SDP Handouts 110106 /
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APPENDIX A

Determining the Significance of Reactor Inspection Findings for At-Power Situations

I APPLICABILITY

The Significance Determination Process (SDP) described in this Appendix is designed to provide NRC inspectors and management with a simplified probabilistic framework for use in identifying potentially risk-significant issues within the Initiating Events, Mitigation Systems, and Barrier cornerstones. In addition, this process identifies findings of very low risk significance that do not warrant further NRC engagement, as long as the findings are entered into the licensee's corrective action program.

II ENTRY CONDITIONS

Each issue entering the SDP process must first be screened using IMC 0612, Appendix B, "Issue Screening", and as applicable Appendix E, "Examples of Minor Findings." Issues screened as minor are not subjected to this SDP.

The entry conditions for the plant-specific reactor safety SDP described in this Appendix are greater than minor inspection findings that have an adverse effect on the Initiating Events, Mitigation Systems, and Barrier Integrity cornerstones during at-power conditions. The Barrier Integrity cornerstone is separated into three barriers which include: Reactor Coolant System (RCS) pressure boundary, fuel barrier, and the containment barrier. The inspector is referred to Inspection Manual Chapter (IMC) 0609, Appendix F, "Fire Protection Significance Determination Process," for inspection findings related to fire protection defense-in-depth; IMC 609, Appendix H, "Containment Integrity Significance Determination Process," for inspection findings involving the primary containment; IMC 0609, Appendix J, "Steam Generator Tube Integrity Findings," for inspection findings involving PWR steam generators; and IMC 0609, Appendix K, "Maintenance Risk Assessment and Risk Management," for inspection findings related to paragraph a(4) of the Maintenance Rule.

III SDP OVERVIEW

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.

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

Phase 1 - Characterization and Initial Screening of Findings

Phase 1 is used to characterize the important attributes of the inspection finding and to initially screen the finding to identify those with very low-

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significance, which can be dispositioned by the licensee's corrective action program.

The Phase 1 Worksheet is applicable for all plant types and is included in this Appendix.

Phase 1 is intended to be accomplished by the inspection staff, with the assistance of a Senior Reactor Analyst (SRA), if needed.

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

Phase 2 is used to develop a plant specific estimate of the risk significance of an inspection finding and to develop the basis for that determination.

The Phase 2 Worksheets are plant-specific in order to account for variations in available mitigation equipment and other plant-specific attributes. The examples of Phase 2 Worksheets used in this Appendix are identified as Table 3.XX. When conducting a Phase 2 analysis, the actual data contained in the various parts of Table 3.XX in the site specific risk-informed inspection notebook must be used. The risk-informed inspection notebooks can be found on the NRC internal web-page by accessing "Risk Informed Regulatory Activities" on the NRR Home Page. The notebooks are not publicly available.

The Phase 2 is intended to be accomplished by the inspection staff, with the assistance of an SRA, if needed. SRAs may review all completed Phase 2 assessments to ensure the results are consistent with the Phase 2 guidance.

The result of the Phase 2 analysis that is White, Yellow, or Red may be used as both the preliminary and/or final significance determination. Using the Phase 2 result as a preliminary significance determination is desirable when it is apparent that an extensive analysis would be necessary to reduce high levels of uncertainty (e.g., increases in initiating event frequencies). For these cases, the intent of the SDP may be better served by acceptance of the Phase 2 result applying applicable SDP Phase 2 usage rules.

Changes should be made to the Phase 2 result when there are known conservatisms such as exposure time, recovery credit, component failure probabilities, etc. to reduce these conservatisms. Although modifying the established Phase 2 result is considered a Phase 3 SDP, the Phase 3 assessment need not involve any greater detail than the modified Phase 2 inputs, especially when it is recognized that the modified inputs are most influential in the outcome of the finding's significance. In these instances, the simplified Phase 3 assessment should be the preliminary color of the finding and be presented to the SERP.

When evaluating the Phase 2 outcome, there may be situations where the result predicts a lower risk estimate (by SDP color) than the licensee's PRA.

