

NRC INSPECTION MANUAL

APOB

INSPECTION MANUAL CHAPTER 0609 APPENDIX G, ATTACHMENT 3

PHASE 2 SIGNIFICANCE DETERMINATION PROCESS TEMPLATE
FOR BWR DURING SHUTDOWN

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The shutdown **Significance Determination Process (SDP)** consists of three phases: Phase 1, Definition and Initial Screening of Findings; Phase 2, Initial Risk Significance Approximation and Basis; and Phase 3, Risk Significance Finalization and Justification. Inspection Manual Chapter (IMC) 0609 Appendix G, **Attachment 1**, Shutdown Operations Significance Determination Process **Phase 1 and Initial Screening and Characterization of Findings** is used by inspectors to conduct the phase 1 screening analysis. This template is used by SRAs or headquarters risk analysts to perform phase 2 analyses for certain BWR shutdown findings discussed below.

01.01 ENTRY CONDITIONS FOR SDP-RELATED INSPECTION FINDING

This template provides a simplified, risk-informed framework to estimate the increase in core damage frequency (CDF) during shutdown operations due to findings that are identified as requiring quantitative assessment from the Phase 1 screening in IMC 0609 Appendix G, Attachment 1.

01.02 MANAGEMENT DIRECTIVE 8.3 ENTRY

Procedures are given in **Section 4** for using this template to perform quantitative assessment of shutdown events to satisfy Management Directive (MD) 8.3.

01.03 APPLICABILITY

The process in this **template** is designed to provide SRAs and analysts with a simple, scrutable probabilistic risk framework for use in identifying potentially risk-significant shutdown issues within the Initiating Events, Mitigation Systems, and Barrier Integrity cornerstones. The results from this SDP tool are intended to facilitate communication on the basis of risk significance between the NRC and licensees.

02.01 LIMITS

This template is a simplified tool that generates order-of-magnitude assessment of the risk significance of inspection findings during shutdown. **If appropriate, a more detailed risk assessment may be performed in a SDP Phase 3 evaluation, especially if the analyst feels that the risk is not being properly assessed in the Phase 2 evaluation. Program guidance in IMC 0609, Attachment 5, "Inspection Finding Review Board" and IMC 0609, Attachment 1, "Significance and Enforcement Review Panel Process," should be followed to determine if a planning SERP is required before committing resources to a detailed risk evaluation in a Phase 3 analysis.**

02.02 PRECAUTIONS

- The **SRA or analyst** should consider each evaluated Core Damage sequence using the event trees **included at the end of this procedure** to ensure that the scenario makes sense for the deficiency. The variability of plant configurations at shutdown and timing issues may result in findings which do not directly map on the event trees. Contact a risk analyst in NRR/APOB for assistance if needed.

- The SRA or analyst must understand: (1) the differences between precursor and condition findings, (2) the definitions of the plant operational states (POSs), and (3) the definitions of the shutdown initiating events. **These terms are defined in IMC 0609, Appendix G.**
- The availability of standby reactor coolant system (RCS) injection along with operator error drives shutdown risk. As long as standby injection is available, in most cases, standby injection buys time for other operator recovery actions such as: leak path termination and residual heat removal (RHR) recovery. If there are factors that could render the standby RCS injection unavailable such as: gas intrusion or support system unavailability, then these factors (assumptions) become risk significant and should be assessed carefully.
- Findings that involve freeze seals that are installed in systems connected to the RCS where failure could lead to a loss of inventory are not covered by these worksheets and go directly to Headquarters for Phase 3 analysis.
- Findings that involve containment closure are assessed using IMC 0609 Appendix H “Containment Integrity Significance Determination Process”.
- **It has been identified that it’s possible for operator dominated sequences to have HEP values that are below levels recommended in the Risk Assessment of Operational Events (RASP) manuals Volumes 1 and 4 when following this procedure. Analysts should be cognizant of this potential and pay closer attention to operator action dominated sequences. If an analyst feels that this procedure is not adequately capturing the risk, they may depart from this procedure and perform a Phase 3 detailed risk assessment.**

03.01 ABBREVIATIONS

CD	Core Damage
High Decay Heat	Decay heat of early time window
Low Decay Heat	Decay heat of late time window
CCW	Component Cooling Water
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling System
IEL	Initiating Event Likelihood
INDIC	Indication
IMC	Inspection Manual Chapter
LOI	Loss of Reactor Inventory Initiating Event
LER	Licensee Event Report
LOOP	Loss of Offsite Power
LORHR	Loss of RHR Initiating Event
OP	Operator
POS	Plant Operational State
PRA	Probabilistic Risk Assessment
RCS	Reactor Coolant System
RHR	Residual Heat Removal
ROP	Reactor Oversight Process
SDP	Significance Determination Process
SG	Steam Generator
SG PORV	Steam Generator Power Operated Relief Valve
SRW	Site Raw Water
SSW	Standby Service Water
TBB	Time to Boiling
TW	Time Window
TW-E	Early Time Window, before refueling operation
TW-L	Late Time Window, after refueling operation

03.02 DEFINITIONS

For a complete list of definitions refer to IMC 0609, Appendix G.

Available - A piece of equipment is considered available if: (1) it can be put into service within half the time that is needed before the equipment will be used to perform its function, (2) procedures or standing orders exist for using the equipment to meet its intended function, (3) all necessary supporting systems (such as AC power, cooling water, and DC control power) can be put into service within half the time that is needed before the equipment will be used to perform its function, and (4) operators have been trained for using the equipment for the given situation.

Shutdown Operations - Shutdown Operation exists during refueling outages, forced outages, and maintenance outages starting when the plant has met the entry conditions for RHR/DHR and cooling has been initiated, and ending when the plant is heating up and RHR/DHR has been secured.

Types of Shutdown Findings

Precursor Finding - Inspection Findings that: (1) cause an event (e.g., a loss of the operating train of RHR/DHR), or (2) increase the likelihood of an event.

Condition findings - Inspection findings that only involve a degradation of the licensee's capability to mitigate an event if an event were to occur. Findings only affecting the standby train of RHR/DHR are condition findings.

Shutdown Initiating Events

Loss of RHR (LORHR) - Includes losses of RHR/DHR resulting from failures of the RHR/DHR system (such as RHR/DHR pump failure) or failures of the RHR/DHR support systems other than offsite power.

Loss of Offsite Power (LOOP) - Includes losses of offsite power which cause a loss of RHR.

Loss of Reactor Inventory (LOI) - Includes losses of RCS inventory that lead to a loss of RHR/DHR function due to automatic isolation of RHR/DHR on low level or loss of RHR/DHR pump suction.

Plant Operational States (POSs)

POS 1 - This POS starts when the RHR/DHR system is put into service. The vessel head is on and the RCS is closed such that an extended loss of the DHR function without operator intervention could result in a RCS re-pressurization above the shutoff head for the RHR pumps.

POS 2 - This POS represents the shutdown condition when (1) the vessel head is removed, and reactor pressure vessel water level is less than the minimum level required for movement of irradiated fuel assemblies within the reactor pressure vessel as defined by Technical Specifications OR (2) the vessel head is on; however, a sufficient RCS vent path exists for decay heat removal.

POS 3 - This POS represents the shutdown condition when the reactor pressure vessel water level is equal or greater than the minimum level required for movement of irradiated fuel assemblies within the reactor pressure vessel as defined by Technical Specifications. This POS occurs during Mode 5 (refueling).

Time Windows

Early Time Window (TW-E) - This time window represents the time before POS 3 is entered. The decay heat is relatively high. The reactor is either in POS 1 or 2.

Late Time Window (TW-L) - This time window represents the time after POS group 3. The decay heat is relatively low.

Step 4.1 – Transition from SDP Phase 1

Use the Information Gathered in the Phase 1 process to identify the set of equipment that the licensee planned to meet the following safety functions: Standby RCS injection, and RCS pressure control if applicable.

Step 4.2 – Determine if the finding is a precursor to an initiating event (a loss of the DHR function) or a condition finding.

NOTE: Precursor findings: (1) cause an event (e.g., a loss / interruption of the operating train of RHR/DHR), or (2) increase the likelihood of an event. Condition findings only involve a degradation of the licensee's capability to mitigate an event if an event were to occur. Findings only affecting the standby train of RHR are condition findings. The template treats precursor and condition findings differently.

