Exercise 1

The Generic PWR Risk-Informed Inspection Notebook will be used for this example. Consider a hypothetical inspection finding that involves the failure of the licensee to identify a 180 degree circumferential crack on a weld on a 2 inch line connected to the reactor coolant system. Evidence of the crack remained unidentified for four months. The inspectors determined that a small loss of coolant accident would result if this weld failed. Assume that recovery credit is not appropriate for the circumstances surrounding this hypothetical finding.

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

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

Table 1 - Categories of Initiating Events for Generic PWR Nuclear Power Plant

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
I	> 1 per 1-10 yr	Loss of Power Conversion System (TPCS)	1	2	3
II	1 per 10-10^2 yr	Loss of offsite power (LOOP), Loss of Class 1E 125V DC Bus A or B (LODC)	2	3	4
III	1 per 10^2 - 10^3 yr	Steam Generator Tube Rupture (SGTR), Stuck open PORV/SRV (SORV), Small LOCA including RCP seal failures **(SLOCA)**, Main Steam Line Break Outside Containment (MSLB)	3	4	5
IV	1 per 10^3 - 10^4 yr	Medium LOCA (MLOCA), LOOP with Loss of One Class 1E 4.16-kV Bus (LEAC)	4	5	6
V	1 per 10^4 - 10^5 yr	Large LOCA (LLOCA), Loss of Component Cooling Water (LCCW)	5	6	7
VI	less than 1 per 10^5 yr	ATWS(1)	6	7	8
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

Notes

Table 3.2 SDP Worksheet for Generic PWR Nuclear Power Plant — Small LOCA (SLOCA)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Early Inventory, HP Injection (EIHP)	1/3 HHSI pumps (1 multi-train system)
Secondary Heat Removal (AFW)	1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train)
Primary Heat Removal, Feed/Bleed (FB)	2/2 PORVs open for Feed/Bleed (operator action = 2)
Low Pressure Injection (LPI)	1/3 LHSI pumps (1 multi-train system)
Low Pressure Recirculation (LPR)	1/3 LHSI pumps with associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow from CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 **SLOCA - LPR** (2,4,7) 3 + 3	6	2	3	0	5
2 **SLOCA - AFW - FB** (5) 3 + 4 + 2	9	2	4 + 2	0	8
3 **SLOCA - EIHP** (8) 3 + 3	6	2	3	0	5

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.

Counting Rule Worksheet

Step	Instructions		
(1)	Enter the number of sequences with a risk significance equal to 9.	(1)	0
(2)	Divide the result of Step (1) by 3 and round down.	(2)	**0**
(3)	Enter the number of sequences with a risk significance equal to 8.	(3)	**1**
(4)	Add the result of Step (3) to the result of Step (2).	(4)	**1**
(5)	Divide the result of Step (4) by 3 and round down.	(5)	**0**
(6)	Enter the number of sequences with a risk significance equal to 7.	(6)	**0**
(7)	Add the result of Step (6) to the result of Step (5).	(7)	**0**
(8)	Divide the result of Step (7) by 3 and round down.	(8)	**0**
(9)	Enter the number of sequences with a risk significance equal to 6.	(9)	0
(10)	Add the result of Step (9) to the result of Step (8).	(10)	**0**
(11)	Divide the result of Step (10) by 3 and round down.	(11)	**0**
(12)	Enter the number of sequences with a risk significance equal to 5.	(12)	**2**
(13)	Add the result of Step (12) to the result of Step (11).	(13)	**2**
(14)	Divide the result of Step (13) by 3 and round down.	(14)	**0**
(15)	Enter the number of sequences with a risk significance equal to 4.	(15)	**0**
(16)	Add the result of Step (15) to the result of Step (14).	(16)	**0**

- 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**

Exercise 2

Scenario

Use the Generic PWR Risk-Informed Inspection Notebook for this exercise. While performing a complete system walkdown of the high head safety injection (HHSI) system in accordance with Inspection Procedure 71111.04, "Equipment Alignment," an inspector identified that a normally locked open manual valve in the discharge flow path of one train was closed. The valve position for this valve was not indicated in the control room. This valve was also not in the flow path during quarterly surveillance testing of the system. It was subsequently determined that the valve had been out of position since maintenance was last performed on the system ten months prior. The inspectors determined that the criteria for crediting operator recovery of the HHSI train were satisfied and that credit for recovery of the train was appropriate.

