Appendix A

Significance Determination of Reactor Inspection Findings for At-Power Situations

I. ENTRY CONDITIONS

This SDP provides a simplified risk-informed framework to estimate the increase in core damage frequency during at-power operations due to conditions which contribute unintended risk increases caused by deficient licensee performance. Conditions which do NOT represent deficient licensee performance, as determined by the staff, are considered part of the acceptable plant normal operating risk, and are NOT candidates for SDP evaluation. The entry conditions for the plant-specific reactor safety SDP described in this Appendix are more than minor inspection findings that have an adverse effect on the Initiating Events, Mitigating Systems, and reactor coolant system aspect of the Barrier Integrity cornerstones. In addition, the inspector is referred to Inspection Manual Chapter (IMC) 0609, Appendix H, "Containment Integrity Significance Determination Process," for more than minor inspection findings that have an adverse effect on the containment aspect of the Barrier Integrity cornerstone.

Each issue should first be screened by using IMC 0612 (formerly 0610*), Appendix B, to determine whether or not the issue is a minor issue. If the issue screens as minor this SDP should not be entered.

II. APPLICABILITY

The process in this Chapter is designed to provide NRC inspectors and management with a simple probabilistic risk framework for use in identifying potentially risk-significant issues within the initiating events, mitigation systems, and barriers cornerstones. This SDP also helps facilitate communication of the basis for significance between the NRC and licensees. In addition, it identifies findings that do not warrant further NRC engagement, due to very low risk significance, when these findings are entered into the licensee's corrective action program.

III. CONCURRENT MULTIPLE EQUIPMENT OR FUNCTIONAL DEGRADATIONS

The manner in which concurrent multiple equipment or functional degradations are evaluated using the SDP is a function of their cause. If the concurrent multiple equipment or functional degradations resulted from a common cause (e.g., a single inadequate maintenance procedure that directly resulted in deficient maintenance being performed on multiple components), then a single inspection finding will be written and characterized for significance by the total increase in core damage frequency (CDF) from these degradations, for the time periods during which they existed, using a reactor safety phase 3 SDP. If multiple cornerstones were affected, the single finding will be assigned to the cornerstone which best reflects the dominant risk influences. The justification for existence of a common cause must be a stronger causal relationship than poor management or

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cross-cutting programs (e.g., an inadequate problem identification and resolution program is an inadequate basis to justify a common cause finding).

If independent causes are determined to have resulted in the multiple equipment or functional degradations, then separate inspection findings will be written and individually characterized for significance assuming none of the other independent findings existed. This is necessary to account for the probabilistic independence of the findings. Such findings that are greater than green are combined by the Action Matrix in IMC 0305, "Operating Reactor Assessment Program." However, the conditional core damage probability (CCDP) of the concurrent independent findings should be evaluated in accordance with the guidelines for initiating a Special Inspection (SI), Augmented Inspection Team (AIT), or Incident Investigation Team (IIT) in accordance with Management Directive (MD) 8.3, "NRC Incident Investigation Program." The decision to initiate such a reactive inspection should be based, in part, on a determination that further information is needed to either fully identify and characterize the licensee performance deficiencies or identify whether the issues have a common cause.

In all cases, the risk of concurrent multiple equipment or functional degradations and the staff's basis for treating these effects as either having a common cause or being independent should be documented in an inspection report or other appropriate public correspondence.

IV. NON-APPLICABILITY OF SDP FOR NRC DETERMINATION OF RISK SIGNIFICANCE OF EVENTS

The risk significance of actual reactor events caused or complicated by equipment malfunction or operator error should always be assessed by NRC risk analysts in accordance with MD 8.3, "NRC Incident Investigation Program." Although this SDP may provide useful risk insights to inspectors for event response or followup, it was not designed or intended to be used for this purpose. The risk significance of an event is characterized by the probability that the core could have been damaged at the moment of the event given all the known conditions. Conversely, the SDP estimates the increase in core damage frequency for the spectrum of all postulated initiating events over a period of time during which known equipment or functional degradation existed. Therefore, the SDP is not used for event significance evaluations.

It should be noted that the SDP is used to estimate the risk significance of licensee performance deficiencies, including those that manifest themselves during events. These performance deficiencies should be dispositioned using the SDP in the same fashion as all other performance deficiencies.

V. RELATIONSHIP TO THE RISK-INFORMED PERFORMANCE INDICATORS

The NRC Reactor Oversight Process (as defined in IMC 2515) evaluates licensee performance using a combination of Performance Indicators (PIs) and inspections.

Thresholds have been established for the PIs, which, if exceeded, may prompt additional NRC actions to focus both licensee and NRC attention toward areas in which there is a potential decline in licensee performance. The white-yellow and yellow-red thresholds for the initiating events and mitigating systems performance indicators were risk-informed using the same "scale" as the SDP described in this appendix. The green-white thresholds were set low enough to identify performance outliers. As a result, licensee performance is assessed by comparing and "adding" the contributions of both performance indicators and inspection findings in the Action Matrix.

VI. ORGANIZATION OF APPENDIX A

Attachment 1 - User Guidance for Significance Determination of Reactor Inspection Findings for At-Power Situations

Attachment 2 - Site Specific Risk-Informed Inspection Notebook Usage Rules

END

ATTACHMENT 1

User Guidance for Significance Determination of Reactor Inspection Findings for At-Power Situations

General Guidance

1. Phase 1, 2, and 3

The plant-specific reactor safety SDP described in this Appendix uses a graduated three-phase process to differentiate inspection findings on the basis of their potential risk significance. The staff's final significance determination may be based on any of these three phases.

Phase 1 - Characterization and Initial Screening of Findings:
Characterization of the finding and an initial screening of very low-significance findings for disposition by the licensee's corrective action program.

Phase 2 - Risk Significance Estimation and Justification Using the Site Specific Risk-Informed Inspection Notebook :
Plant specific estimation of the risk significance of an inspection finding and development of the basis for the determination.

Phase 3 - Risk Significance Estimation Using Any Risk Basis That Departs from the Phase 1 or 2 Process:
Any departure from the guidance provided in this Appendix for Phase 1 or Phase 2 constitutes a Phase 3 analysis. Phase 3 analysis methods will utilize appropriate PRA techniques and rely on the expertise of NRC risk analysts.

Phases 1 and 2 are intended to be accomplished by the inspection staff, with the assistance of a senior reactor analyst (SRA), where necessary. Phase 3 is intended to be performed by a SRA or risk analyst.

Inspectors should obtain licensee risk perspectives as early in the SDP process as a licensee is prepared to offer them, and to use the SDP framework to the extent possible to evaluate the adequacy of the licensee's assumptions.