Go To Step 4.3 for Precursor Findings

OR

Go To Step 4.4 for Condition Findings

NOTE: If this tool is being used to assess a shutdown event under Management Directive 8.3, Go to Step 4.5.

Step 4.3 – Process for Assessing Precursor Findings

Step 4.3.1 – Identify each time window (TW) and plant operation state (POS) where the finding could have occurred.

Figure 1 defines the POSs and TWs for a BWR plant. It also shows the relationship between the POSs and the modes defined in the Technical Specifications (TSs).

Step 4.3.2 – Determine the IEL.

The initiating event likelihood (IEL) is the conditional likelihood of having a loss of the RHR function given the occurrence of the findings.

- IF a finding increases the likelihood of a loss of offsite power (LOOP) or actually caused a LOOP, THEN LOOP is the applicable initiating event. Use Table 1 to determine the IEL. Go to Step 4.3.3.
- IF a finding increases the likelihood of a loss of reactor inventory (LOI) or actually caused a LOI, THEN LOI is the applicable initiating event. Use Table 3 to determine the IEL. Go to Step 4.3.3.
- IF a finding increases the likelihood of a loss of the operating train of RHR (LORHR) or actually caused a LORHR (except for LOOP and LOI), THEN LORHR is the applicable initiating event. Use Table 3 to determine the IEL. Go to Step 4.3.3.

- IF a finding involves the RHR support systems (except for LOOP and LOI), THEN LORHR is the applicable initiating event. Use Table 4 to determine the IEL. Go to Step 4.3.3.

Step 4.3.3 – Use the SDP worksheet.

Choose the SDP worksheet that contains the POS and initiating event that were determined to be applicable in steps 4.3.1 and 4.3.2. The SDP worksheets are included at the end of this procedure.

Step 4.3.4 – Enter the time to RCS boiling.

Enter the time to RCS boiling and an approximate time to core uncover/core damage in the first line of the worksheet.

Tools exist for determining these times, including an electronic Core Uncovery Calculator located on the RASP Tool Box web page, or by using licensee values if available.

Step 4.3.5 – Fill-in the IEL determined in step 4.3.2 in each row of the lower section of the applicable worksheet.

Determine the credit for each top event function.

A. Verify that the licensee has the important instrumentation referenced for the top event function.

NOTE: If the licensee does not have the referenced instrumentation available or the referenced instrumentation is not reflective of RCS conditions, then the default operator credit MUST be decreased by two.

B. To obtain the Equipment Credit, credit each available system that is (1) capable of maintaining the top event function and (2) is not impacted by the finding. Use the event tree associated with the worksheet to help understand the successes and failures associated with each accident sequence. Use the guidance in Tables 5 and 6 to determine equipment credits. Document key assumptions.

C. To obtain the Operator Credit, use the default operator credit unless any of the following four conditions are applicable:

1. If the referenced instrumentation is missing or misleading, then decrease the operator credit by two.
2. The default time is incorrect and significantly reduced. If the diagnosis time is less than 20 minutes OR the time to perform the action is approximately the time required, then decrease the operator credit by one.
3. If the action is complicated by missing or inaccessible equipment, steam or high radiation, or loop seals for venting pumps, then decrease the operator credit by two.
4. If the procedures are incomplete for the shutdown plant configuration, then decrease the operator credit by one.

NOTE: If the default operator credit is changed and results in a negative operator credit, then the operator credit is zero.

D. Determine the Credit for Function for each Top Event Function needed. Select the lower of Equipment Credit and Operator Credit and enter the value in this column.

Step 4.3.7 – Quantification of Core Damage Scenarios

Quantify each accident scenario by adding the credits for IEL + Mitigation Credit. Enter the sum in the Result column.

NOTE: For phase 2 analyses, the recovery credit is not used.

Step 4.3.8 – Identify the frequency of finding occurrence

Select between Condition A or B.

A. If the **finding** occurred during an outage (forced outage, refueling outage, etc.), the **preliminary** color of the finding is determined by using **Table 7 – Counting Rule Worksheet**. The resulting ICCDP associated with the **finding** is interpreted as the addition to the licensee's total CDF contribution over the previous year (previous 12 months). Therefore, the resulting ICCDP becomes the increase in delta CDF.

B. If the deficiency needs a random event to reveal the deficiency (e.g. at Palisades, the digging of a sign revealed underground protective cabling common to both offsite power sources outside the protected area), then the frequency of the random event (1/32 calendar years of operation) is multiplied by:

The Frequency that the licensee enters an outage (1 outage per 18 months) * (12 months/ calendar year) *(Number of Days of POS 1 operation/ outage) * (1 calendar year/365 days) *(CCDP of POS 1 operation)

Added to:

The Frequency that the licensee enters an outage (1 outage per 18 months) * (12 months/ calendar year) *(Number of Days of POS 2 operation/ outage) * (1 calendar year/365 days) *(CCDP of POS 2 operation).

Step 4.4 – Process for Assessing SDP Condition Findings

NOTE: Only the core damage scenarios impacted by the finding are quantified.

Step 4.4.1 – Select the applicable initiating events.

Select the applicable initiating events (LOOP, LORHR, and/or LOI) by identifying the equipment or safety functions affected and determine the initiating event scenarios that must be evaluated (i.e., the affected function plays some role in mitigating the initiating event scenario).

Step 4.4.2 – Determine the exposure times.

Determine the exposure times for the degraded condition in the mitigating system. A separate exposure time must be determined for each POS for findings that span one or more POS. Using Table 4, determine an IEL for each applicable initiating event in each applicable POS. Figure 1 defines the POSs and TWs for a BWR plant. It also shows the relationship between the POSs and the modes defined in the TSs.

Step 4.4.3 – Choose the SDP Worksheet(s)

Choose the SDP worksheet(s) that contain the POSs and initiating events that were determined to be applicable in Steps 4.4.1 and 4.4.2. Perform the following steps on the Worksheet for each applicable POS and initiating event. The SDP worksheets are included at the end of this procedure.

Step 4.4.4 – Enter the time to RCS boiling

Enter the time to RCS boiling and an approximate time to core uncover/core damage in the first line of the worksheet.

Tools exist to estimate these times, including an electronic Core Uncovery Calculator located on the RASP Tool Box web page, or by using the licensee values if available.

Step 4.4.5 – Fill-in the IEL determined in step 4.4.2 in each row of the lower section of the worksheet.

Step 4.4.6 – Determine the revised credit for each top event function impacted by the finding.

A. Verify that the licensee has the important instrumentation referenced for the top event function.

NOTE: If the licensee does not have the referenced instrumentation available or the referenced instrumentation is not reflective of RCS conditions, then the default operator credit must be decreased by two.

B. To obtain the Equipment Credit, credit each available system that is (1) capable of maintaining the top event function and (2) is not impacted by the finding. Use the event tree associated with the worksheet to help understand the successes and failures associated with each accident sequence. Use the guidance in Tables 5 and 6 to determine equipment credits. Document key assumptions.

NOTE: Each top event has an equipment credit and an operator credit, only the equipment credit change or the operator credit change is propagated through the worksheets. See the following example:

Example: If the licensee has a finding that changes the MINJ equipment credit from 5 to 3, then the revised credit for the MINJ&SRV becomes 3, regardless of the SRV credit or the operator credit.

C. Determine the revised Operator Credit. Use the default operator credit listed in the worksheet unless any of the following four conditions are applicable.

1. If the referenced instrumentation is missing or misleading, then decrease the operator credit by two.
2. The default time is incorrect and significantly reduced. If the diagnoses time is less than 20 minutes OR the time to perform the action is approximately the time required, then decrease the operator credit by one.
3. If the action is complicated by missing or inaccessible equipment, steam or high radiation, or loop seals for venting pumps, then decrease the operator credit by two.
4. If the procedures are not complete for the shutdown plant configuration, then the operator credit is decreased by one.

Caution: It has been identified that it's possible for operator dominated sequences to have HEP values that are below levels recommended in the Risk Assessment of Operational Events (RASP) manuals Volumes 1 and 4 when following this procedure. Analysts should be cognizant of this potential and pay closer attention to operator action dominated sequences. If an analyst feels that this procedure is not adequately capturing the risk, they may depart from this procedure and perform a Phase 3 detailed risk assessment.