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

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

Table 2 Initiators and System Dependency for Generic PWR Nuclear Power Plant ¶

¶

Affected Systems	Major Components	Support Systems	Initiating Event Scenarios
Engineered Safeguards Features Actuation System (ESFAS)	Three actuation trains, each with a load sequencer	120V vital AC, DC	All
Essential Cooling Water System (ECWS)	Three trains, each with one pump	4.16-kV, 480V (for MOVs), DC, ESFAS	All
High Head Safety Injection (HHSI) System	Three pumps (800 gpm @1275 psi, shutoff head = 1650 psid)	4.16-kV, 480V, DC, ESFAS, SI pump room cooling[8]	**All except LLOCA, ATWS, LODC**
Instrument Air (IA)	Two IA compressors (per unit). Back up is two station air compressors	Offsite power, BOP diesel[5]	LOIA
Low Head Safety Injection (LHSI) System	Three pumps	4.16-kV, 480V, DC, ESFAS, SI pump room cooling[8]	All except ATWS, LOCW, LODC
Main Steam Isolation System	For each steam generator: one MSIV [FW isolation and Control Valves[10]]	Offsite power and IA, DC, ESFAS	SGTR, MSLB
	For each steam generator: one PORV	480V, DC, 120V vital AC	All except LLOCA, and MLOCA
	For each steam generator: five safety relief valves	None	TPCS, LOOP, ATWS, LEAC

Table 1 - Categories of Initiating Events for Generic PWR Nuclear Power Plant

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
I	> 1 per 1-10 yr	**Loss of Power Conversion System (TPCS)**	**1**	2	3
II	1 per 10-10^2 yr	**Loss of offsite power (LOOP)**, Loss of Class 1E 125V DC Bus A or B (LODC)	**2**	3	4
III	1 per 10^2 - 10^3 yr	**Steam Generator Tube Rupture (SGTR), Stuck open PORV/SRV (SORV), Small LOCA including RCP seal failures (SLOCA), Main Steam Line Break Outside Containment (MSLB)**	**3**	4	5
IV	1 per 10^3 - 10^4 yr	**Medium LOCA (MLOCA), LOOP with Loss of One Class 1E 4.16-kV Bus (LEAC)**	**4**	5	6
V	1 per 10^4 - 10^5 yr	Large LOCA (LLOCA), **Loss of Component Cooling Water (LCCW)**	**5**	6	7
VI	less than 1 per 10^5 yr	ATWS(1)	**6**	7	8
			> 30 days	**3-30 days**	**< 3 days**

Table 3.1 SDP Worksheet for Generic PWR Nuclear Power Plant — Transients with Loss of PCS (TPCS) (1)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Secondary Heat Removal (AFW)	1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with (1/1 SG PORV or 1/5 safety relief valves) per SG that is fed by AFW
High Pressure Injection for FB (EIHP)	**1/3 HHSI pumps (1 multi-train system)**
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2) (2)
High Pressure Recirculation (LPR)	1/3 LHSI trains and with associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow aligned to CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 TPCS - AFW - LPR (3) 1 + 4 + 3	8				
2 TPCS - AFW - FB (4) 1 + 4 +2	7				
3 TPCS - AFW - **EIHP** (5) 1 + 4 + 3	8	1	4 + 3	1	9

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

Operator open manual valve.

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.

Table 3.2 SDP Worksheet for Generic PWR Nuclear Power Plant — Small LOCA (SLOCA)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Early Inventory, HP Injection (EIHP) **Secondary Heat Removal (AFW)** **Primary Heat Removal, Feed/Bleed (FB)** **Low Pressure Injection (LPI)** **Low Pressure Recirculation (LPR)**	**1/3 HHSI pumps (1 multi-train system)** 1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) 2/2 PORVs open for Feed/Bleed (operator action = 2) 1/3 LHSI pumps (1 multi-train system) 1/3 LHSI pumps with associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow from CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 SLOCA - LPR (2,4,7) 3 + 3	6				
2 SLOCA - AFW - FB (5) 3 + 4 + 2	9				
3 SLOCA - **EIHP** (8) 3 + 3	6	**3**	**3**	**1**	**7**

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

Operator open manual valve

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.

Table 3.3 SDP Worksheet for Generic PWR Nuclear Power Plant — Stuck Open PORV (SORV)[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Isolation of Small LOCA (BLK) **Early Inventory, HP Injection (EIHP)** **Secondary Heat Removal (AFW)** **Primary Heat Removal, Feed/Bleed (FB)** **Low Pressure Injection (LPI)** **Low Pressure Recirculation (LPR)**	The closure of the block valve associated with stuck open PORV (operator action = 2) [2] **1/3 HHSI pumps (1 multi-train system)** 1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) 1/1 remaining PORVs open for Feed/Bleed (operator action = 2) 1/3 LHSI pumps (1 multi-train system) 1/3 LHSI pumps with associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow from CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 SORV - BLK - LPR (2, 4, 7) **3 + 2 + 3**	**8**				
2 SORV - BLK - AFW - FB (5) **3 + 2 + 4 + 2**	**11**				
3 SORV - BLK - EIHP (8) **3 + 2 + 3**	**8**	**3**	**2 + 3**	**1**	**9**

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

Operator open manual valve

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.

Table 3.4 SDP Worksheet for Generic PWR Nuclear Power Plant — Medium LOCA (MLOCA)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Early Inventory, HP Injection (EIHP) **Low Pressure Injection (LPI)** **Low Pressure Recirculation (LPR)**	**½ remaining HHSI trains (1 multi-train system)(2)** ½ remaining LHSI trains (1 multi-train system) ½ remaining LHSI trains with associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow from CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 MLOCA - LPR (2) **4 + 3**	7				
2 MLOCA - LPI (3) **4 + 3**	7				
3 MLOCA - **EIHP** (4) **4 + 3**	7	**4**	**2**	**1**	**7**

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

Operator open manual valve

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.