2. Use of SDP Phase 1 and Phase 2 Worksheets

The Phase 1 Worksheet is generic for all plant types and is included in this Appendix. The Phase 2 Worksheets are plant-specific to account for variations in available mitigation equipment and other plant-specific attributes. The Phase 2 Worksheets, identified as Table 3.XX are provided separately from this Appendix in the site specific risk-informed inspection notebook.

The Phase 1 and 2 Worksheets are not required to be included in the inspection report. However, any finding documented in an inspection report should be given sufficient detail to allow a knowledgeable reader to reconstruct the SDP determination. This is intended to provide a clear and objective basis for the significance determination of the finding. Further guidance on inspection report documentation is provided in IMC 0612.

3. Treatment of Reactor Safety Inspection Issues Not Addressed By Phase 2 SDP Worksheets

In the event that the Phase 2 SDP Worksheets do not clearly address the inspection finding of concern (e.g., internal flooding, etc.), the probabilistic framework of the SDP should be used to characterize the significance of the finding. A Phase 3 analysis of the inspection finding should be performed by a SRA or risk analyst and the finding should be characterized consistent with the guidance of this Appendix.

Detailed Guidance

Phase 1 - Characterization and Initial Screening of Findings

Step 1.1 - Definition of the Inspection Finding and Assumed Impact

Using the Phase 1 Worksheet, state the performance deficiency and factually describe the known observations associated with the issue. Describe the assumed impact on affected plant safety functions. Do not include hypothetical conditions (e.g., single failure criteria). A bounding determination of significance may be made by assuming a worst-case condition (e.g., assume complete loss of function, even if unsupported by the facts known at that time). If a bounding determination results in greater than green, greater factual detail will be necessary to complete the SDP.

Because the purpose of the SDP is to estimate the increase in core damage frequency due to deficient licensee performance, the SDP evaluation should not include equipment unavailability due to planned maintenance and testing. The impact of this equipment not being available for mitigation purposes is included in the baseline core damage frequency for each plant.

Step 1.2 - Initial Screening of the Inspection Finding

Use the decision logic in the Phase 1 Worksheet to determine if the issue can be characterized as green without the need for more detailed analysis of potential risk increase by Phase 2. Inspectors are encouraged to evaluate findings using Phase 2 even if they screen as Green in Phase 1. Doing so helps the inspector develop plant-specific risk insights.

Phase 2 - Risk Significance Estimation and Justification Using the Site Specific Risk-Informed Inspection Notebook

The Phase 2 process incorporates the following Tables.

Plant Specific Tables found in the Site Specific Risk-informed Inspection Notebooks:

Table 1	"Categories of Initiating Events for XXX Plant" (Generic version of Table 1 is incorporated into this document for information only.)
Table 2	"Initiators and System Dependency for XXX Plant"
Table 3	"SDP Worksheets for XXX Plant"

Generic Tables located in this document to be used in conjunction with the Notebooks:

Table 4	"Risk Significance Estimation Matrix"
Table 5	"Remaining Mitigation Capability Credit"
Table 6	"Counting Rule Worksheet"

NOTE: The initial version (Revision 0) of the Site Specific Risk-Informed Inspection Notebooks are generally formatted for an alpha-numeric significance determination scheme. In order to accommodate the implementation of the counting rule, the alpha-numeric scheme was converted to a fully numeric scheme. Until all Site Specific Risk-Informed Inspection Notebooks are re-formatted for the numeric scheme (Revision 1 and later revisions), the following conversion should be performed when conducting a Phase 2 analysis.

Set A = 1, B = 2, C = 3, D = 4, E = 5, F = 6, G = 7, and H = 8.

Step 2.1 - Selection of Initiating Event Scenarios

Enter Table 2, "Initiators and System Dependency for XXX Plant," with the equipment or safety function that was assumed to be impacted by the inspection finding. Determine the initiating event worksheets that must be evaluated.

Step 2.2 - Estimation of Initiating Event Likelihood

Enter Table 1, "Categories of Initiating Events for XXX Plant," with the exposure time associated with the finding (i.e., > 30 days, between 3 and 30 days, or < 3 days). Determine the Initiating Event Likelihood (i.e., 1 through 8) for each of the initiating events identified in Step 2.1. If the finding increases the likelihood of an initiating event, increase the Initiating Event Likelihood value in accordance with the SDP usage rules located in Attachment 2. Enter the Initiating Event Likelihood value on the applicable inspection notebook worksheet.

Step 2.3 - Estimation of Remaining Mitigation Capability

NOTE: Reference the SDP usage rules located in Attachment 2 for determining the Remaining Mitigation Capability.

Step 2.3.1 For each of the inspection notebook worksheets identified in Step 2.1, determine which of the safety functions are impacted by the finding.

Step 2.3.2 Circle the sequences on each worksheet that contain one or more of the safety functions identified in Step 2.3.1. In addition, if the inspection finding increases the likelihood of an initiating event, circle all of the sequences on the worksheet for that particular initiating event.

Step 2.3.3 For each safety function impacted by the finding, evaluate the unaffected equipment. Enter Table 5, "Remaining Mitigation Capability Credit," and determine the remaining mitigation capability credit for each of these functions. The Remaining Mitigation Capability credit assigned may or may not be reduced as a result of the inspection finding.

Step 2.3.4 Determine if the nature of the degradation is such that an operator could recover the unavailable equipment or function in time to mitigate the assumed initiating event. Credit for recovery should be given only if the following criteria are satisfied: (1) sufficient time is available; (2) environmental conditions allow access, where needed; (3) procedures describing the appropriate operator actions exist; (4) training is conducted on the existing procedures under similar conditions; and (5) any equipment needed to perform these actions is available and ready for use. If recovery credit is appropriate, enter a value of 1 in the Recovery of Failed Train column of the applicable inspection notebook worksheets.

Step 2.4 - Estimation of Risk Significance of the Inspection Finding

Step 2.4.1 Determine the Sequence Risk Significance for each of the sequences circled in Step 2.3.1.

Sequence Risk Significance = (Initiating Event Likelihood + Remaining Mitigation Capability Credit + Recovery Credit)

Step 2.4.2 Complete Table 6, "Counting Rule Worksheet." The result is the Risk Significance (i.e., Green, White, Yellow, or Red) of the inspection finding based on the internal initiating events that lead to core damage.