In some instances the licensee's PRA results may be overly conservative and the SDP notebook may reflect a more realistic risk estimate. In these cases, the SRA should try to determine whether the Phase 2 result or the licensee's PRA result provides the more realistic risk estimate.

When considering the use of the Phase 2 result, there may be situations that produce non-conservative results as indicated in the risk-informed inspection notebook benchmarking results. For these situations, the SRA should attempt to identify and correct the non-conservatism.

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

Phase 3 is used to address those situations that depart from the guidance provided for Phase 1 or Phase 2. A Phase 3 analysis need be no more detailed than an adjustment to the Phase 2.

If the Phase 2 SDP Worksheets do not clearly address the inspection finding of concern (e.g., internal flooding, external event initiators, etc.), then a Phase 3 analysis should be performed to characterize the significance of the finding. In these instances, the Phase 3 should focus on the influential affects of the performance deficiency. Since there are a limited number of licensees who have external event PRA models, the Phase 3 analysis should not attempt to place more quantitative emphasis on the SDP result than is reasonable. Rather, the SRA or risk analyst should use qualitative insights using the licensee's IPEEE for the preliminary significance determination. In these cases, the overall SDP is best served by having the licensee provide clarifying information for NRC consideration.

Phase 3 is intended to be performed using appropriate PRA techniques and rely on the expertise of an SRA or risk analyst using the best available information that is accessible or can be determined within the SDP timeliness goal established for a particular finding. For the purposes of the SDP, it is not necessary to develop new risk analysis tools or perform extensive analyses or reviews when SDP timeliness would be jeopardized. When it is apparent that the best available information may not be sufficient to provide a meaningful result, the SRA should transition more of the assessment responsibility to the licensee. In these cases, the role of the SRA or other risk analyst would be to review the licensee's assessment versus becoming unnecessarily overburdened in the assessment process.

When a Phase 2 SDP or simplified Phase 3 SDP is used as the basis for a preliminary/final decision, the SRA should confirm the results by engaging with the licensee as early in the process as possible to determine if the licensee's results are similar. When the results are similar (i.e., same significance color), the Phase 2 SDP or simplified Phase 3 result should be used as a basis for the applicable decision and therefore it would be unnecessary to perform a more detailed Phase 3 analysis.

In the event the initial Phase 2 or Phase 3 SDP result is significantly different than the licensee's result (i.e., more than an order of magnitude), the SRA should attempt to determine the reason(s) for the difference within SDP timeliness constraints. Reasonable effort to determine the difference may include further evaluation and comparison with the licensee's PRA model and the use of the Standardized Plant Analysis Risk (SPAR) model for the plant. The SRA should not however make extensive SPAR modeling changes to accommodate the Phase 3 analysis when those changes would cause the SDP timeliness goal to be challenged. SPAR modeling issues, however, should be forwarded to the Division of Risk, NRR for their review in consultation with the Office of Research.

IV TREATMENT OF CONCURRENT MULTIPLE EQUIPMENT OR FUNCTIONAL DEGRADATIONS

Concurrent multiple equipment or functional degradations are evaluated based on 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 is written. The significance characterization is determined using a reactor safety Phase 3 SDP, is based on the time periods during which the degradations existed, and reflects the total increase in core damage frequency (CDF).

If multiple cornerstones were affected, the single finding will be assigned to the cornerstone which best reflects the dominant risk influences. The justification for the existence of a common cause must be a stronger causal relationship than poor management or 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 multiple equipment or functional degradations, then separate inspection findings are written. The findings are individually characterized for significance, assuming none of the other independent findings existed. This is necessary to account for the probabilistic independence of the findings.

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.

V RELATIONSHIP OF THE SDP 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 Agency's attention on areas where 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.

END

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

APPENDIX A

ATTACHMENT 1

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

Phase 1 - Characterization and Initial Screening of Findings

Step 1.1: Characterize the inspection finding and describe the assumed impact.