NOTE: If the default operator credit is changed and results in a negative operator credit, then the operator credit is zero.

Example: If the licensee has a finding that changes the operator credit from a 5 to a 3 due to a loss of instrumentation, then the revised credit for the MINJ&SRV becomes 3, regardless of the equipment MINJ&SRV equipment credit.

D. Determine the Credit for Function for each Top Event Function needed. Select the lower of Equipment Credit and Operator Credit and enter the value in the Credit for Function column.

Step 4.4.7 – Quantification of Core Damage Scenarios.

Quantify each accident scenario that is impacted by the finding adding the credits for IEL + Mitigation Credit. Enter the sum in the Result column.

NOTE: For phase 2 analyses, the recovery credit is not used.

Step 4.4.8 – Go to the next applicable worksheet and begin at step 4.4.1, or if all worksheets are completed, continue to step 4.4.9.

Step 4.4.9 – Estimating the risk significance of the inspection finding

The preliminary color of the finding is determined by using Table 7 – Counting Rule Worksheet. Using the quantified values obtained from steps 4.4.7 and 4.4.8, complete the Counting Rule Worksheet. The result is the Risk Significance (Green, White, Yellow or Red) of the inspection finding based on the internal initiating events that lead to core damage.

Step 4.5 – Process for Assessing Events Under Management Directive 8.3

Step 4.5.1 – Identify the TW and POS where the shutdown event occurred.

Step 4.5.2 – Identify the appropriate shutdown initiating event.

Use an IEL = 0 if the event caused a loss or interruption of the RHR function.

OR

Determine the IEL. Evaluate each question in order. Only one of the following will apply:

- IF a finding increases the likelihood of a loss of offsite power (LOOP) or actually caused a LOOP, THEN LOOP is the applicable initiating event. Use Table 1 to determine the IEL. Go to Step 4.5.3.
- IF a finding increases the likelihood of a loss of reactor inventory (LOI) or actually caused a LOI, THEN LOI is the applicable initiating event. Use Table 2 to determine the IEL. Go to Step 4.5.3.
- IF a finding increases the likelihood of a loss of the operating train of RHR (LORHR) or actually caused a LORHR (except for LOOP and LOI), THEN LORHR is the applicable initiating event. Use Table 3 to determine the IEL. Go to Step 4.5.3.
- IF a finding involves the RHR support systems (except for LOOP and LOI), THEN LORHR is the applicable initiating event. Use Table 3 to determine the IEL. Go to Step 4.5.3.

Step 4.5.3 – Use the SDP worksheet that contains the POS and initiating event that were determined to be applicable in Step 4.5.1 and 4.5.2.

Step 4.5.4 – Enter the time to RCS boiling.

Enter the time to RCS boiling and an approximate time to core uncover/core damage in the first line of the worksheet.

Tools exist for determining these times, including an electronic Core Uncovery Calculator located on the RASP Tool Box web page, or by using licensee values if available.

Step 4.5.5 – Fill-in the IEL determined in step 4.5.2 in each row of the lower section of the worksheet.

Step 4.5.6 – Determine the revised Credit for Function for each top event function impacted by the finding for the as found condition during the event.

A. Verify the licensee has the important instrumentation referenced for the top event function.

NOTE: If the licensee does not have the referenced instrumentation available or the referenced instrumentation is not reflective of RCS conditions, then the default operator credit MUST be reduced by two.

B. To obtain the Equipment Credit, credit each available system that is (1) capable of maintaining the top event function and (2) is not impacted by the finding. Use the event tree associated with the worksheet to help understand the successes and failures associated with each accident sequence. Use guidance in Tables 5 and 6 to determine equipment credits. Document key assumptions.

C. To obtain the Operator Credit, use the default operator credit unless any of the following four conditions are applicable:

1. If the referenced instrumentation is missing or misleading, then decrease the operator credit by two.
2. The default time is incorrect and significantly reduced. If the diagnoses time is less than 20 minutes OR the time to perform the action is approximately the time required, then decrease the operator credit by one.
3. If the action is complicated by missing or inaccessible equipment, steam or high radiation, or loop seals for venting pumps, then decrease the operator credit by two.
4. If the procedures are not directed for the shutdown configuration that the plant is in, then the operator credit is decreased by one.

NOTE: If the default operator credit is changed and results in a negative operator credit, then the operator credit is zero.

D. Determine the Credit for Function for each Top Event Function needed. Select the lower of Equipment Credit and Operator Credit and enter the value in the **the Credit for Function** column.

Step 4.5.7 – Quantification of Core Damage Scenarios

Quantify each accident scenario by adding the credits for IEL + Mitigation Credit. Enter the sum in the Result column.

NOTE: For phase 2 analyses, the recovery credit is not used.

Step 4.5.8 – Go to the next applicable worksheet and begin at step 4.5.1, or if all worksheets are completed, continue to step 4.5.9.

Step 4.5.9 – Estimating the Risk Significance of the Inspection Finding

The preliminary color of the finding is determined by using Table 7 – Counting Rule Worksheet. Using the quantified values obtained from steps 4.4.7 and 4.4.8, complete the Counting Rule Worksheet. The result is the Risk Significance (Green, White, Yellow or Red) of the inspection finding based on the internal initiating events that lead to core damage.

Figure 1 – Determination of Applicable POSs and Time Windows – BWRs

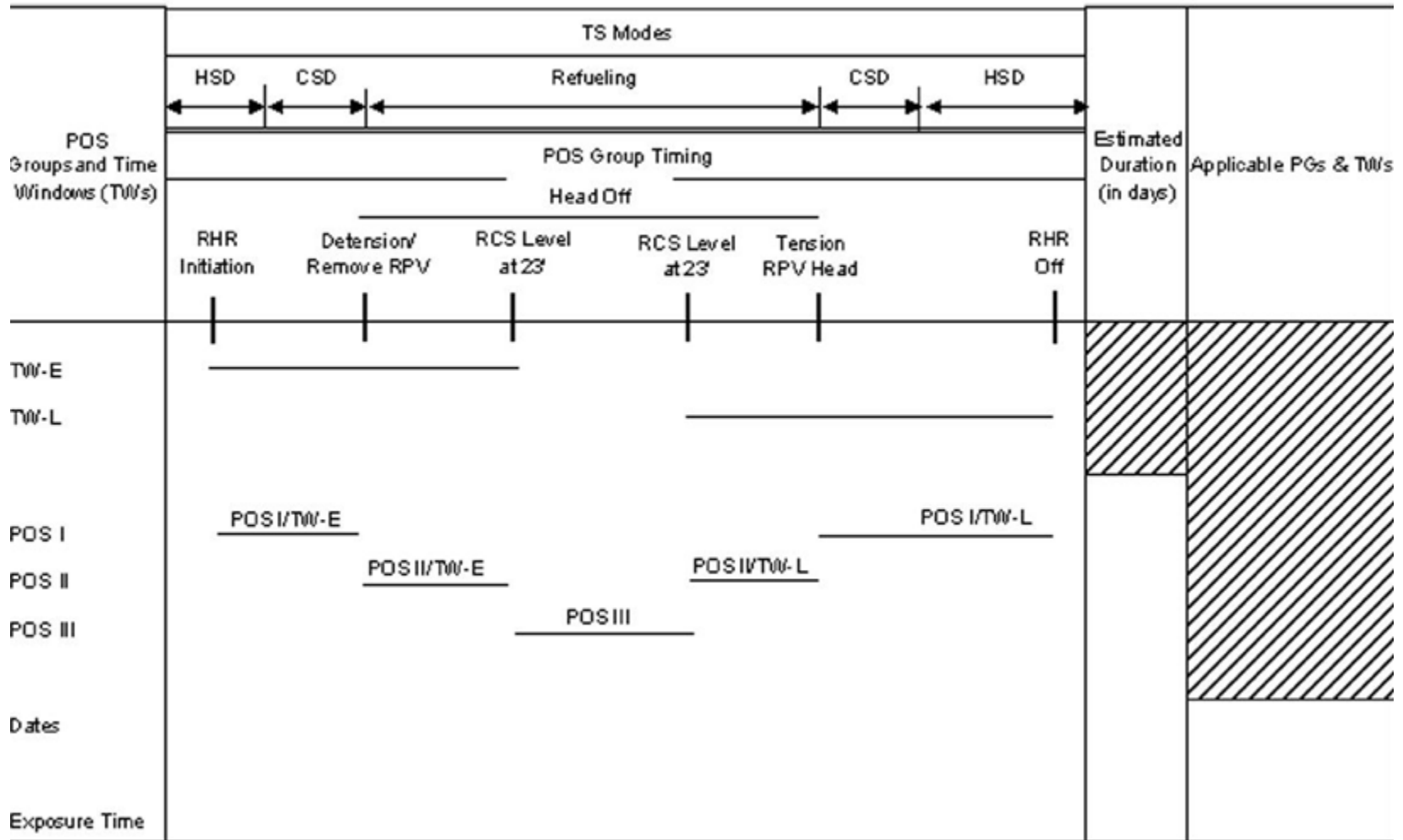


Table 1 – Initiating Even Likelihoods (IELs) for LOOP Precursors

Type of LOOP precursor	Estimated Initiator Rating
Actual LOOP occurred	0
Work Activities have the potential to affect existing power supplies (example: crane operating close to a Reserve Auxiliary Transformer supplying power to RHR without adequate controls on its movement)	1