Table 3.6 SDP Worksheet for Generic PWR Nuclear Power Plant — Loss of Offsite Power (LOOP)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Emergency AC Power (EAC)	1/3 Standby Diesel Generators (1 multi-train system)
Secondary Heat Removal (TDAFW)	1/1 TDAFW pump (1 ASD train) with 1/ 5 safety relief valves per SG that is fed by AFW
Secondary Heat Removal (AFW)	1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train)
Recovery of AC Power in < 2 hrs (REC2)	Recovery of AC power (operator action = 1)[1]
Recovery of AC power in < 5 hrs (REC5)	Recovery of AC power (operator action = 2)[3, 4]
Early Inventory, HP Injection (EIHP)	**1/3 HHSI pumps (1 multi-train system)**
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2)
Low Pressure Recirculation (LPR)	1/3 LHSI trains and with the associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow aligned to CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 LOOP - AFW - LPR (3) 2 + 4 + 3	9				
2 LOOP - AFW - FB (4) 2 + 4 + 2	8				
3 LOOP - AFW - **EIHP** (5) 2 + 4 + 3	9	2	4 + 3	1	10
4 LOOP - EAC - LPR (7, 11) 2 + 3 + 3 (AC Recovered)	8				
5 LOOP - EAC - **EIHP** (8, 13) 2 + 3 + 3	8	2	3 + 3	1	9
6 LOOP - EAC - REC5 (9) 2 + 3 + 2	7				
7 LOOP - EAC - TDAFW - FB (12) 2 + 3 + 1 + 2 (AC Recovered)	8				
8 LOOP - EAC - TDAFW - REC2 (14) 2 + 3 + 1 + 1	7				

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

Table 3.7 SDP Worksheet for Generic PWR Nuclear Power Plant — Steam Generator Tube Rupture (SGTR) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Secondary Heat Removal (AFW)	1/3 MDAFW trains (1 multi-train system) [2]
Early Inventory, HP Injection (EIHP)	**1/3 HHSI pumps (1 multi-train system)**
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2)
Pressure Equalization (EQ)	Operator depressurizes RCS to less than setpoint of relief valve of SG using 1/3 pressurizer spray valves or 2/2 pressurizer PORVs (operator action = 2)
Isolation of Faulted SG (ISOL)	Operator isolates the faulted SG by closing 1/1 MSIV and associated Feedwater Isolation Valve (operator action = 2)
Cooldown and depressurization (DEPR)	Operator cools down and depressurizes the RCS using 1/4 SG PORVs or ½ pressurizer PORVs (operator action = 2)
Low Pressure Recirculation (LPR)	1/3 LHSI trains and with the associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow aligned to CCW (1 multi-train system)
Low Pressure Injection (SDC)	1/3 RHR trains (pumps & HXs) and ½ charging pumps (operator action = 3) [3]

Circle Affected Functions		EL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 SGTR - EQ - ISOL (3) 3 + 2 + 2	7				
2 SGTR - **EIHP** - SDC (5) 3 + 3 + 3	9	3	3 + 3	1	10
3 SGTR - **EIHP** - DEPR (6) 3 + 3 + 2	8	3	3 + 2	1	9
4 SGTR - **EIHP** - EQ (7) 3 + 3 + 2	8	3	3 + 2	1	9
5 SGTR - AFW - LPR (9) 3 + 3 + 3	9				
6 SGTR - AFW - ISOL (10) 3 + 3 + 2	8				
7 SGTR - AFW - FB (11) 3 + 3 + 2	8				
8 SGTR - AFW - **EIHP** (12) 3 + 3 + 3	9	3	3 + 3	1	10

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

Operator open manual valve

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.

Table 3.9 SDP Worksheet for Generic PWR Nuclear Power Plant — Main Steam Line Break Outside Containment (MSLB)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
MSLB Isolated (MSIV)[1]	3/4 MSIVs close [failure means at least 2 MSIVs failed] (1 multi-train)
High Pressure Injection (EIHP)	**1/3 HHSI pumps (1 multi-train system)**
Secondary Heat Removal (AFW)	1/3 MDAFW trains (1 multi-train system)
Feedwater valves close (FWVC)	Isolation of the feed to the SG whose MSIV did not close by auto trip of MFW pumps or isolation of MFW line, and operators close the valves feeding the SG from AFW, or trip of the AFW pump (operator action =2) [2]
Stop Injection (STIN)	Operators stop high pressure injection (operator action = 1) [3]
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2)
High Pressure Recirculation (LPR)	1/3 LHSI pumps and with the associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow aligned to CCW (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 MSLB - FWVC - STIN (3) **3 + 2 + 1**	**6**				
2 MSLB - AFW - LPR (5) **3 + 3 + 3**	**9**				
3 MSLB - AFW - FB (6) **3 + 3 + 2**	**8**				
4 MSLB - **EIHP** - FWVC (8) **3 + 3 + 2**	**8**	**3**	**3 + 2**	**1**	**9**
5 MSLB - **EIHP** - AFW (9) **3 + 3 + 3**	**9**	**3**	**3 + 3**	**1**	**10**
6 MSLB - MSIV (10) **3 + 3**	**6**				

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

Operator open manual valve

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.