(1) Record the performance deficiency and factually describe known observations associated with the deficiency on page 1 of the Phase 1 Screening Worksheet.

(2) Describe the known or assumed impact on affected plant safety functions (e.g., high/low pressure injection, containment heat removal, power conversion system, etc.) Note that the safety functions affected must be those identified in the Site Specific Risk-Informed Inspection Notebooks, when applicable. Do not include hypothetical conditions (e.g., single failure criteria) or speculate on the "worst case" potential degradation as an input to an official SDP result. However, a bounding determination of significance may be made by assuming a worst-case condition. For example, assume complete loss of function, even if unsupported by the facts known at that time. However, if a bounding determination results in a White, Yellow, or Red characterization, greater factual detail will be necessary to complete the official SDP.

CAUTION: The SDP is used to estimate the increase in CDF due only to deficient licensee performance. Therefore, 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 CDF for each plant.

Step 1.2: Perform an initial screening of the inspection finding.

(1) Use the decision logic on pages 4 and 5 of the Phase 1 Screening Worksheet to determine if the issue can be characterized as Green. Note that the examples provided in the worksheet are not all inclusive.

(2) If the finding screens as Green, then document in accordance with IMC 0612.

(3) If the finding screens as other than Green, perform a Phase 2 analysis.

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

The Phase 2 process uses the following tables found in the Site Specific Risk-informed Inspection Notebooks. The plant specific notebooks can be found on the NRC internal web-page by accessing "Risk Informed Regulatory Activities" on the NRR Home Page. The tables presented in this Appendix are generic for the purpose of illustration.

Table 1	"Categories of Initiating Events for XXX Plant"
Table 2	"Initiators and System Dependency for XXX Plant"
Table 3	"SDP Worksheets for XXX Plant"
Table 4	"Remaining Mitigation Capability Credit"
Table 5	"Counting Rule Worksheet"

Step 2.1: Select the initiating event scenarios.

On Table 2, "Initiators and System Dependency for XXX Plant," in the plant specific notebook, locate the equipment or safety function that was assumed to be affected by the inspection finding. Identify the initiating event scenarios that must be evaluated using the plant specific worksheets. (See Table 2 in this attachment for an example.)

Step 2.2: Estimate the Initiating Event Likelihood.

(1) On Table 1, "Categories of Initiating Events for XXX Plant," locate the exposure time associated with the finding (i.e., > 30 days, between 3 and 30 days, or < 3 days). If the inception of the condition is unknown, go to Usage Rule 1.1 of Attachment 2, "Site Specific Risk-Informed Inspection Notebook Usage Rules," of this Appendix to determine the appropriate exposure time.

(2) Determine the Initiating Event Likelihood (i.e., 1 through 8) for each of the initiating events identified in Step 2.1.

(3) Go to Attachment 2 and review the information contained in Phase 1 Worksheet to determine if the finding increases the likelihood of each initiating event identified in Step 2.1.

(4) If the finding increases the likelihood of an initiating event, increase the Initiating Event Likelihood (IEL) value in accordance with the SDP usage rules in Attachment 2.

(5) Enter the IEL value in the IEL column on the applicable notebook worksheet. (See Table 3.XX "SDP Worksheet for Generic BWR," contained in this Appendix.)

Step 2.3: Estimate the Remaining Mitigation Capability in accordance with the SDP usage rules in Attachment 2.

(1) For each of the inspection scenarios identified in Step 2.1, determine which safety functions are affected by the finding.

(2) Circle the affected safety functions on each worksheet identified in Step 2.1.

(3) If the inspection finding increases the likelihood of an initiating event, circle the initiating event for each of the sequences on the worksheet for that particular initiating event.

(4) Evaluate the unaffected equipment for each safety function affected by the finding. Using Table 4, "Remaining Mitigation Capability Credit," 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. Unaffected safety functions will retain their assigned full mitigation capability credit.