Step 2.5 - Screening for the Potential Risk Contribution Due to External Initiating Events

The plant-specific SDP Phase 2 Worksheets do not currently include initiating events related to fire, flooding, severe weather, seismic, or other initiating events that are considered by the licensee's IPEEE analysis. Therefore, the increase in risk of the inspection finding due to these external initiators is not accounted for in the reactor safety Phase 2 SDP result. Because the increase in risk due to external initiators may change the risk significance characterization of the inspection finding, the impact of external initiators should be evaluated by a SRA or other NRC risk analyst. Experience with using the Site Specific Risk-Informed Inspection Notebooks has indicated that accounting for external initiators could result in increasing the risk significance attributed to an inspection finding by as much as one order of magnitude. Therefore, if the Phase 2 SDP result for an inspection finding represents an increase in risk of greater than 1E-7 per year (Risk Significance Estimation of 7 or less), then an SRA or other NRC risk analyst should perform a Phase 3 analysis to estimate the increase in risk due to external initiators. This evaluation may be qualitative or quantitative in nature. Qualitative evaluations of external events should, as a minimum, provide the logic and basis for the conclusion and should reference all of the documents reviewed.

Step 2.6 - Screening for the Potential Risk Contribution Due to LERF

If any of the reactor safety Phase 2 SDP sequence results are greater than 1E-7 per year (sequence result 7 or less) and involve any of the sequence types listed below, then the finding should be screened for its potential risk contribution to LERF using IMC 0609, Appendix H.

- ISLOCA, Transients (includes SBO scenarios), or Small LOCAs for all reactor containment types
- ATWS for BWR Mark I and II reactor containment types
- SGTRs for all PWR reactor containment types

Phase 3 - Risk Significance Estimation Using Any Risk Basis That Departs from the Phase 1 or 2 Process:

If necessary, Phase 3 will refine or modify, with sufficient justification, the earlier screening results from Phases 1 and 2. In addition, Phase 3 will address findings that cannot be evaluated using the Phase 2 process. Phase 3 analysis will utilize appropriate PRA techniques and rely on the expertise of NRC risk analysts.

Human Reliability Analysis (HRA) Model

It is recognized that several HRA methods are available to quantify human error probabilities (HEPs) for use in probabilistic risk analysis (PRA) models. However, there is no general agreement among PRA experts as to which HRA method should be used for HEP quantification. For consistency in SDP Phase 3 evaluations, the analyst should utilize the Accident Sequence Precursor (ASP) Human Error Worksheets to derive the applicable HEPs. However, if the analyst utilizes the licensee's PRA model as the basis for the Phase 3 evaluation and there are no concerns with the licensee's HRA method (e.g., the concerns with the licensee's HRA method identified during the staff's review of the licensee's IPE submittal, if any, have been corrected), then the analyst should use the licensee's HRA method. The analyst should always document and determine the adequacy of any influential assumptions used in any HEP analysis.

Initiating Event Frequency

NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987 - 1995," provides generic frequency estimates for the occurrence of initiating events in U.S. nuclear plants. For SDP Phase 3 evaluations, risk analysts may use the frequency estimates of LOCA events as listed in NUREG/CR-5750. However, the initiating event frequency estimates used in the licensee's PRA model should be used if these estimates are more conservative (i.e., higher) than those listed in NUREG/CR-5750. If relevant factual evidence of plant conditions or characteristics are known and could increase these frequency estimates, then SPSB/NRR should be consulted to determine whether the factual evidence and its associated degree of uncertainty provides reasonable confidence that the frequency estimates do not significantly alter the significance characterization of the inspection finding.

Documentation

Each finding processed through the SDP must be given a color characterizing its significance. In addition, each colored inspection finding must be justified with sufficient detail to allow a knowledgeable reader to reconstruct the decision logic used to arrive at the final color. Further guidance on inspection report documentation is given in IMC 0612.

Reference/Title (LER #, Inspection Report #, etc):

Performance Deficiency (concise statement clearly stating the deficient licensee performance):

Factual Description of Identified Condition (statement of <u>facts</u> known about the finding, without hypothetical failures included):

System(s) and train(s) degraded by identified condition:

Licensing Basis Function of System(s) or Train(s) (as applicable):

Other Safety Function of System(s) or Train(s) (as applicable):

Maintenance Rule category (check one): ___ risk-significant ___non-risk-significant

Time that identified condition existed or is assumed to have existed:

Functions and Cornerstones degraded as a result of this identified condition (check ✓)

INITIATING EVENT CORNERSTONE

_____ Transient initiator contributor (e.g., reactor/turbine trip, loss offsite power)

_____ Primary or Secondary system LOCA initiator contributor (e.g., RCS or main steam/feedwater pipe degradations and leaks)

MITIGATION SYSTEMS CORNERSTONE

_______ Core Decay Heat Removal Degraded

_____ Initial Injection Heat Removal Degraded

_____ Primary (e.g., Safety Inj)

____ Low Pressure

____ High Pressure

_____ Secondary - PWR only (e.g., AFW)

_____ Long Term Heat Removal Degraded (e.g., ECCS sump recirculation, suppression pool cooling)

_____ Reactivity Control Degraded

_____ Fire/Flood/Seismic/Weather Protection Degraded

BARRIERS CORNERSTONE

_____ RCS LOCA Mitigation Boundary Degraded (e.g., PORV block valve, PTS issue)

_____ Containment Barrier Degraded

_____ Reactor Containment Degraded

_____ Actual Breach or Bypass

_____ Heat Removal, Hydrogen or Pressure Control Degraded

_____ Control Room, Aux Bldg, or Spent Fuel Bldg Barrier Degraded

_____ Fuel Cladding Barrier Degraded

SDP PHASE 1 SCREENING WORKSHEET FOR IE, MS, and B CORNERSTONES
Check the appropriate boxes ✔

If the finding is assumed to degrade:

1. fire protection defense in depth (DID), detection, suppression, barriers, fire brigade. **STOP. Go to** IMC 0609, Appendix F
2. the safety of a shutdown reactor. **STOP. Go to** IMC 0609, Appendix G
3. the safety of an operating reactor, identify the degraded areas:
   ☐ Initiating Event ☐ Mitigation Systems ☐ RCS Barrier ☐ Fuel Barrier ☐ Containment Barriers
4. **Two or more** of the above areas degraded → **STOP. Go to Phase 2**
5. If **only one** of the above areas is degraded, continue **only** in the **appropriate** column below.