Table 3.10 SDP Worksheet for Generic PWR Nuclear Power Plant — Loss of Component Cooling Water (LCCW) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
RCP Trip (RCP) Seal Injection using PDP (PDP) High Pressure Injection (EIHP) Secondary Heat Removal (AFW)	Operator trips the RCPs to prevent a seal LOCA (operator action = 2) [2] Operator starts PDP for seal injection (operator action = 2) [2] 1/3 HHSI trains (1 multi-train system) 1/3 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 LCCW - AFW (2) 5 + 4	9				
2 LCCW -- EIHP (3) 5 + 3	8	5	3	1	9
3 LCCW - RCP (4) 5 + 2	7				

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

Operator open manual valve

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.

Table 3.12 SDP Worksheet for Generic PWR Nuclear Power Plant — LOOP and Loss of One Class 1E 4.16-kV Bus (LEAC)[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
PORV Recloses (PORV)	2/2 Pressurizer PORVs reclose after opening during transient (1 train)
Secondary Heat Removal (AFW)	½ MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with 1/5 safety relief valve per SG that is fed by AFW
High Pressure Injection for FB (EIHP)	**½ HHSI pumps (1 multi-train system)**
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2)
Low Pressure Recirculation (LPR)	½ LHSI pumps with (associated ½ RHR heat exchangers or 2/4 RCFCs with cooling flow aligned to CCW) (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 LEAC - AFW - LPR (3) 4 + 4 + 3	11				
2 LEAC - AFW - FB (4) 4 + 4 +2	10				
3 LEAC - AFW - **EIHP** (5) 4 + 4 + 3	11	4	4 + 2	1	11
4 LEAC - PORV - LPR (7) 4 + 2 + 3	9				
5 LEAC - PORV - **EIHP** (8) 4 + 2 + 3	9	4	2 + 2	1	9
6 LEAC - PORV - AFW (9) 4 + 2 + 4	10				

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

Operator open manual valve

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.

Counting Rule Worksheet

Step	Instructions		
(1)	Enter the number of sequences with a risk significance equal to 9.	(1)	8
(2)	Divide the result of Step (1) by 3 and round down.	(2)	2
(3)	Enter the number of sequences with a risk significance equal to 8.	(3)	0
(4)	Add the result of Step (3) to the result of Step (2).	(4)	2
(5)	Divide the result of Step (4) by 3 and round down.	(5)	0
(6)	Enter the number of sequences with a risk significance equal to 7.	(6)	2
(7)	Add the result of Step (6) to the result of Step (5).	(7)	2
(8)	Divide the result of Step (7) by 3 and round down.	(8)	0
(9)	Enter the number of sequences with a risk significance equal to 6.	(9)	0
(10)	Add the result of Step (9) to the result of Step (8).	(10)	0
(11)	Divide the result of Step (10) by 3 and round down.	(11)	0
(12)	Enter the number of sequences with a risk significance equal to 5.	(12)	0
(13)	Add the result of Step (12) to the result of Step (11).	(13)	0
(14)	Divide the result of Step (13) by 3 and round down.	(14)	0
(15)	Enter the number of sequences with a risk significance equal to 4.	(15)	0
(16)	Add the result of Step (15) to the result of Step (14).	(16)	0

- 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**

Exercise 3

Scenario

Use the Generic BWR Risk-Informed Inspection Notebook for this exercise. The "A" instrument air (IA) compressor seized shortly after it was started for periodic rotation of the operating equipment. It was subsequently determined that the compressor seized because of improperly performed preventive maintenance which had been conducted two days prior. The IA system is a normally cross-tied support system. The inspectors determined that the criteria for crediting operator recovery of the IA compressor were not satisfied and that credit for recovery of the compressor was not appropriate.

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

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

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

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Affected System		Major Components	Support Systems	Initiating Event Scenarios
Code	Name			
DGCW	Diesel generator Cooling Water	Pumps	480 V-AC	All
SW	Service water	5 pumps in Unit 1/ 2 Crib house; shared system supplying a common header	4160 V-AC, 125 V-DC, IA	LOSW
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	SW, 480V AC	**LOIA**

Table 1 - Categories of Initiating Events for Generic BWR Nuclear Power Plant

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
I	> 1 per 1-10 yr	Transient (Reactor Trip) (TRAN), Loss of Power Conversion System (Loss of condenser, Closure of MSIVs, Loss of feedwater) (TPCS)	1	2	3
II	1 per 10-10^2 yr	Loss of offsite power (LOOP), Inadvertent or stuck open SRVs (IORV), **Loss of Instrument Air (LOIA)**	2	3	4
III	1 per 10^2-10^3 yr	Loss of Service Water (LOSW), Loss of an AC Bus (LOAC)	3	4	5
IV	1 per 10^3-10^4 yr	Small LOCA (RCS rupture) (SLOCA), Medium LOCA (RCS rupture) (MLOCA)	4	5	6
V	1 per 10^4-10^5 yr	Large LOCA (RCS rupture) (LLOCA), ATWS	5	6	7
VI	less than 1 per 10^5 yr	ISLOCA, Vessel rupture	6	7	8
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