(5) Determine if 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:

(a) sufficient time is available;
(b) environmental conditions allow access, where needed;
(c) procedures describing the appropriate operator actions exist;
(d) training is conducted on the existing procedures under similar conditions;
(e) 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: Estimate the risk significance of the inspection finding.

(1) Determine the Sequence Risk Significance for each of the sequences circled in Step 2.3 (1), using the following formula:

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

(2) Complete Table 5, "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: Screen 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 increase 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 or equal to 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 - Screen for the Potential Risk Contribution Due to Large Early Release Frequency (LERF).

If the total ΔCDF from the Phase 2 Worksheets (i.e., sum of all sequences) is less than 1E-7 per year, then the finding is not significant from a LERF perspective and no further evaluation is necessary. However, if the total ΔCDF is greater than or equal to 1E-7 then the finding must be screened for its potential risk contribution to LERF using IMC 0609, Appendix H.

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 using the best available information that is accessible or can be determined within the established SDP timeliness goal. While, for the purposes of the SDP, the level of analysis should be commensurate with the anticipated significance of the findings, it should not be necessary to develop new risk analysis tools or perform extensive analyses, and the evaluation effort should take into account the importance of SDP timeliness.

Human Reliability Analysis (HRA) Model[1]

Use the Standardized Plant Analysis Risk (SPAR) - H method to derive the applicable human error probabilities (HEPs) in SDP Phase 3 evaluations. If the licensee's PRA model is used as the basis for the Phase 3 evaluation and if 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 use the licensee's HRA method. The adequacy of any influential assumptions used in any HEP analysis must always be determined and documented.

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, the frequency estimates of LOCA events as listed in NUREG/CR-5750 may be used. 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 the Probabilistic Safety Assessment Branch (SPSB)/NRR should be consulted to determine whether the evidence and the 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 evaluated through the SDP must be given a color characterizing its significance. In addition, each 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 provided in IMC 0612.

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[1]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.

SDP PHASE 1 SCREENING WORKSHEET FOR INITIATING EVENTS, MITIGATION SYSTEMS, AND BARRIERS CORNERSTONES
Reference/Title (LER #, Inspection Report #, etc):
Performance Deficiency (concise statement clearly stating deficient licensee performance):
Factual Description of Condition (statement of facts known about the condition that resulted from the performance deficiency, without hypothetical failures included):
System(s)/Train(s) Degraded by Condition:
Licensing Basis Function of System(s)/Train(s):
Other Safety Function of System(s)/Train(s):
Maintenance Rule Category (check one): _____ risk-significant ______non risk-significant
Time condition existed or is assumed to have existed:

CORNERSTONES AND FUNCTIONS DEGRADED AS A RESULT OF DEFICIENCY (✔) Check the appropriate boxes		
INITIATING EVENTS CORNERSTONE	**MITIGATION SYSTEMS CORNERSTONE**	**BARRIERS CORNERSTONE**
❒ Primary System LOCA initiator contributor - (e.g., RCS leakage from pressurizer heater sleeves, RPV piping penetrations, CRDM nozzles, PORVs, SRVs, ISLOCA issues, etc.) ❒ Transient initiator contributor (e.g., reactor/turbine trip, loss of offsite power, loss of service water, main steam/feedwater piping degradations, etc.) ❒ Fire initiator contributor (e.g., transient loadings and combustibles, hotwork) ❒ Internal/external flooding initiator contributor	❒ Core Decay Heat Removal Degraded ❒ Short Term Heat Removal Degraded ❒ Primary (e.g., Safety Inj, [main feedwater, HPCI, and RCIC - BWR only]) ____ High Pressure ____ Low Pressure ❒ Secondary - PWR only (e.g. AFW, main feedwater, ADVs) ❒ Long Term Heat Removal Degraded (e.g., ECCS sump recirculation, suppression pool) ❒ Reactivity Control Degraded ❒ Seismic/Fire/Flood/Severe Weather Protection Degraded	❒ RCS Boundary as a mitigator following plant upset (e.g., pressurized thermal shock). Note: all other RCS boundary issues, such as leaks, will be considered under the Initiating Events Cornerstone. ❒ Containment Barrier Degraded ❒ Reactor Containment Degraded ___ Actual Breach or Bypass ___ Heat Removal, Hydrogen or Pressure Control Degraded ❒ Control Room, Aux Bldg/Reactor 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 strategies involving: detection, suppression (equipment for both manual and automatic), barriers, fire prevention and administrative controls, and post fire safe shutdown systems, **THEN STOP. Go to** IMC 0609, Appendix F. Issues related to performance of the fire brigade are not included in Appendix F and require NRC management review.