Initiating Event	Mitigation Systems	RCS Barrier or Fuel Barrier	Containment Barriers
1. Does the finding contribute to the likelihood of a Primary or Secondary system LOCA initiator? ☐ **If YES → Stop. Go to Phase 2** ☐ If NO, continue 2. Does the finding contribute to both the likelihood of a reactor trip AND the likelihood that mitigation equipment or functions will not be available? ☐ **If YES → Stop. Go to Phase 2** ☐ If NO, continue 3. Does the finding increase the likelihood of a fire or internal/external flood? ☐ **If YES** → Use the IPEEE or other existing plant-specific analyses to identify core damage scenarios of concern and factors that increase the frequency. Provide this input for **Phase 3** analysis. ☐ If NO, screen as Green	1. Is the finding a design or qualification deficiency confirmed not to result in loss of function per GL 91-18 (rev 1)? ☐ **If YES** → screen as Green ☐ If NO, continue 2. Does the finding represent an actual loss of safety function of a System? ☐ **If YES → Stop. Go to Phase 2** ☐ If NO, continue 3. Does the finding represent an actual loss of safety function of a single Train, for > its Tech Spec Allowed Outage Time? ☐ **If YES → Stop. Go to Phase 2** ☐ If NO, continue 4. Does the finding represent an actual loss of safety function of one or more non-Tech Spec Trains of equipment designated as risk-significant per 10CFR50.65, for >24 hrs? ☐ **If YES → Stop. Go to Phase 2** ☐ If NO, continue 5. Does the finding screen as potentially risk significant due to a seismic, fire, flooding, or severe weather initiating event, using the criteria on page 3 of this Worksheet? ☐ **If YES** → Use the IPEEE or other existing plant-specific analyses to identify core damage scenarios of concern and provide this input for **Phase 3** analysis. ☐ If NO, screen as Green	1. RCS Barrier **Stop. Go to Phase 2** 2. Fuel Barrier screen as Green	1. Does the finding only represent a degradation of the radiological barrier function provided for the control room, or auxiliary building, or spent fuel pool, or SBGT system (BWR)? ☐ **If YES** → screen as Green ☐ If NO, continue 2. Does the finding represent a degradation of the barrier function of the control room against smoke or a toxic atmosphere? ☐ **If YES → Stop. Go to Phase 3** ☐ If NO, continue 3. Does the finding represent an actual open pathway in the physical integrity of reactor containment or an actual reduction of the atmospheric pressure control function of the reactor containment? ☐ **If YES → Stop. Go to Appendix H of IMC 0609** ☐ If NO, screen as Green Page 2 of 3

SDP PHASE 1 SCREENING WORKSHEET FOR IE, MS, and B CORNERSTONES

Seismic, Fire, Flooding, and Severe Weather Screening Criteria

1. Does the finding involve the loss or degradation of equipment or function **specifically** designed to mitigate a seismic, flooding, or severe weather initiating event (e.g., seismic snubbers, flooding barriers, tornado doors)? (Equipment and functions for the mitigation or suppression of fire initiating events, such as thermal wrap or sprinkler systems, should be evaluated using IMC 0609 Appendix F and are not evaluated here)

   □**If YES** ➛ continue to question 2
   □If NO ➛ skip to question 3

2. If the equipment or safety function is assumed to be completely failed or unavailable, are ANY of the following three statements TRUE? The loss of this equipment or function by itself, during the external initiating event it was intended to mitigate

   a) would cause a plant trip or any of the Initiating Events used by Phase 2 for the plant in question;

   b) would degrade **two or more** Trains of a multi-train safety system or function;

   c) would degrade one or more Trains of a system that supports a safety system or function.

   □**If YES** ➛ the finding is potentially risk significant due to external initiating event core damage sequences - return to page 2 of this Worksheet
   □If NO, screen as Green

3. Does the finding involve the total loss of any safety function, identified by the licensee through a PRA, IPEEE, or similar analysis, that contributes to external event initiated core damage accident sequences (i.e., initiated by a seismic, fire, flooding, or severe weather event)?

   □**If YES** ➛ the finding is potentially risk significant due to external initiating event core damage sequences - return to page 2 of this Worksheet
   □If NO, screen as Green

Result of Phase 1 screening process:

☐ **Screen as Green** ☐ **Go to Phase 2** ☐ **Go to Phase 3**

Important Assumptions (as applicable):

Row	Initiating Event (IE) Frequency	Initiating Event Type	Initiating Event Likelihood $X = -\log_{10}$(IE Frequency)		
I	>1 per 1-10 yr	• Reactor Trip (TRANS) • Loss of Power Conversion System (TPCS)	1	2	3
II	1 per 10-10^2 yr	• Loss of Offsite Power (LOOP) • Inadvertent or Stuck Open SRV (IORV) - (BWR)	2	3	4
III	1 per 10^2-10^3 yr	• Steam Generator Tube Rupture (SGTR) • Loss of Component Cooling Water (LCCW) • Stuck open PORV/SRV (SORV) - (PWR) • Small LOCA including RCP seal failures - (PWR) • MSLB/MFLB	3	4	5
IV	1 per 10^3-10^4 yr	• Small LOCA (RCS rupture) - (BWR) • Med LOCA • loss of offsite power with loss of one AC bus (LEAC)	4	5	6
V	1 per 10^4-10^5 yr	• Large LOCA • ATWS - (BWR)	5	6	7
VI	<1 per 10^5 yr	• ATWS - (PWR) • ISLOCA	6	7	8
			>30 days	30-3 days	<3 days
			Exposure Time for Degraded Condition		

Table 1 - Generic Example - Categories for Initiating Events

Table 2 - Initiators and System Dependency for Generic BWR Nuclear Power Plant

Affected System		Major Components	Support Systems	Initiating Event Scenarios
Code	Name			
ADS	Reactor Vessel Pressure Control and Automatic Depressurization System	5 relief Valves (ADS) & 8 safety valves	IA/nitrogen, 125 V-DC	All except LLOCA
PCS	Power Conversion System	3 reactor feed pumps, 4 condensate pumps,4 condensate booster pumps	4160 V-AC, 125 V-DC, TBCCW, IA	TRAN, IORV, SLOCA, ATWS
RHR	Residual Heat Removal	2 Loops, each with 2 RHR pumps & 1 RHR HX, MOVs	4160 V-AC, 125 V-DC, 480V AC, RHRSW, Pump Room HVAC	All
AC	AC Power (non-EDG)	4160V AC, 480V AC	125V DC	All
DC	DC Power	125V DC (2 batteries & 4 battery charger), 250V DC (2 batteries & 3 battery charger) (shared between two units)	480V AC	All
EDG	Emergency Diesel Generators	1 dedicated EDG, 1 shared EDG, & 1 SBO DG	125 V-DC, DGCW, EDG HVAC	LOOP
RHRSW	RHR Service Water	2 Loops, 2 pump-motor set per loop	HVAC, 4160 V-AC, 480 V-AC, 125 V-DC	All
SW	Service water	5 pumps in Unit 1/ 2 Crib house; shared system supplying a common header	4160 V-AC, 125 V-DC, IA	LOSW

