justify low safety significance (LSS/NRS) of the SSC by demonstrating one or more of the following:

- The reclassification is consistent with the defense-in-depth philosophy (per section 2.2.3 below) and sufficient safety margin is maintained (per section 2.2.4).
- Operating experience does not indicate active failure mechanisms (e.g., for piping flow accelerated corrosion or MIC), relaxing the requirements will have minimal impact on the failure rate increase, and failures can be detected in a timely fashion.
- Relaxing the requirements will have a minimal impact on the expected onsite occupational or offsite doses from transients and accidents that do not contribute to CDF or LERF.