2. steam generator tube integrity, **THEN STOP. Go to** IMC 0609, Appendix J.

3. the safety of an operating reactor, **THEN IDENTIFY** the degraded cornerstone(s):

   - ☐ Initiating Event
   - ☐ Mitigation Systems
   - ☐ RCS Barrier (e.g., PTS issues)
   - ☐ Fuel Barrier
   - ☐ Containment Barriers

IF TWO OR MORE of the above cornerstones are degraded ➝ **THEN STOP. Go to Phase 2.**

IF ONLY ONE of the above cornerstones is degraded, **THEN CONTINUE** in the appropriate column on page 4 of 5 of this worksheet.

NOTE: When assessing the significance of a finding affecting multiple cornerstones, the finding should be assigned to the cornerstone that best reflects the dominant risk of the finding.

Initiating Events Cornerstone	Mitigation Systems Cornerstone	RCS Barrier or Fuel Barrier	Containment Barriers Cornerstone
LOCA Initiators 1. Assuming worst case degradation, would the finding result in exceeding the Tech Spec limit for identified RCS leakage or could the finding have likely affected other mitigation systems resulting in a total loss of their safety function. □ **If YES → Stop. Go to Phase 2.** □ If NO, screen as Green. Transient Initiators 1. 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, screen as Green. External Event Initiators 1. 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 operability per "Part 9900, Technical Guidance, Operability Determination Process for Operability and Functional Assessment." 2. □ **If YES, screen as Green.** □ If NO, continue. 2. Does the finding represent a loss of system safety function? □ **If YES → Stop. Go to Phase 2.** □ If NO, continue. 3. Does the finding represent 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, flooding, or severe weather initiating event, using the criteria on page 5 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 (e.g.,pressurized thermal shock issues) Stop. Go to Phase 3. 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 involve an actual reduction in defense-in-depth for the atmospheric pressure control or hydrogen control functions of the reactor containment? □ **If YES → Stop. Go to Appendix H of IMC 0609.** □ If NO, screen as Green.

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

Seismic, 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)?

   - ☐ **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 4 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, flooding, or severe weather event)?

   - ☐ **If YES** ➛the finding is potentially risk significant due to external initiating event core damage sequences - return to page 4 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:

Performed by: ________________________________ Date: ______________

Table 1 - Generic Example - Categories for Initiating Events					
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 2 - Generic BWR Example - Initiators and System Dependency

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

Affected System		Major Components	Support Systems	Initiating Event Scenarios
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
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.

Table 4 - Remaining Mitigation Capability Credit

Type of Remaining Mitigation Capability	Remaining Mitigation Capability Credit $X = -\log_{10}(\text{failure prob})$
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 - 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**

APPENDIX A

ATTACHMENT 2

Site Specific Risk-Informed Inspection Notebook Usage Rules

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1.0 DETERMINING THE INITIATING EVENT LIKELIHOOD

1.1 Exposure Time

Rule: 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

Rule: 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

Rule: 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

Rule: 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) $\approx$ 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

Rule: 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

Rule: 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

Rule: 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.

2.0 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

Rule: 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

Rule: 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

Rule: 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

Rule: 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.

3.0 CHARACTERIZING THE RISK SIGNIFICANCE OF INSPECTION FINDINGS

3.1 Treatment of Shared Systems Between Units

Rule: 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

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 used 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 that is 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 that is one order of magnitude more risk significant, 6 or White.

END