Table 2 - Initiators and System Dependency for Generic BWR Nuclear Power Plant

Affected System		Major Components	Support Systems	Initiating Event Scenarios
TBCCW	Turbine Building Closed Cooling Water System	2 pumps, 2 HXs, an expansion tank	SW, IA, 4160 V-AC	TRAN, TPCS, SLOCA, IORV, LOOP, ATWS
HPCI	High Pressure Coolant Injection	1 TDP, MOV	125 V-DC, 250 V-DC, Room HVAC	All except LLOCA, LOSW
LPCS	Low Pressure Core Spray	2 Trains or Loops; 1 LPCS pump per train	4160 V-AC, 480 V-AC, 125 V-DC, SW, Pump Room HVAC	All except LOSW
RCIC	Reactor Core Isolation Cooling	1 TDP, MOV	125 V-DC, Room HVAC	All except LLOCA, MLOCA
FPS	Fire Protection System	2 diesel fire pumps, MOV	120V AC, SW, 24V Nickel-cadmium batteries	LOSW, LOIA
CRD	Control Rod Drive Hydraulic System	2 MDP, MOV	Non-emergency ESF AC Buses, TBCCW	TRAN, TPCS, SLOCA, IORV, LOOP, ATWS
IA	Instrument Air	2 compressors for each unit plus a shared compressor supplying both units	SW, 480V AC	LOIA
SLC	Standby Liquid Control	2 MDP, 2 explosive valves	480 V-AC, 125 V-DC	ATWS
APCV	Augmented Primary Containment Vent	Valves, Dampers	Essential Service Bus, IA backed up by accumulators for each valve operator	All

Table 3.XX - SDP Worksheet for Generic BWR — Transients (Reactor Trip) (TRAN)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Power Conversion System (PCS)	1/3 Feedpumps and 1/4 condensate/condensate booster pumps (operator action = 3)
High Pressure Injection (HPI)	HPCI (1 ASD train) or RCIC (1 ASD train)
Depressurization (DEP)	1/5 ADS valves (RVs) manually opened (operator action = 2)
Low Pressure Injection (LPI)	1/4 RHR pumps in ½ trains in LPCI Mode (1 multi-train system) or ½ LPCS trains (1 multi-train system)
Containment Heat Removal (CHR)	1/4 RHR pumps in ½ trains with heat exchangers and 1/4 RHRSW pumps in SPC (1 multi-train system)
Containment Venting (CV)	Venting through 8" drywell or wetwell APCV (operator action = 2)
Late Inventory Makeup (LI)	2/2 CRD pumps (operator action = 2)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 TRAN - PCS - CHR - CV (5, 9) **1 + 3 + 3 + 2**	**9**				
2 TRAN - PCS -CHR - LI (4, 8) **1 + 3 + 3 + 2**	**9**				
3 TRAN - PCS - HPI - DEP (11) **1 + 3 + 2 + 2**	**8**				
4 TRAN - PCS - HPI - LPI (10) **1 + 3 + 2 + 6**	**12**				

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and available and ready for use.

	Remaining Mitigation Capability Credit (with Examples)						
Initiating Event Likelihood	6	5	4	3	2	1	0
	2 Multi-Train Systems OR 1 Train + 1 Multi-Train System + Recovery of Failed Train	1 Train + 1 Multi-Train System OR 1 Multi-Train System + 1 Automatic Steam-Driven (ASD) Train + Recovery of Failed Train	2 Diverse Trains OR 1 Multi-Train System + Recovery of Failed Train	1 Train + Recovery of Failed Train OR 1 Multi-Train System	1 Train OR 1 Automatic Steam-Driven (ASD) Train + Recovery of Failed Train	Recovery of Failed Train OR 1 Automatic Steam-Driven (ASD) Train	None
1	Green	White	Yellow	Red	Red	Red	Red
2	Green	Green	White	Yellow	Red	Red	Red
3	Green	Green	Green	White	Yellow	Red	Red
4	Green	Green	Green	Green	White	Yellow	Red
5	Green	Green	Green	Green	Green	White	Yellow
6	Green	Green	Green	Green	Green	Green	White
7	Green	Green	Green	Green	Green	Green	Green
8	Green	Green	Green	Green	Green	Green	Green

Table 4 - Risk Significance Estimation Matrix

Type of Remaining Mitigation Capability	Remaining Mitigation Capability Credit X = - $\log_{10}$(failure prob)
Recovery of Failed Train Operator action to recover failed equipment that is capable of being recovered after an initiating event occurs. Action may take place either in the control room or outside the control room and is assumed to have a failure probability of approximately 0.1 when credited as "Remaining Mitigation Capability." Credit should be given only if the following criteria are satisfied: (1) sufficient time is available; (2) environmental conditions allow access, where needed; (3) procedures describing the appropriate operator actions exist; (4) training is conducted on the existing procedures under similar conditions; and (5) any equipment needed to perform these actions is available and ready for use.	1
1 Automatic Steam-Driven (ASD) Train A collection of associated equipment that includes a single turbine-driven component to provide 100% of a specified safety function. The probability of such a train being unavailable due to failure, test, or maintenance is assumed to be approximately 0.1 when credited as "Remaining Mitigation Capability."	1
1 Train A collection of associated equipment (e.g., pumps, valves, breakers, etc.) that together can provide 100% of a specified safety function. The probability of this equipment being unavailable due to failure, test, or maintenance is approximately 1E-2 when credited as "Remaining Mitigation Capability."	2
1 Multi-Train System A system comprised of two or more trains (as defined above) that are considered susceptible to common cause failure modes. The probability of this equipment being unavailable due to failure, test, or maintenance is approximately 1E-3 when credited as "Remaining Mitigation Capability," regardless of how many trains comprise the system.	3
2 Diverse Trains A system comprised of two trains (as defined above) that are not considered to be susceptible to common cause failure modes. The probability of this equipment being unavailable due to failure, test, or maintenance is approximately 1E-4 when credited as "Remaining Mitigation Capability."	4 (=2+2)
Operator Action Credit Major actions performed by operators during accident scenarios (e.g., primary heat removal using bleed and feed, etc.). These actions are credited using three categories of human error probabilities (HEPs). These categories are Operator Action = 1 which represents a failure probability between 5E-2 and 0.5, Operator Action = 2 which represents a failure probability between 5E-3 and 5E-2, and Operator Action = 3 which represents a failure probability between 5E-4 and 5E-3.	1, 2, or 3