Table 2 – Initiating Event Likelihood (IELs) for Loss of Inventory (LOI) Precursors

Time to RHR loss due to isolation of RHR on level 3 given no operator action	Is RCS Level Indication a reasonable reflection of RCS level?	Can leak path be readily identified within ½ time to loss of RHR	Can drain path be isolated by at least one functional valve such that a train of RHR can be re-started (e.g. not RHR suction valves)	Estimated IEL
loss of RHR occurred or X<20 min.	N/A	N/A	N/A	0
20<X<40 min.	YES	YES	YES	1
20<X<40 min.	NO	N/A	N/A	0
20<X<40 min.	YES	NO	N/A	0
20<X<40 min.	YES	YES	NO	0
40<X<60 min.	YES	YES	YES	2
40<X<60 min.	NO	YES	YES	0
40<X<60 min.	YES	NO	N/A	0
40<X<60 min.	YES	YES	NO	0
1<X<2 hours	YES	YES	YES	3
1<X<2 hours	NO	YES	YES	1
1<X<2 hours	YES	NO	N/A	0
1<X<2 hours	YES	YES	NO	0
X>2 hours	YES	YES	YES	4
X>2 hours	NO	YES	YES	1
X>2 hours	YES	NO	N/A	0
X>2 hours	YES	YES	NO	0

Table 3 – Initiating Event Likelihoods (IELs) for LORHR Precursors

Note: For findings affecting Loss of the Operating Train of RHR and RHR Supports System Including SSW, AC and DC components

Time to RHR loss given no successful operator action	Trouble Alarms Present for Finding Ex. DHR high temp. DHR low flow Support System Trouble Alarms Ex. SSW low flow	Can Action to Recover RHR be identified within ½ time to RHR loss? E.g. RHR recovery procedures, Support System Recovery procedures,	Can Action to Recover RHR be performed within ½ time to RHR loss?	Estimated IEL
Loss of RHR occurred OR < 20 minutes	N/A	N/A	N/A	0
20<X<40 min.	YES	YES	YES	1
20<X<40 min.	NO	N/A	N/A	0
20 <X<40min.	Yes	NO	N/A	0
20<X<40 min.	YES	YES	NO	0
40<X<60min.	YES	YES	YES	2
40<X<60min.	NO	N/A	N/A	0
40<X<60min.	YES	NO	N/A	0
40>X<60min	YES	YES	NO	0
1<X<2 hours	YES	YES	YES	3
1<X<2 hours	NO	YES	YES	1
1<X<2 hours	YES	NO	N/A	0
1<X<2 hours	YES	YES	NO	0
X>2 hour	YES	YES	YES	4
X>2 hour	NO	YES	YES	1
X>2 hour	YES	NO	N/A	0
X> 2 hour	YES	YES	NO	0

Table 4 – Initiating Even Likelihoods (IELs) for Condition Findings – BWRs

Row	Approximate Conditional Frequency	Example Event Type	Estimated IEL ⁽¹⁾		
0	> 1 per yr	Loss of an Operating Train of RHR (LORHR)	0	1	2
I	1 per 1-10 yr	Loss of offsite power (LOOP)	1	2	3
II	1 per 10-10 ² yr	Loss of Inventory (LOI)	2	3	4
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

1. The likelihood ratings are presented in terms of 0, 1, 2, etc. A rating of 0 is comparable to a frequency of 1 per year, a rating of 1 is comparable to a frequency of 1E-1 per year, and similarly, a rating of 2 is comparable to a frequency of 1E-2 per year.

Table 5 - Mitigation Capability Credits for Installed Equipment

Type of Remaining Capability	Remaining Capability Rating
<p>Recovery of Failed Train</p> <p>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 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.</p>	1
<p>1 Automatic Steam-Driven (ASD) Train</p> <p>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.”</p>	1
<p>1 Train</p> <p>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.”</p>	2
<p>1 Multi-Train System</p> <p>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.</p>	3
<p>2 Diverse Trains</p> <p>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.”</p>	4 = (2+2)

Table 6 - Credit for Temporary Equipment

Mitigation Capability	Credits
Equipment available during power operation and available during shutdown operation	Use credit similar to at-power SDP; manual alignment and actuation may be needed limiting the credit to the credit for operator action
Temporary Equipment (e.g., skid mounted diesel) that is available during shutdown; equipment and tools needed are staged for quick hookup	Use credit of 1

Table 7 - 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) _____
<p>* If the result of Step 16 is greater than zero, then the risk significance of the inspection finding is of high safety significance (RED).</p> <p>* 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).</p> <p>* 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).</p> <p>* 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).</p>	
<p>Phase 2 Result ~ GREEN ~ WHITE ~ YELLOW ~ RED</p>	

Worksheet 1. SDP for a BWR Plant - Loss of Inventory in POS 1 (Head on)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____ (NOTE: losses of inventory shorten time to core damage)				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u>	<u>Operator Credit</u>	<u>Credit for Function</u>
Isolation of the loss (ISOL)	Downcomer losses: Auto isolation of RHR on Low Vessel Level W/low level alarm ----- Losses from lower plenum	Credit = 3 ----- - Unisolable leak (lower plenum) - 0	N/A ----- Credit = 0	
Early Automatic ECCS (AECCS)	1 low pressure ECCS pump train in automatic		N/A	
Manual Low-Pressure Injection - Leak isolated (MINJ)	Reconfigure RHR to ECCS injection, or LPCS, or a condensate pump or another low pressure non-ECCS pump capable of keeping the core covered Operator needs Vessel level indic. W/low level alarms		Credit = 4 (Assumes time to RHR shutoff head > 1hr).	
Manual Low-Pressure Injection - Leak not isolated (MINJX)	Reconfigure RHR to ECCS injection or other high flow rate source essentially equivalent in capability to ECCS injection. Operator needs Vessel level indication w/low level alarms		Credit = 4 (Assumed time to CD >2hours w/o leak path isolation)	

DHR Recovery before RCS pressure control needed. Leak Isolated. (RHRREC)	Operator restarts RHR before RCS pressure control needed. OR Operator initiates an alternate, diverse, DHR path such as CRD and RWCU before RCS pressure control is needed.		Credit = 4 (Time to RHR shutoff head >1 hr.)	
RCS Pressure Control (SRV)	Operator opens an RCS vent path (e.g. SRV) to control RCS pressure. Operator needs RCS pressure indication.		Credit = 2	
Manual High-Pressure Injection at Pressure (MINJY)	Operator injects following isolation of RHR on high pressure or SRVs lifting, using high pressure pumps such as Control Rod Drive pumps or HPCI.		Credit = 1	
Containment Venting (CV)	Operator opens available vent paths. Additionally, long term make-up water must be provided to the injection source.		Credit = 3	

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LOI - RHRREC- CV (3)				
LOI - RHRREC - SRV (4)				
LOI - MINJ - CV (6)				
LOI - MINJ - MINJY (7)				
LOI - ISOL - CV (9)				
LOI - ISOL - SRV (10)				
LOI - ISOL - AECCS - CV (12)				
LOI - ISOL - AECCS - SRV (13)				
LOI-ISOL-AECCS-MINJX (14)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Notes:

1. Different non-ECCS sources may apply for different plants. Examples include: firewater and high-pressure service water.
2. Failure of ECCS and alternate injection sources is assumed to fail the ability of the operator to recover RHR and is assumed to fail suppression pool cooling and makeup.
3. Failure to isolate the leak reduces the ability to recover RHR.
4. Non-ECCS systems are not assumed to be able to keep core covered if leak path is not isolated.
5. If a leak is isolated by the operator, it is assumed that ECCS will not automatically be activated.
6. Actions to steam the core at high or low pressure to prevent core damage are treated as recovery actions

Worksheet 2 SDP for a BWR Plant - Loss Inventory Control in POS 2 (Head off or RCS vented)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____ (NOTE: losses of inventory shorten time to core damage)				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u>	<u>Operator Credit</u>	<u>Credit for Function</u>
Isolation of the loss (ISOL)	Downcomer losses: Auto isolation of RHR on Low Vessel Level W/low level alarm ----- Losses from lower plenum	Credit = 3 ----- ----- Unisolable leak (lower plenum) - 0	N/A ----- Credit = 0	
Early Automatic ECCS (AECCS)	1 low pressure ECCS pump train in automatic		N/A	
Manual RCS Injection by operator - Leak isolated (MINJ)	Reconfigure RHR to ECCS injection, or manual CRD, or HPCS, or LPCS, or LPCI, or condensate pump or CRD or other non-ECCS before Core Damage Operator needs Vessel level indic. W/low level alarms		Credit = 4 (Time to CD > 3 hrs. w/o injection)	

Manual RCS Injection - - Leak not isolated (MINJX)	Reconfigure RHR to ECCS injection or other high flow rate source essentially equivalent in capability to ECCS injection before core damage. Operator needs Vessel level indic. W/ low level alarms		Credit = 4 (Time to CD > 3 hrs w/o injection.)	
DHR Recovery before Long Term Cooling needed Leak Isolated. (RHRREC)	Operator restarts RHR before Long Term Cooling needed OR Operator initiates an alternate, diverse DHR path such as CRD and RWCU before Long Term Cooling is needed.		Credit = 4	
Long Term Cooling (LCOOL)	Operator maintains long term inventory source		Credit = 4	

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LOI-RHRREC-LCOOL (3)				
LOI-AECCS-RHRREC-LCOOL (6)				
LOI-AECCS-MINJ (7)				
LOI -ISOL-LCOOL (9)				
LOI - ISOL-AECCS - LCOOL (11)				
LOI-ISOL-AECCS-MINJX (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 ready for use.

Notes:

1. Different non-ECCS sources may apply for different plants. Examples include: firewater and high-pressure service water.
2. Failure of ECCS and alternate injection sources is assumed to fail the ability of the operator to recover RHR
3. Failure to isolate the leak reduces the ability to recover RHR.
4. Non-ECCS systems are not assumed to be able to keep core covered if leak path is not isolated.
5. If a leak is isolated by the operator, it is assumed that ECCS will not automatically be activated.

Worksheet 3 SDP for a BWR Plant - Loss of Inventory in POS 3 (Cavity Flooded)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____ (NOTE: losses of inventory shorten time to core damage)				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u>	<u>Operator Credit</u>	<u>Credit for Function</u>
Isolation of the loss (ISOL)	Downcomer losses: Auto isolation of RHR on Low Vessel Level W/low level alarm ----- Losses from lower plenum	Credit = 3 ----- Unisolable leak (lower plenum) - 0	N/A ----- Credit = 0	
Manual RCS Injection - Leak isolated (MINJ)	Reconfigure RHR to ECCS injection, or manual CRD, or HPCS, or LPCS, or LPCI, or condensate pump or CRD or other non-ECCS before Core Damage Operator needs Vessel level indic. W/low level alarms		Credit = 4 (Time to CD > 3 hrs. w/o injection)	
Manual RCS Injection - Leak not isolated (MINJX)	Reconfigure RHR to ECCS injection or other high flow rate source essentially equivalent in capability to ECCS injection before Core Damage Operator needs Vessel level indic. W/low level alarms		Credit = 4 (Time to CD > 3 hrs. w/o injection.)	

DHR Recovery before Long Term Cooling needed. (RHRREC)	Operator restarts RHR before Long Term Cooling is needed. OR Operator initiates an alternate, diverse DHR path such as CRD and RWCU before Long Term Cooling is needed.		Credit = 4	
Long Term Cooling	Operator maintains long term inventory source		Credit = 4	

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LOI-RHRREC-LCOOL (3)				
LOI - MINJ (4)				
LOI-ISOL-LCOOL (6)				
LOI-ISOL-MINJX (7)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Notes:

1. Different non-ECCS sources may apply for different plants. Examples include: firewater and high-pressure service water.
2. Failure to isolate the leak reduces the ability to recover RHR.

3. Non-ECCS systems are not assumed to be able to keep core covered if leak path is not isolated.
 Worksheet 4 SDP for a BWR Plant - Loss of Operating Train of RHR (LORHR) in POS 1 (Head On)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u> ¹	<u>Operator Credit</u>	<u>Credit for Function</u>
DHR Recovery (RHRREC) before RHR shutoff head reached	<p>Operator restores a train of RHR or Alternate DHR path before RHR shutoff head (Tshut) is reached</p> <p>Operator needs RHR inlet/outlet temp indic. and RHR flow indic. with low flow alarm</p> <p>OR IF APPLICABLE²</p> <p>Operator recovers failed RHR support systems before RHR shutoff head (Tshut) is reached.</p>		<p>Credit = 0 if Tshut < 20 min</p> <p>If recovery action can be identified within ½ time to Tshut AND recovery action can be performed within ½ Tshut, then:</p> <p>Credit = 1, if 20 < Tshut < 40min. Credit = 2, if 40min < Tshut < 1 hr Credit = 3, if Tshut > 1 hr.</p>	

¹If **finding** is being transferred from LOOP tree, analyst must consider if the front-line systems and necessary support systems are supported from successful EAC.

²If this worksheet is being used to assess a RHR support system deficiency that could cause a loss of the operating train of RHR, the equipment credit and operator credit is determined by the operator's ability to recover the support system before the RHR shutoff head is reached.

Manual Low-Pressure Injection & RCS Pressure Control (MINJ&SRV)	Operator uses a LPCS pump, a condensate pump or another low-pressure pump capable of keeping the core covered, in addition to the RHR pumps which are assumed to be failed. Operator needs RCS pressure indication and RCS level indication with low level alarm AND Operator opens an RCS vent a path to control RCS pressure (e.g. SRV).		Credit = 2	
Manual High-Pressure Injection at Pressure (MINJY)	Following isolation of RHR on high pressure, operator injects using high pressure pumps such as Control Rod Drive pumps or HPCI and steaming out the SRVs at their safety setpoint.		Credit = 1	
Containment Venting (CV)	Operator vents containment and provides long term inventory for injection system		Credit = 3	

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LORHR - RHRREC - CV (3)				
LORHR - RHRREC - MINJ&SRV- CV (5)				
LORHR-RHRREC- MINJ&SRV-MINJY (6)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Notes:

1. Failure to recover RHR before RHR shutoff head is reached is assumed to fail short term injection using LPCI.
2. Actions to prevent core damage by steaming the core at high or low pressure are treated as recovery actions.

Worksheet 5. SDP Worksheet for a BWR Plant — Loss of Operating Train of RHR in POS 2 (Head Off or RCS Vented)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u> ³	<u>Operator Credit</u>	<u>Credit for Function</u>
DHR Recovery (RHRREC) before RCS Level 3 reached and RHR automatically isolates	Operator restores a train of RHR or Alternate DHR path before RCS Level 3 (Tisol) reached Operator needs RHR inlet/outlet temp indic. and RHR flow indic. with low flow alarm OR IF APPLICABLE ⁴ Operator recovers failed RHR support systems before RCS Level 3 (Tisol) is reached.		Credit = 0 if Tisol <20 min If recovery action can be identified within ½ time to Tisol AND recovery action can be performed within ½ Tisol, then: Credit = 1, if 20<Tisol <40min. Credit = 2, if 40min<Tisol <1 hr Credit = 3, if Tisol > 1 hr.	
Early Automatic ECCS (AECCS)	1 low pressure ECCS pump train in automatic in addition to the RHR pumps which are assumed to be failed.		N/A	

³If **finding** is being transferred from LOOP tree, analyst must consider if the front-line systems and necessary support systems are supported from successful EAC.