Table 3.4 SDP Worksheet for Generic BWR — Loss of Instrument Air (LOIA)[1,2]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
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 1/2 trains in LPCI Mode (1 multi-train system) or 1/2 LPCS trains (1 multi-train system)
Containment Heat Removal (CHR)	1/4 RHR pumps in 1/2 trains with heat exchangers and 1/4 RHRSW pumps in SPC (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 **LOIA** - CHR (2,4) 2 + 3	5	3	3	0	6
2 **LOIA** - HPI - LPI (5) 2 + 2 + 6	10	3	2 + 6	0	11
3 **LOIA** - HPI - DEP (6) 2 + 2 + 2	6	3	2 + 2	0	7

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

None

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.

Exercise 4

The Saint Lucie Nuclear Power Plant Unit 1 Risk-Informed Inspection Notebook will be used for this example. Consider a hypothetical inspection finding that involves the unavailability of the "B" component cooling water (CCW) pump for 2 days. At Saint Lucie, the CCW system is a split train support system. Assume that recovery credit is appropriate for the circumstances surrounding this hypothetical finding.

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

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

Table 2 Initiators and System Dependency St. Lucie Nuclear Power Plant, Unit 1 [1,2]

Affected Systems	Major Components	Support Systems	Initiating Event Scenarios
AC Power System (AC)	AC Power Distribution (two safety related buses), AC Instrument Power, and fast transfer	DC, HVAC[3]	All
Auxiliary Feedwater (AFW)	Two MDPs (one per SG) with normally closed cross-connections, Unit 1 condensate storage tank (UICST)	AC, ESFAS, DC	All except MLOCA and LLOCA
	One TDP to both SGs, UICST	ESFAS, DC, Main Steam	
Long Term AFW Make up	Automatic CST make up from demineralized water through an air operated valve LCV-12-9	IA backed by EDG	
	AFW cross tie to Unit 2 CST through a manual valve	None	
	CST make up from Treated Water Storage Tank (TWST) through TWST pumps and manual valves	Non safety related AC	
CCW	Three pumps in two trains with one CCW heat exchanger in each train and the third pump as a swing pump	AC, ESFAS, ICW, DC	**All except LICW**
Condensate / MFW	Three Condensate pumps	AC, DC, TCW	TRANS, LCCW, SLOCA
	Two MFW pumps	AC, DC, IA, TCW	
Containment Cooling System (CCS)	Four fan coolers	AC, ESFAS, *CCW*	All except LCCW and LICW
Containment Spray System	Two trains with normally closed cross-	AC, DC, ESFAS,	All except LCCW

Table 1 Categories of Initiating Events for St. Lucie Nuclear Power Plant, Unit 1

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
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**), Loss of Instrument Air (**LIA**)	2	3	**4**
III	1 per 10^2 - 10^3 yr	Steam Generator Tube Rupture (**SGTR**), Stuck open PORV/SRV (**SORV**), Small LOCA including RCP seal failures (**SLOCA**), Main Steam Line Break (**MSLB**)	3	4	**5**
IV	1 per 10^3 - 10^4 yr	Medium LOCA (**MLOCA**), Loss of CCW (**LCCW**), Loss of ICW (LICW), Loss of a DC Bus (**LDCBUS**)	4	5	**6**
V	1 per 10^4 - 10^5 yr	Large LOCA (**LLOCA**)	5	6	**7**
VI	less than 1 per 10^5 yr	**ATWS**, Interfacing System LOCA (ISLOCA)	6	7	**8**
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

Table 3.1 SDP Worksheet for St. Lucie, Unit 1 — Transients (Reactor Trip) (TRANS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Power Conversion System (PCS)	1/ 2 Main Feedwater trains and 1/3 condensate pumps (operator action = 3) (1)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (2)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operator action = 2) (4)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 TRANS - PCS - LTAFWMU - SDC - CHR(5) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 2 + 2	1	16
2 TRANS - PCS - LTAFWMU - SDC - HPR (6) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 2 + 2	1	16
3 TRANS - PCS - LTAFWMU - SDC - HPSI (7) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 3 + 2	1	17

2 TRANS - PCS - LTAFWMU - SDC - HPR (6) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 2 + 2	1	16
3 TRANS - PCS - LTAFWMU - SDC - HPSI (7) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 3 + 2	1	17
4 TRANS - PCS - LTAFWMU - SDC - FB1 (8) 1 + 3 + 5 + 2 + 2	13	3	3 + 5 + 2 + 2	1	16
5 TRANS - PCS - AFW - CHR (10) ■ 1 + 3 + 4 + 3	11	3	3 + 4 + 2	1	13
6 TRANS - PCS - AFW - HPR (11) ■ 1 + 3 + 4 + 3	11	3	3 + 4 + 2	1	13
7 TRANS - PCS -AFW - HPSI (12) ■ 1 + 3 + 4 + 3	11	3	3 + 4 + 2	1	13
8 TRANS - PCS - AFW - FB (13) ■ 1 + 3 + 4 + 2	10				