Table 5 - Remaining Mitigation Capability Credit

Counting Rule Worksheet		
Step	**Instructions**	
(1)	Enter the number of sequences with a risk significance equal to 9.	(1) ______
(2)	Divide the result of Step (1) by 3 and round down.	(2) ______
(3)	Enter the number of sequences with a risk significance equal to 8.	(3) ______
(4)	Add the result of Step (3) to the result of Step (2).	(4) ______
(5)	Divide the result of Step (4) by 3 and round down.	(5) ______
(6)	Enter the number of sequences with a risk significance equal to 7.	(6) ______
(7)	Add the result of Step (6) to the result of Step (5).	(7) ______
(8)	Divide the result of Step (7) by 3 and round down.	(8) ______
(9)	Enter the number of sequences with a risk significance equal to 6.	(9) ______
(10)	Add the result of Step (9) to the result of Step (8).	(10) ______
(11)	Divide the result of Step (10) by 3 and round down.	(11) ______
(12)	Enter the number of sequences with a risk significance equal to 5.	(12) ______
(13)	Add the result of Step (12) to the result of Step (11).	(13) ______
(14)	Divide the result of Step (13) by 3 and round down.	(14) ______
(15)	Enter the number of sequences with a risk significance equal to 4.	(15) ______
(16)	Add the result of Step (15) to the result of Step (14).	(16) ______

- If the result of Step 16 is greater than zero, then the risk significance of the inspection finding is of high safety significance (RED).
- If the result of Step 13 is greater than zero, then the risk significance of the inspection finding is at least of substantial safety significance (YELLOW).
- If the result of Step 10 is greater than zero, then the risk significance of the inspection finding is at least of low to moderate safety significance (WHITE).
- If the result of Steps 10, 13, and 16 are zero, then the risk significance of the inspection finding is of very low safety significance (GREEN).

Phase 2 Result: ☐ **GREEN** ☐ **WHITE** ☐ **YELLOW** ☐ **RED**

Table 6 - Counting Rule Worksheet

Attachment 2

Site Specific Risk-Informed Inspection Notebook Usage Rules

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1. Determining Initiating Event Likelihood

1.1 Exposure Time

The exposure time used in determining the Initiating Event Likelihood should correspond to the time period that the condition being assessed is reasonably known to have existed. If the inception of the condition is unknown, then an exposure time of one-half of the time period since the last successful demonstration of the component or function (*t/2*) should be used.

Basis:

A *t/2* exposure time is used when the inception of the condition being assessed is unknown because it represents the mean exposure time for a statistically valid large sample.

Example:

Consider an inspection finding that corresponds to the loss of a safety function which was identified as a result of a failed monthly surveillance. The inception of the condition is unknown. The monthly surveillance was last successfully performed 32 days prior to the surveillance failure. An exposure time of 16 days (greater than 3 but less than 30 days) would be used in assessing the inspection finding.

1.2 Inspection Finding (Not Involving a Support System) that Increases the Likelihood of an Initiating Event

If the amount of increase in the frequency of the initiating event due to the inspection finding is not known, increase the Initiating Event Likelihood for the applicable initiating event by one order of magnitude. If specific information exists that indicates the Initiating Event Likelihood should be increased by more than one order of magnitude, consult with the regional Senior Reactor Analyst (SRA) to determine the appropriate Initiating Event Likelihood.

Basis:

This simplified rule was needed to facilitate phase 2 screening. Scaling up the frequency of an initiating event strongly depends on the type and the severity of the inspection finding. Judgement and experience with the use of the phase 2 notebooks were utilized in the establishment of this rule. If an increase by more than one order of magnitude is believed to be appropriate, the SRA should be consulted.

Example:

Consider an inspection finding that involves an error in a relay calibration procedure that results in the undervoltage setpoint on the supply breakers from each of the offsite power lines being set incorrectly high. As a result, normal voltage perturbations on the offsite power distribution system could result in a loss of offsite power event. The exposure time associated with this inspection finding is 10 days. In accordance with Table 1, "Categories of Initiating Events," an Initiating Event Likelihood of 3 would normally be used; but, because the inspection finding increases the likelihood of a loss of offsite power event, an Initiating Event Likelihood of 2 would be used. Each of the sequences on the loss of offsite power worksheet would then have to be solved because the loss of offsite power initiating event frequency is a component in each of these sequences. For those plants that have a special initiator for loss of offsite power with loss of one AC bus, this worksheet would be solved in a similar manner.

1.3 Inspection Finding (Normally Cross-tied Support System) that Increases the Likelihood of an Initiating Event

For inspection findings that involve the unavailability of one train of a multi-train, normally cross-tied support system that increases the likelihood of an initiating event, increase the Initiating Event Likelihood by one order of magnitude for the associated special initiator.

Basis:

Simple reliability models and generic data have been used to determine that an order of magnitude increase is appropriate for different configurations of cross-tied support systems. For example, based on generic data the initiating event frequency for a cross-tied support system with one running train and two standby trains is on the order of 1E-4 per year. The initiating event frequency for a cross-tied support system with one running train and one standby train is on the order of 1E-3 per year. Therefore, if an inspection finding causes the former system configuration to be changed to the latter, the risk significance should be evaluated by increasing the initiating frequency by one order of magnitude.

Example:

Consider an inspection finding that involves the unavailability of one of three component cooling water pumps. Each of the pumps is capable of providing 100 percent of the required flow. The component cooling water system is a two train system that is normally cross-tied. The exposure time associated with this inspection finding is 90 days. The loss of component cooling water special initiator is located in Row III of Table 1, "Categories of Initiating Events," for the affected plant. As a result, an Initiating Event Likelihood of 3 would normally be assigned when solving loss of component cooling water accident sequences; but, because the inspection finding increases the likelihood of a loss of component cooling water event, an Initiating Event Likelihood of 2 would be used. Each of the sequences on the loss of component cooling water worksheet would then have to be solved because the loss of component cooling water initiating event frequency is a component in each of these sequences.

1.4 Inspection Finding (Normally Running Components of a Split Train Support System) that Increases the Likelihood of an Initiating Event and the Impact on Mitigating System Capability Can Be Explicitly Determined

For inspection findings that involve the unavailability of a normally running component of a split train support system that increases the likelihood of an initiating event, increase the Initiating Event Likelihood by one order of magnitude for the associated special initiator. In addition, determine the impact on the mitigation capability of the supported systems and evaluate each of the worksheets directed by Table 2, "Initiators and System Dependency," for the unavailability of the affected supported systems.

Basis:

Simple reliability models and generic data have been used to estimate the failure probabilities of plant equipment. A generic failure probability for a normally running train is approximately 1E-1 [(1E-5 per hour) x (8760 hours) ≈ 1E-1]. Therefore, it is appropriate to increase the initiating event likelihood by one order of magnitude for inspection findings involving normally running components of split train support systems.