⁴If this worksheet is being used to assess a RHR support system deficiency that could cause a loss of the operating train of RHR, the equipment credit and operator credit is determined by the operator's ability to recover the support system before the RHR shutoff head is reached.

Manual RCS Injection before CD (MINJ)	Operator actuates LPCS pump, or another high pressure or low-pressure pump capable of keeping core covered, in addition to the RHR pumps which are assumed to be failed Operator needs Vessel level indic. with low level alarms		Credit = 2	
Long Term Cooling (LCOOL)	Operator maintains long term inventory source		Credit = 4	

<u>Core Damage Sequences</u>	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LORHR-RHRREC-LCOOL (3)				
LORHR -RHREC-AECCS-LCOOL (5)				
LORHR-RHRREC-AECCS-MINJ (6)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Worksheet 6. SDP Worksheet for a BWR Plant - Loss of Offsite Power in POS 1 (Head On)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u>	<u>Operator Credit</u>	<u>Credit for Function</u>
Emergency AC before RHR pump shutoff head reached (EAC)	1 EDG or 1 alternate on-side AC power source ⁵		Credit = 3 (assumed 2 hrs to shutoff head)	
AC-Independent injection and RCS Pressure Control (ACI&SRV)	Operator actuates 1 AC independent pump (. e.g. Firewater) Operator needs RCS pressure indication and RCS level indication with low level alarm AND Operator opens an RCS vent path to control RCS pressure (e.g. SRV)		Credit =3 (Time to CD w/o injection > 3hrs)	
Recovery of LOOP in 8 hours (RLOOP8)	Offsite power recovered before core damage with no RCS makeup (assumed 8 hours)	Credit = 1		
Recovery of LOOP in 20 hours (RLOOP20)	Offsite power recovered after battery depletion but before core damage (12 hours to depletion + 8 hours to core damage)	Credit = 2		

⁵Alternate AC source can be credited if can be tied in to 4KV buses at least 1hour before RHR pump shutoff head reached.

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LOOP-EAC-RLOOP20 (3)				
LOOP-EAC-ACI&SRV-RLOOP8 (5)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Notes:

1. Different non-ECCS sources may apply for different plants. Examples include: firewater and high-pressure service water.
2. In sequence 1, LOOP followed by successful start of an EDG or EAC source, analyze the Loss of RHR sequences. The IEL for the Loss of RHR analysis should be the LOOP IEL. The analysis must consider the complexities of recovering RHR with specific deficiencies of the electrical system.

Worksheet 7. SDP Worksheet for a BWR Plant - Loss of Offsite Power in POS 2 (Head Off or RCS Vented)

FILL IN: TIME TO BOILING _____ TIME TO CORE DAMAGE _____ (NOTE: losses of inventory shorten time to core damage)				
<u>Top Event Function:</u>	<u>Success Criteria and Important Instrumentation:</u>	<u>Equip. Credit</u>	<u>Operator Credit</u>	<u>Credit for Function</u>
Emergency AC (EAC)	1 EDG or 1 alternate on-side AC power source ⁶		Credit = 3	
AC-Independent injection before core damage (EAC-AIC)	Operator actuates 1 AC independent pump (e.g. fire water) Operator needs Vessel level indication w/low level alarms		Credit =3 (Time to CD w/o injection > 3hrs)	
Recovery of LOOP in 8 hours (RLOOP8)	Offsite power recovered before core damage with no RCS makeup (assumed 8 hours)	Credit = 1		
Recovery of LOOP in 20 hours (RLOOP20)	Offsite power recovered after battery depletion but before core damage (12 hours to depletion + 8 hours to core damage)	Credit = 2		

⁶Alternate AC source can be credited if can be tied in to 4KV buses at least 1hour before RHR pump shutoff head reached.

<u>Core Damage Sequences</u> (Circle Affected Functions)	<u>IEL</u>	<u>Mitigation Credit</u>	<u>Recovery</u>	<u>Result</u>
LOOP - EAC- RLOOP20 (3)				
LOOP - EAC-ACI - RLOOP8 (5)				
<p>Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:</p> <p>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 ready for use.</p>				

Notes:

1. Different non-ECCS sources may apply for different plants. Examples include: firewater and high-pressure service water.
2. In sequence 1, LOOP followed by successful start of an EDG or EAC source, analyze the Loss of RHR sequences. The IEL for the Loss of RHR analysis should be the LOOP IEL. The analysis must consider the complexities of recovering RHR with specific deficiencies of the electrical system.