Table 3.2 SDP Worksheet for St. Lucie, Unit 1 — Transients without PCS (TPCS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (1)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from trains Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers (operator action = 2) (3)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 TPCS - LTAFWMU - SDC - CHR (4) 1 + 5 + 2 + 3	11	3	5 + 2 + 2	1	13
2 TPCS - LTAFWMU - SDC - HPR (5) 1 + 5 + 2 + 3	11	3	5 + 2 + 2	1	13
3 TPCS - LTAFWMU - SDC - HPSI (6) 1 + 5 + 2 + 3	11	3	5 + 2 + 2	1	13

4 TPCS - LTAFWMU - SDC - FB1 (7) 1 + 5 + 2 + 2	10	3	5 + 2 + 2	1	13
5 TPCS - AFW - CHR (9)■ 1 + 4 + 3	8	3	4 + 2	1	10
6 TPCS - AFW - HPR (10) ■ 1 + 4 + 3	8	3	4 + 2	1	10
7 TPCS -AFW -HPSI (11) ■ 1 + 4 + 3	8	3	4 + 2	1	10
8 TPCS - AFW - FB (12) ■ 1 + 4 + 2	7				

Table 3.3 SDP Worksheet for St. Lucie, Unit 1 — Small LOCA (SLOCA) (1/ 2"<D<3") [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Secondary Heat Removal (SHR)	1/ 2 Main Feedwater trains and 1/3 condensate pumps (operator action = 1) [2] or 1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Feed and Bleed (FB)	2/2 PORV (operator action = 2) [3]
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers with long term AFW makeup and RCS makeup from BAM tanks and SITs (operator action = 2) [4]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation modes (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SLOCA - SDC - HPR (3) ■ 3 + 2 + 3	8	5	2 + 2	1	10
2 SLOCA - SDC - CHR (4) ■ 3 + 2 + 3	8	5	2 + 2	1	10
3 SLOCA - HPSI (5, 10) ■ 3 + 3	6	5	2	1	8

4 SLOCA - SHR - HPR (7) ■ 3 + 5 + 3	11	5	5 + 2	1	13
5 SLOCA - SHR - CHR (8) ■ 3 + 5 + 3	11	5	5 + 2	1	13
6 SLOCA - SHR - FB (9) ■ 3 + 5 + 2	10				

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:■

Table 3.4 SDP Worksheet for St. Lucie, Unit 1 — Stuck Open Relief Valve (SORV)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Isolation (BLK)	Operator closes the block valve (1 train) (1)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Feed and Bleed (FB)	Operator conducts FB using the remaining 1/1 PORV (operator action = 2) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers and long term AFW makeup and RCS makeup from BAM tanks and SITs (operator action = 2) (3)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SORV - BLK - SDC - HPR (4) 3 + 2 + 2 + 3	10	5	2 + 2 + 2	1	12
2 SORV - BLK - SDC - CHR (5)	10	5	2 + 2 + 2	1	12
3 SORV - BLK - HPSI (6,11) 3 + 2 + 3	8	5	2 + 2	1	10
4 SORV - BLK - AFW - HPR (8)	12	5	2 + 4 + 2	1	14
5 SORV - BLK - AFW - CHR (9)	12	5	2 + 4 + 2	1	14
6 SORV - BLK - AFW - FB (10)	11				

Table 3.5 SDP Worksheet for St. Lucie, Unit 1 — Medium LOCA (MLOCA) (3"<D<5")[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode[2] (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 MLOCA - CHR (2)■ 4 + 3	■ 7	6	2	1	9
2 MLOCA - HPR (3) ■ 4 + 3	7	6	2	1	9
3 MLOCA - HPSI (4) ■ 4 + 3	7	6	2	1	9

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

■

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■

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.

Table 3.6 SDP Worksheet for St. Lucie, Unit 1 — Large LOCA (LLOCA) (D > 5")

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Safety Injection Tank (SIT)	3/3 unaffected SITs (1 train)
Low Pressure Safety Injection (LPSI)	1/ 2 LPSI trains (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode(1) (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LLOCA - CHR (2) 5 + 3	8	7	2	1	10
2 LLOCA - HPR (3) 5 + 3	8	7	2	1	10
3 LLOCA - LPSI (4) 5 + 3	8	7	2	1	10
4 LLOCA - SIT (5) 5 + 2	7				

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

Table 3.7 SDP Worksheet for St. Lucie, Unit 1 — Loss of Offsite Power (LOOP) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Emergency Diesel Generator (EDG)	1/ 2 Emergency Diesel Generators (1 multi-train system) or crosstie other unit EDG (operator action=1) [2]
Turbine-driven AFW pump (TDAFW)	1/1 TDP trains of AFW (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Recovery of AC Power in < 2 hrs (REC2)	(Operator action = 1) [3]
Auxiliary Feedwater (AFW)	[1/ 2 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with steam relief through 1/ 2 ARVs or 1/16 safety valves] with [long term AFW make up from demineralized water or unit 2 CST [4]]
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Recovery of AC Power in < 7 hrs (REC7)	Recovery of offsite power and establishment of long term AFW make up from demineralized water or unit 2 CST(Operator action = 2) [5]
Feed and Bleed (FB)	2/2 PORV (operator action = 2) [6]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or ½ containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LOOP - AFW - CHR (3) ■ 2 + 4 + 3	9	4	4 + 2	1	11
2 LOOP - AFW - HPR (4) ■ 2 + 4 + 3	9	4	4 + 2	1	11
3 LOOP - AFW - FB (5) ■ 2 + 4 + 2	8				