Example:

Consider an inspection finding that involves the unavailability of a normally running pump in a component cooling water system. The component cooling water system is a split, three train support system with one pump normally running in each train. The supported mitigating systems that are impacted by the unavailability of one train of component cooling water are one of three trains of the high pressure safety injection and residual heat removal systems. The exposure time associated with this inspection finding is 21 days. The loss of component cooling water special initiator is located in Row III of Table 1, "Categories of Initiating Events," for the affected plant. As a result, an Initiating Event Likelihood of 4 would normally be assigned when solving loss of component cooling water accident sequences. But, because the finding pertains to a normally running component cooling water pump, an Initiating Event Likelihood of 3 would be used. In addition, each of the worksheets specified by Table 2, "Initiators and System Dependency," for the high pressure safety injection and residual heat removal systems need to be solved considering one train of each of these systems unavailable.

1.5 Inspection Finding (Normally Standby Components of a Split Train Support System) that Increases the Likelihood of an Initiating Event and the Impact on Mitigating System Capability Can Be Explicitly Determined

For inspection findings that involve the unavailability of a normally standby component of a split train support system that increases the likelihood of an initiating event, increase the Initiating Event Likelihood by two orders of magnitude for the associated special initiator. In addition, determine the impact on the mitigation capability of the supported systems and evaluate each of the worksheets directed by Table 2, "Initiators and System Dependency," for the unavailability of the affected supported systems.

Basis:

Simple reliability models and generic data have been used to estimate the failure probabilities of plant equipment. A generic failure probability for a normally standby train is approximately 1E-2. Therefore, it is appropriate to increase the initiating event likelihood by two orders of magnitude for inspection findings involving normally standby components of split train support systems.

Example:

Consider an inspection finding that involves the unavailability of a normally standby pump in a service water system. The service water system is a split train support system with one pump in standby in each train. The supported mitigating systems that are impacted by the unavailability of one train of service water are one of two emergency diesel generators and one of two trains of the residual heat removal system. The exposure time associated with this inspection finding is 21 days. The loss of service water special initiator is located in Row III of Table 1, "Categories of Initiating Events," for the affected plant. As a result, an Initiating Event Likelihood of 4 would normally be assigned when solving loss of service water accident sequences. But, because the finding pertains to a normally standby service water pump, an Initiating Event Likelihood of 2 would be used. In addition, each of the worksheets specified by Table 2, "Initiators and System Dependency," for the emergency diesel generators and the residual heat removal system need to be solved considering one train of each of these systems unavailable.

1.6 Inspection Findings Involving Emergency Diesel Generators

For inspection findings that involve the unavailability of emergency diesel generators (EDGs), increase the Initiating Event Likelihood by two orders of magnitude for the loss of offsite power with loss of one AC bus (LEAC) special initiator, if applicable at the affected plant. (Note: This special initiator is also referred to as LOOPEDG, LOOP1EDG, or LOOPLEAC. The inconsistency with the special initiator acronym will be addressed in the first revision of the site specific risk-informed inspection notebooks.) In addition, determine the impact on mitigation capability of the supported systems and evaluate the loss of offsite power (LOOP) worksheet accounting for the unavailability of the EDG and the affected supported systems. (Note: The unavailability of an EDG does not increase the likelihood of a LOOP event; therefore, the LOOP initiating event likelihood is not adjusted when performing the LOOP worksheet.)

Basis:

The frequency of LEAC is estimated by multiplying the frequency of a loss of offsite power event with the unavailability of an EDG (approximately 1E-2). If the inspection finding is related to the unavailability of an EDG, then the frequency of LEAC should be the same as the frequency of a LOOP event. In addition, because most plants have two trains of emergency AC power and many of the mitigating systems have more than two trains, the loading of the emergency AC buses is asymmetrical. Therefore, the LEAC worksheet reflects the loss of the emergency AC bus with the greatest risk impact.

Example:

Consider an inspection finding that involves the unavailability of one of two EDGs. The supported mitigating systems that are impacted by the unavailability of one train of emergency AC power includes one train of the auxiliary feedwater, high pressure safety injection, and residual heat removal systems. The exposure time associated with this inspection finding is 270 days. In accordance with Table 2, "Initiators and System Dependency," for the affected plant, the LOOP and LEAC worksheets need to be evaluated. The LOOP initiator is located in Row II of Table 1, "Categories of Initiating Events," for the affected plant. As a result, an Initiating Event Likelihood of 2 is assigned when solving LOOP accident sequences. The LEAC initiator is located in Row IV of Table 1, "Categories of Initiating Events." As a result, an Initiating Event Likelihood of 4 would normally be assigned when solving LEAC accident sequences; but, because the inspection finding increases the likelihood of a LEAC event, an Initiating Event Likelihood of 2 would be used. When solving the LOOP worksheet, the EDG and the equipment that it supports needs to be considered unavailable and the remaining mitigation capability modified accordingly. In those sequences where AC power has been recovered (Note: These sequences are annotated as AC Recovered on the worksheets.), full credit is given for the supported mitigating equipment because offsite power is available and the equipment does not need the unavailable EDG to perform its function. The LEAC worksheet already takes into account the equipment lost by the unavailability of the EDG; however, each sequence needs to be solved because the LEAC initiating event frequency is a component in each of these sequences.

1.7 Inspection Findings Involving Safety-Related Battery Chargers

Inspection findings that involve the unavailability of a battery charger for a safety-related DC bus should be treated in the same fashion as a finding that increases the likelihood of the loss of DC bus special initiator (See Section 1.4).

Basis:

Inspection findings that involve the unavailability of a battery charger for a safety-related DC bus should be treated as a finding that increases the likelihood of an initiating event because without the battery charger the associated battery will discharge under normal loads and result in a loss of the DC bus.

Example:

Consider an inspection finding that involves the unavailability of the battery charger for one of two safety-related DC buses and the facility does not have an installed spare. The exposure time associated with this inspection finding is 1 day. The loss of DC bus special initiator is located in Row IV of Table 1, "Categories of Initiating Events," for the affected plant. As a result, an Initiating Event Likelihood of 6 would normally be assigned when solving loss of DC bus accident sequences; but, because the inspection finding increases the likelihood of a loss of DC bus event, an Initiating Event Likelihood of 5 would be used. Each of the sequences on the loss of DC bus worksheet would then have to be solved because the loss of DC bus initiating event frequency is a component in each of these sequences. In addition, each of the worksheets specified by Table 2, "Initiators and System Dependency," for the equipment powered by the affected DC train need to be solved considering this equipment unavailable.

2. Determining Remaining Mitigation Capability

2.1 Inspection Finding that Degrades Mitigation Capability and Does Not Reduce Remaining Mitigation Capability Credit to a Value Less Than Full Mitigation Credit

For inspection findings that involve the unavailability of mitigating system equipment, such that sufficient mitigation capability remains to receive full mitigation credit for the affected safety function, solve all of the worksheet sequences that contain the safety function giving full mitigation credit.

Basis:

All of the worksheet sequences that contain the safety function are solved giving full mitigation credit because the increase in risk due to the degradation is less than one order of magnitude.