Figure 2 – Event Tree for Loss of Inventory – BWR POS – 1

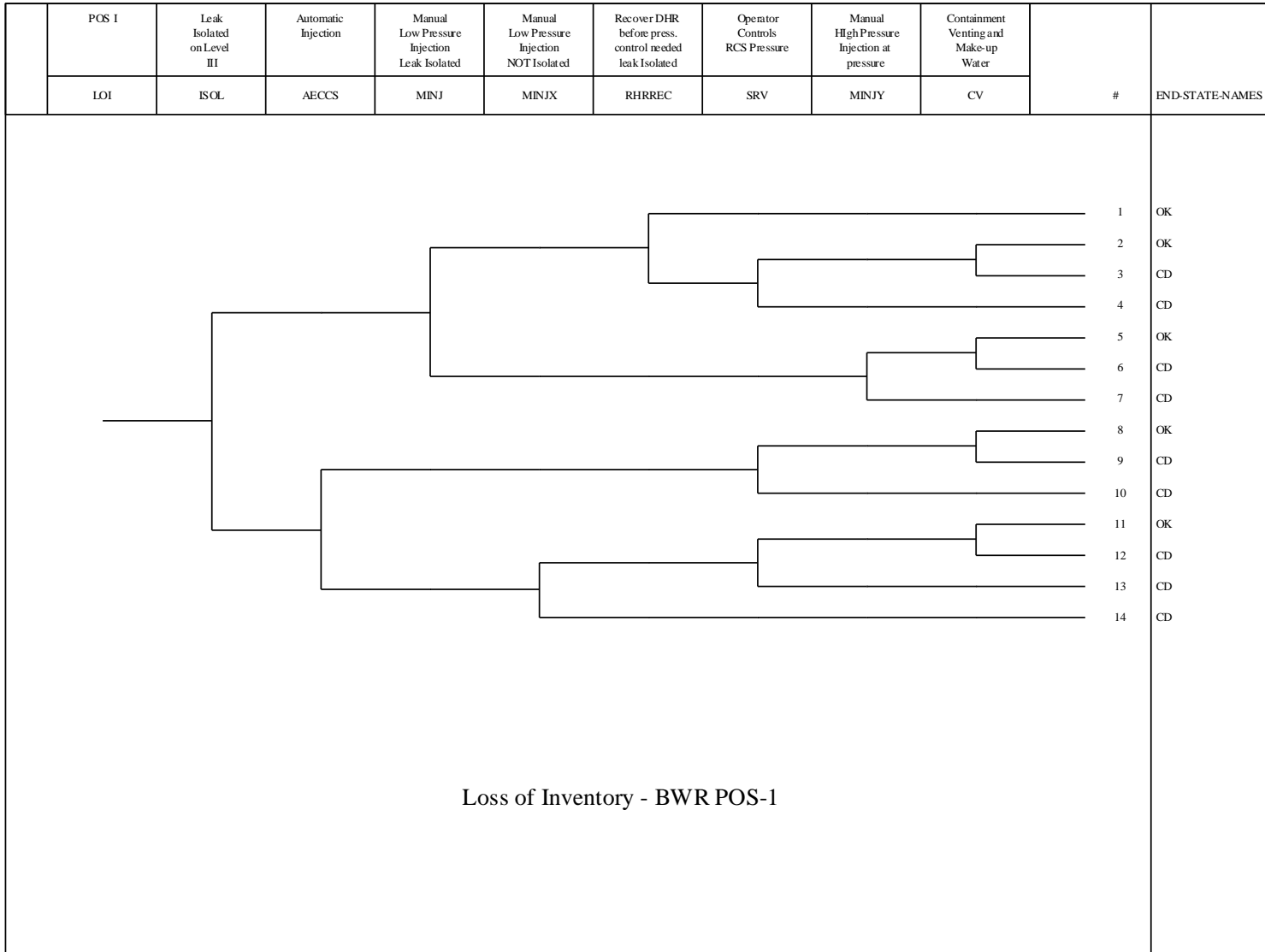


Figure 3 – Event Tree for Loss of Inventory – BWR POS – 2

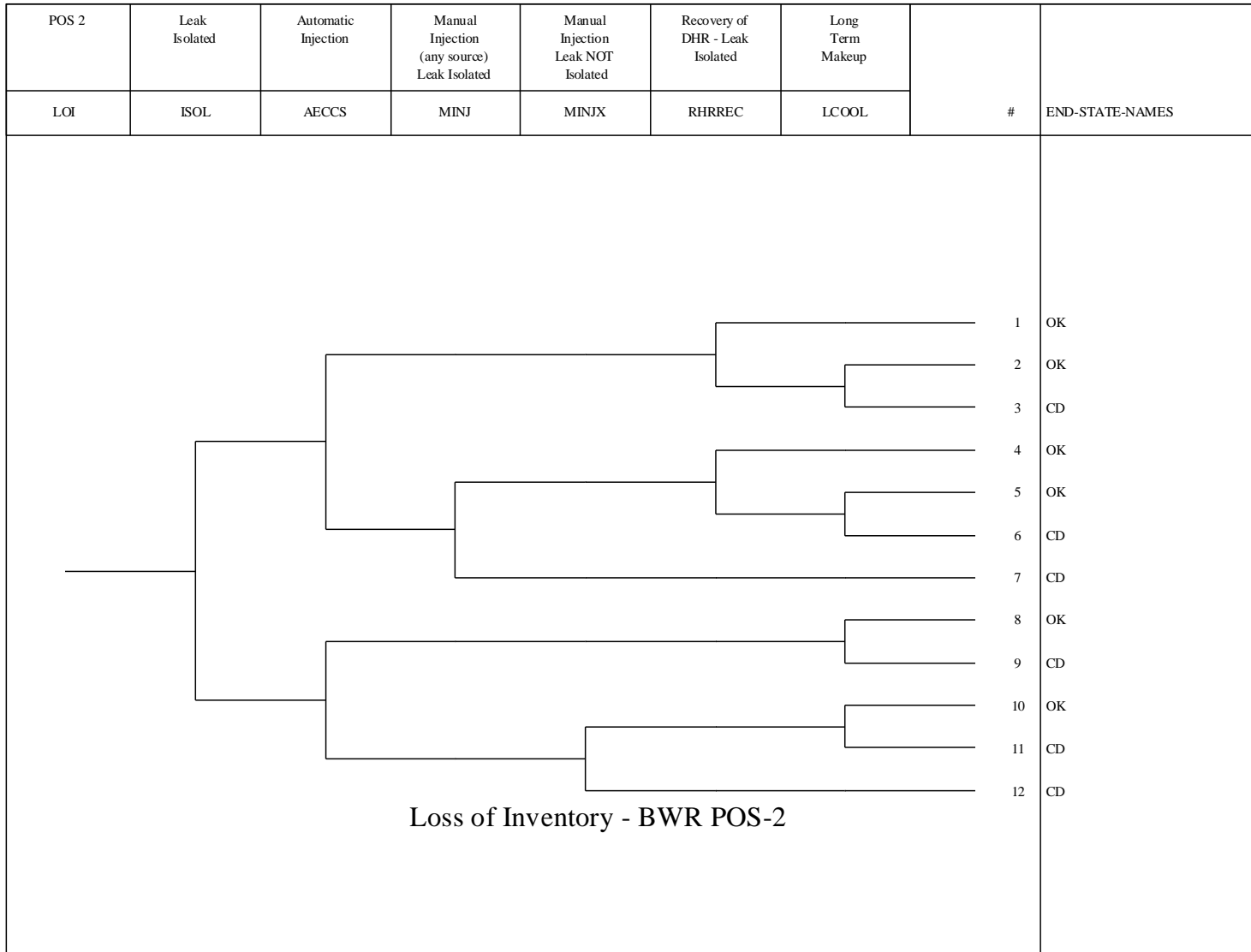


Figure 4 – Event Tree for Loss of Inventory BWR POS - 3

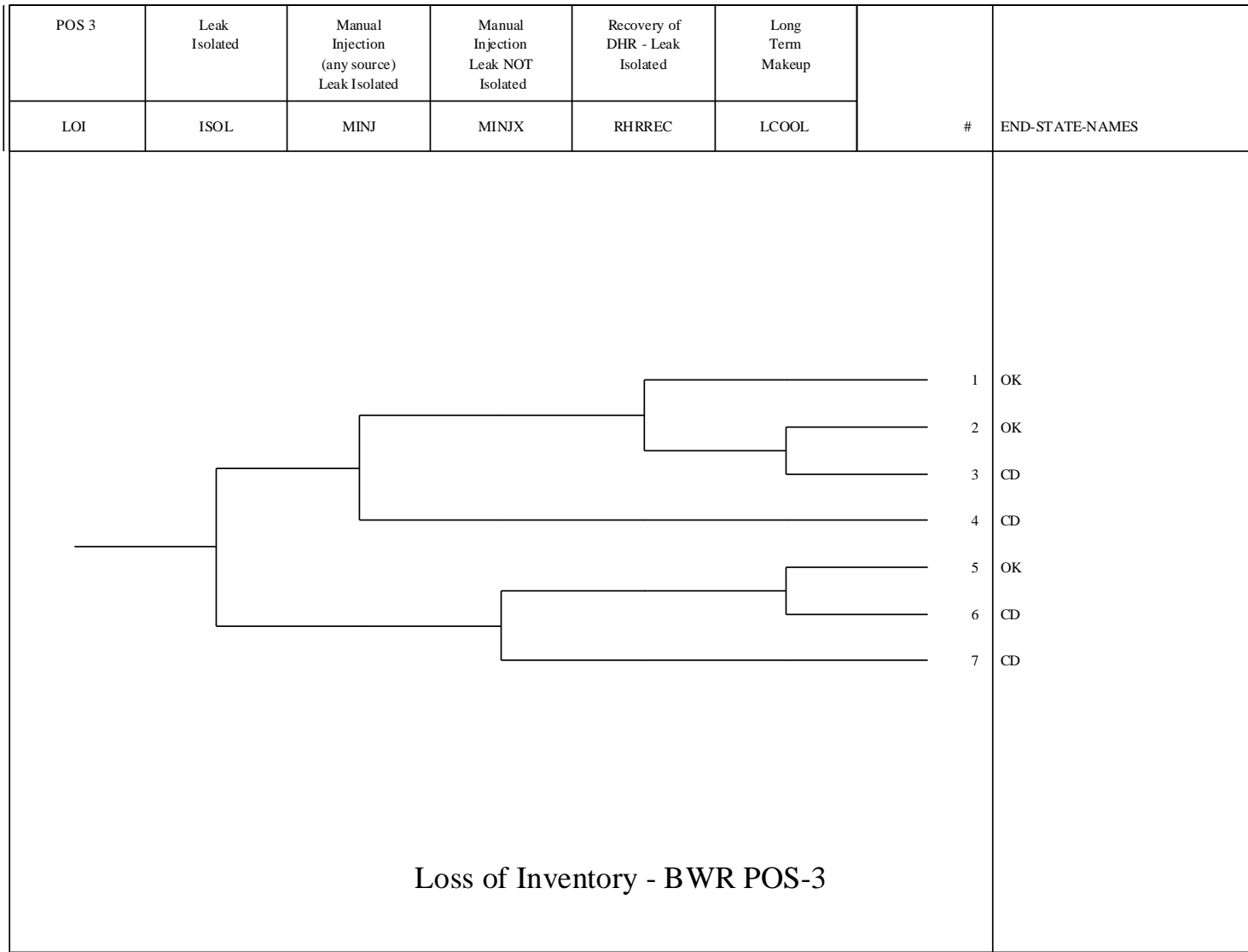


Figure 5 - Event Tree for Loss of Offsite Power- BWR POS - 1

	POS-1	Emergency AC	AC-Indep. Injection & Pressure Control	Recover AC in 8 hours	Recover AC in 20 hours before Battery Depletes and CD		
	LOOP	EAC	ACI&SRV	RLOOP8	RLOOP20	#	END-STATE-NAMES
Loss of Offsite Power - BWR POS-1							