4 LOOP - AFW - HPSI (6) ■ 2 + 4 + 3	9	4	4 + 2	1	11
5 LOOP - EDG - REC7 (8) ■ 2 + 4 + 2	8				
6. LOOP - EDG - TDAFW - CHR (10) ■ 2 + 4 + 1 + 3	10	4	4 + 1 + 2	1	12
7 LOOP - EDG - TDAFW - HPR (11) ■ 2 + 4 + 1 + 3	10	4	4 + 1 + 2	1	12
8 LOOP - EDG - TDAFW - FB (12) ■ 2 + 4 + 1 + 2	9				
9 LOOP - EDG - TDAFW - HPSI (13) ■ 2 + 4 + 1 + 3	10	4	4 + 1 + 2	1	12

Table 3.8 SDP Worksheet for St. Lucie, Unit 1 — Steam Generator Tube Rupture (SGTR)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MDPs of AFW (1 multi-train system) or 1/1 TDP of AFW (1 ASD Train) to the unaffected SGs and steam relief through 1/1 ARV or 1/8 safety valves
Pressure Equalization (EQ)	Operator isolates the ruptured SG (MSIV, SG blowdown line, main steam bypass valve. AFW steam supply) and depressurizes RCS using SG RV and pressurizer spray to less than setpoint of SG relief valves (operator action = 3) (1)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection train (1 multi-train system)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2) (2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (2)
Long Term AFW Makeup (LTAFWMU)	Automatic make up from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator ■ action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operator ■ action = 2) (4)
Shutdown Cooling (SDC2)	1/ 2 LPSI trains with SDC heat exchangers with long term RCS makeup from BAM tanks using 1/3 charging pumps and SITs and ultimate isolation of the faulted SG (operator action = 2) (1, 4)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
High Pressure Recirculation (HPR2)	1/ 2 high pressure safety injection trains in recirculation mode with long term RCS makeup from BAM tanks and SITs via 1/3 charging pumps and ultimate isolation of the faulted SG (operator action = 3) (1)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SGTR - LTAFWMU - SDC - CHR (4) **3 + 5 + 2 + 3**	**13**	**5**	**5 + 2 + 2**	**1**	**15**

2 SGTR - LTAFWMU - SDC - HPR (5) 3 + 5 + 2	13	5	5 + 2 + 2	1	15
3 SGTR - LTAFWMU - SDC - FB1 (6) 3 + 5 + 2	12	5	5 + 2 + 2	1	15
4 SGTR - LTAFWMU - SDC - HPSI (7) 3 + 5 +	13	5	5 + 2 + 2	1	15
5 SGTR - EQ - SDC2 (9) ¶ 3 + 3 + 2	8	5	3 + 2	1	11
6 SGTR - EQ - HPSI (10) ¶ 3 + 3 + 3	9	5	3 + 2	1	11
7 SGTR - AFW - CHR (12) ¶ 3 + 4 + 3	10	5	4 + 2	1	12
8 SGTR - AFW - HPR2 (13) ¶ 3 + 4 + 3	10	5	4 + 2	1	12
9 SGTR - AFW - FB (14) ¶ 3 + 4 + 2	9				
10 SGTR - AFW - HPSI (15) ¶ 3 + 4 + 3	10	5	4 + 2	1	12

Table 3.9 SDP Worksheet for St. Lucie, Unit 1 — Anticipated Transients without Scram (ATWS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Turbine Trip (TTP)	Manually trip the turbine (operator action = 2)(1)
Auxiliary Feedwater System (AFW)	2/2 MDPs of AFW (1 train) or 1/1 TDP of AFW (1 ASD Train) to both SGs and steam relief through 2/2 ARVs or 2/16 safety valves
Primary Safety Valves Open (SRVO)	3/3 SRVs and 2/2 PORVs open (1 train)
Emergency Boration (EB)	Operator conducts emergency boration using 1/3 charging pumps from boric acid tank (operator action = 2)(2)
Primary Safety Valves Reclose (SRVR)	3/3 SRVs and 2/2 PORVs reclose (1 train)
Long Term AFW Makeup (LTAFWMU)	Automatic make up from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operator action = 2) (4)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection train (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 ATWS - TTP (11) **6 + 2**	**8**				
2 ATWS - AFW (10) **6 + 3**	**9**				

2 ATWS - AFW (10) ■ 6 + 3	9				
3 ATWS - SRVO (9) ■ 6 + 2	8				
4 ATWS - EB (8) ■ 6 + 2	8				
5 ATWS - SRVR - HPSI (7) ■ 6 + 2 + 3	11	8	2 + 2	1	13
6 ATWS - SRVR - HPR (6) ■ 6 + 2 + 3	11	8	2 + 2	1	13
7 ATWS - SRVR - CHR (5) ■ 6 + 2 + 3■	11	8	2 + 2	1	13
8 ATWS - LTAFWMU - SDC (3)■ 6 + 5 + 2	13	8	5 + 2	1	16

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.