Example:

Consider an inspection finding that involves the unavailability of one steam generator power operated relief valve (SGPORV) on one of four steam generators. Each steam generator has one SGPORV and four safety relief valves. In accordance with Table 2, "Initiators and System Dependency," all of the worksheets except those for medium and large break loss-of-coolant-accident initiators would need to be evaluated considering one SGPORV unavailable. A review of the safety functions on each of these worksheets will reveal that the safety functions impacted by the inspection finding are secondary heat removal and rapid cooldown and depressurization. However, because all four steam relief valves are available on the affected steam generator, sufficient mitigation capability remains to receive full mitigation credit for these functions. Therefore, each sequence on these worksheets that contain these safety functions needs to be solved giving full mitigation credit for the function.

2.2 Inspection Finding (Normally Split Train Support System) that Does Not Increase the Likelihood of an Initiating Event and the Impact on Mitigating System Capability Can Be Explicitly Determined

For inspection findings that involve the unavailability of one train of a normally split train support system that does not increase the likelihood of an initiating event, determine the impact on the mitigation capability of the supported systems and evaluate each of the worksheets directed by Table 2, "Initiators and System Dependency," for the unavailability of the affected supported systems.

Basis:

Evaluation of this type of inspection finding involves a direct application of the SDP with the simultaneous unavailability of multiple systems.

Example:

Consider an inspection finding that involves the unavailability of one of two trains of an emergency service water (ESW) system. The ESW system is a standby, split train support system for the auxiliary feedwater system, the high pressure safety injection system, the residual heat removal system, and the emergency diesel generators. As a result, one of two trains of each of these systems are unavailable. In accordance with Table 2, "Initiators and System Dependency," all of the worksheets would need to be evaluated considering one train of each of these systems unavailable for the exposure time associated with the finding.

2.3 Inspection Findings Involving a Loss of Redundancy of Equipment

When an inspection finding reduces the remaining mitigation capability such that the total available equipment is less than 2 times the equipment that is required to fulfill the safety function, the remaining mitigation capability credit should not exceed one train.

Basis:

The SDP worksheets typically assume that if the mitigation capability is such that a single failure can be tolerated without loss of a function, then multi-train credit is assigned. However, if an inspection finding indicates that a performance issue contributed to the failure of at least one train of a system, there is a higher potential for a common cause failure mechanism. In such cases single train credit is more appropriate when the remaining mitigation capability does not provide full redundancy (twice the number of trains required).

Example:

Consider a finding that involves the unavailability of one train of a low pressure injection system. The system is normally a four train system that requires two trains to satisfy the success criteria (e.g., 2/4 trains (multi-train system)). Each of the worksheets specified by Table 2, "Initiators and System Dependency," for this system needs to be solved considering one train unavailable. When solving each of the worksheets that credit this system, only one train of remaining mitigation capability credit would be given because of the loss of redundancy (e.g., 2/3 trains (1 train)) in this system.

2.4 Inspection Findings Involving Equipment that Impact Operator Action Credit

When evaluating inspection findings that impact safety functions involving mitigating equipment and operator action, the remaining mitigation credit should correspond to the equipment or operator action credit, whichever is most limiting.

Basis:

The failure of safety functions that are composed of both equipment and operator action can occur by the failure of either the equipment or the operator action. Because the associated failure probabilities are relatively small, the failure probability of the safety function can be determined by adding the individual failure probabilities together. Consequently, the failure probability of the safety function can be approximated by the order of magnitude of the most limiting component. For example, a safety function is comprised of a multi-train system which has a failure probability of 1E-3 coupled with an operator action which has a failure probability of 1E-2. Therefore, the failure probability of the safety function is 1.1E-2, or approximately 1E-2.

Example:

Consider an inspection finding involving the failure of one of the high pressure safety injection (HPSI) pumps. One of the safety functions impacted by this finding is high pressure recirculation (HPR). The success criteria for the HPR function is one of two HPSI pumps, one of two residual heat removal (RHR) pumps and one of two RHR heat exchangers with operator action for switchover (operator action credit = 3). With one HPSI pump unavailable, the remaining mitigation capability becomes equipment limited and a credit of 2 (1 train) should be assigned to the HPR function.

3. Characterizing the Risk Significance of Inspection Findings

3.1 Treatment of Shared Systems Between Units

When evaluating inspection findings that involve systems that impact multiple units, the inspection finding should be evaluated for each unit separately.

Basis:

The risk significance of an inspection finding is attributed to the unit on which it is applicable. If the inspection finding affects more than one unit and it affects the units differently, then the SDP should be conducted once for each unit as it applies to that unit.

Example:

Consider an inspection finding that involves the unavailability of an emergency diesel generator (EDG). The particular EDG is credited as mitigating equipment on the dedicated unit and a second unit via an operator action to cross-tie the EDG. Therefore, the inspection finding needs to be evaluated separately for each unit. For the dedicated unit, the finding would be evaluated as a finding involving a normally standby, split train support system that increases the likelihood of an initiating event and the impact on mitigating system capability can explicitly be determined. For the other unit, the inspection finding would be evaluated as a finding that impacts the remaining mitigation capability, the ability to cross-tie the EDG, which is credited in certain accident sequences. Specifically, only LOOP and LEAC accident sequences that contain the emergency AC power function need to be solved. As a result, the inspection finding will result in separate risk characterizations for each unit which may or may not be the same.

3.2 Counting Rule

Every 3 affected accident sequences that have the same order of magnitude of risk, as determined by the addition of the initiating event likelihood and the remaining mitigation capability, constitute one equivalent sequence which is more risk significant by one order of magnitude. This rule is applied in a cascading fashion.

Basis:

The Counting Rule is necessary because the risk significance of an inspection finding is determined by the increase in core damage frequency due to the associated performance deficiency. This risk increase represents the summation of the changes in risk associated with each of the affected accident sequences. A simplified rule was needed to relate accident sequences that represent different orders of magnitude of risk significance. Judgement and experience with the use of the Phase 2 Notebooks were utilized in the establishment of this rule.

Examples:

Consider an inspection finding that affects three accident sequences in the Phase 2 Notebook that each have a risk significance of 7, Green. Using the Counting Rule, these three accident sequences would constitute an equivalent accident sequence one order of magnitude more risk significant, 6 or White.

Now consider an inspection finding that affects a total of eight accident sequences in the Phase 2 Notebook. One sequence has a risk significance of 7, Green, and seven sequences have a risk significance of 8. Using the Counting Rule, the seven sequences of 8 would constitute two equivalent sequences one order of magnitude more risk significant, 7. In turn, these two sequences when added with the sequence that had a risk significance of 7 would constitute an equivalent accident sequence one order of magnitude more risk significant, 6 or White.

END