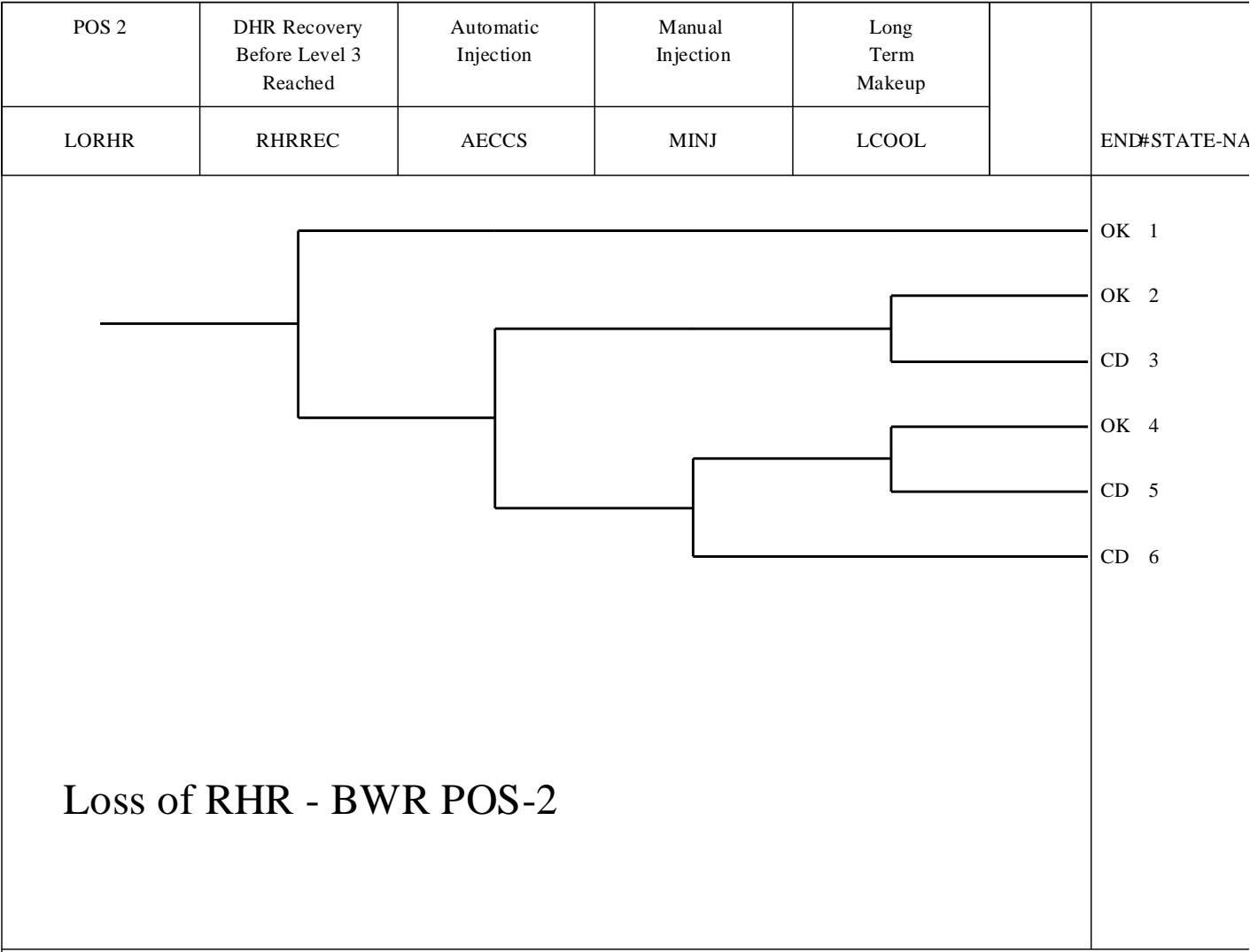
Figure 6 – Event Tree for Loss of Offsite Power – BWR POS 2

	POS-2	Emergency AC	AC-Indep. Injection	Recover AC in 8 hours	Recover AC in 20 hours before Battery Depletes and CD			
	LOOP	EAC	ACI	RLOOP8	RLOOP20	#	END-STATE-NAMES	
							1	LORHR
						2	OK	
						3	CD	
						4	OK	
						5	CD	
Loss of Offsite Power - BWR POS-2								

Figure 7 – Event Tree for Loss of RHR – BWR POS -1

POS 1	DHR Recovery before RHR shutoff head reached	Manual Injection and RCS Pressure Control	Manual High Pressure Injection at Pressure	Containment Venting and Make-up Water			
LORHR	RHRREC	MINJ&SRV	MINJY	CV	#	END-STATE-NAMES	
<p>Loss of RHR - BWR POS-1</p>							

Figure 8 – Event Tree for Loss of RHR – BWR POS 2



ATTACHMENT 1

Revision History for IMC 0609, Appendix G, Attachment 3

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML041470333 05/25/2004 CN 04-015	Initial Issue	None	N/A
N/A	ML050700185 02/28/2005 CN 05-007	Revised to revise the definition of available to consider a support system available if the support system can be placed in service within half the time the equipment is needed for operation; to revise the definition of Plant Operational State (POS) POS 1 and POS 2 to account for RCS being closed vs. operational mode (POS 1) and sufficient RCS vent path being available (POS 2); to revise BWR Loss of Inventory POS 2 and BWR Loss of RHR Event Trees that credit automatic ECCS when the inventory loss was automatically isolated; to revise Worksheet 5 to account for the RCS being vented as a condition for worksheet use and Worksheet 7 was revised to credit automatic ECCS when the inventory loss was automatically isolated		
N/A	ML19102A206 01/08/20 CN 20-004	<p>Re-formatted the layout to conform with the current standards in IMC-0040 and a general editorial cleanup designed to make the procedure easier to use.</p> <p>Removed historical information regarding SRM to SECY 97-168 in the Purpose Section that no longer had value being in this document.</p> <p>Removed the language from section 01.01 regarding multiple performance deficiencies and referring to Appendix A. The guidance for those situations is in IMC 0308 Attachment 3.</p>	N/A	ML19156A186

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
		<p>Replaced the term performance deficiency with findings throughout this procedure.</p> <p>Added a sentence that a headquarters risk analyst can also perform Phase 2.</p> <p>Added language to section 2.01 that Phase 2 is a reasonably conservative analysis and a risk analyst or SRA can always do a Phase 3 evaluation if they feel the risk is not adequately being captured in a Phase 2.</p> <p>Edited definitions so that the definitions are consistent with what is contained in IMC 0609, Appendix G.</p> <p>Revised the definition for Shutdown Operations to align it with the scope of Appendix G.</p> <p>Deleted a caution in step 4.1 about availability and another caution about standby injection since they are redundant and had already been mentioned in precaution section.</p> <p>Table 7, the Counting Rule Worksheet, was added to this procedure. And clarified that the color significance of the finding is determined using the counting rule worksheet.</p> <p>A typo is corrected in step 4.5.2. The correct value should be 0.</p>		

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		<p>Revised the statement under section 2.01 Limits to let analysts know that this procedure is a reasonably conservative, order-of-magnitude assessment and that a more detailed Phase 3 may be performed.</p> <p>A new item was added to section 02.02 Precautions to alert analysts that it is possible for the procedure to generate HEP values below the levels recommended in the RASP manuals and analysts should be aware of this issue and that a Phase 3 detailed risk evaluation is an option if they feel the risk is not being adequately captured.</p> <p>Revised the definition for a LOOP under initiating events to remove the statement that LOOP events are not assessed in POS 3, since there could be times that they are still assessed.</p> <p>The first column of each worksheet was renamed. Instead of “safety functions needed” the new wording is “top event function”. This was done to be consistent with the step instructions in this procedure and also with the terminology in Appendix G, Attachment 2, it also better describes the column since users of the procedure will be referring to the top event from the associated event trees.</p> <p>Removed the language from section 01.01 regarding multiple performance deficiencies and referring to Appendix A. The guidance for those situations is in IMC 0308 Attachment 3.</p> <p>Step 4.3.8 the word preliminary was added to make it clear any color significance assigned by a Phase 2 assessment is only preliminary.</p>		0609G2-1933 ML19112A189