Table 3.10 SDP Worksheet for St. Lucie, Unit 1 — Main Steam Line Break Outside (MSLB)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Closure of 1 MSIV (MSIV)	Closure of ½ MSIVs (1 multi-train system)
Isolation of Feed to Faulted SG (ISOF)	Isolation of feedwater to the faulted SG (1 train)
Auxiliary Feedwater System (AFW)	1/1 MD AFW trains (1 train) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Injection (HPSI)	1/ 2 HPSI trains (1 multi-train system)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)(1)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (1)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and ½ LPSI trains with SDC heat exchangers (operator action = 2) (3)
High Pressure Recirculation (HPR)	1/ 2 high pressure recirculation trains (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 MSLB - LTAFWMU - SDC - CHR (4) 3 + 5 + 2 + 3	13	5	5 + 2 + 2	1	15
2 MSLB - LTAFWMU - SDC - HPR (5)	13	5	5 + 2 + 2	1	15
3 MSLB - LTAFWMU - SDC - FB1 (6)	12	5	5 + 2 + 2	1	15
4 MSLB - LTAFWMU - SDC - HPSI (7)	13	5	5 + 2 + 2	1	15
5 MSLB - AFW - CHR (9) 3 + 3 + 3	9	5	3 + 2	1	11

6 MSLB - AFW - HPR (10) 3 + 3 + 3	9	5	3 + 2	1	11
7 MSLB - AFW - FB (11) 3 + 3 + 2	8				
8 MSLB - AFW - HPSI (12) 3 + 3 + 3	9	5	3 + 2	1	11
9 MSLB - ISOF (13)	5				
10 MSLB - MSIV (14) 3 + 3	6				

Table 3.11 SDP Worksheet for St. Lucie, Unit 1 — Loss of a DC Bus (LDCBUS)[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Isolate Open PORV (ISO)	Closing the block valve (1 train) [2]
Auxiliary Feedwater System (AFW)	1/1 MD AFW trains (1 train) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/1 ARV and 1/16 safety valves
High Pressure Injection (HPSI)	1/1 HPSI trains (1 train)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) [3]
Shutdown Cooling (SDC)	1/ 2 charging pumps and 1/1 LPSI train with SDC heat exchangers with RCS makeup from BAM tanks and SITs (operator action = 2) [4]
High Pressure Recirculation (HPR)	1/1 high pressure recirculation train (1 train)
Containment Heat Removal (CHR)	2/2 fan coolers or 1/1 containment spray train (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LDCBUS - LTAFWMU - SDC (3) 4 + 5 + 2	11	6	5 + 0	1	12
2 LDCBUS - AFW (4,10) 4 + 3	7				
3 LDCBUS - ISO - SDC - CHR (7) 4 + 2 + 2 + 3	11	6	2 + 0 + 0	1	9
4 LDCBUS - ISO - SDC - HPR (8) 4 + 2 + 2 + 2	10	6	2 + 0 + 0	1	9
5 LDCBUS - ISO - HPSI (9) 4 + 2 + 2	8	6	2 + 0	1	9

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.

Table 3.12 SDP Worksheet for St. Lucie, Unit 1 — Loss of Instrument Air (LIA)[1]¶

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains(1 multi-train system) or 1/1 TD AFW train (1 ASD train) with 1/16 secondary safety valves
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action = 2) [2]
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) [2]
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU))	Align AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) [3]
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers; manual local action to open the heat exchanger outlet valve (operator action=2) [4]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LIA - LTAFWMU - SDC - CHR (4)■ **2 + 3 + 2 + 3**	**10**	**4**	**3 + 2 + 2**	**1**	**12**
2 LIA - LTAFWMU - SDC - HPR (5) **2 + 3 + 2**	**10**	**4**	**3 + 2 + 2**	**1**	**12**
3 LIA - LTAFWMU - SDC - HPSI (6) **2 + 3 +**	**10**	**4**	**3 + 2 + 2**	**1**	**12**
4 LIA - LTAFWMU - SDC - FB1 (7) **2 + 3 + 2 +**	**9**	**4**	**3 + 2 + 2**	**1**	**12**

5 LIA - AFW - CHR (9) 2 + 4 + 3	9	4	4 + 2	1	11
6 LIA - AFW - HPR (10) 2 + 4 + 3	9	4	4 + 2	1	11
7 LIA - AFW - HPSI (11) 2 + 4 + 3	9	4	4 + 2	1	11
8 LIA - AFW - FB (12) 2 + 4 + 2	8				

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.

Table 3.13 SDP Worksheet for St. Lucie, Unit 1 — Loss of Component Cooling Water (LCCW

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Tripping RCPs (RCPTRIP)	Operator trips RCPs to prevent a seal LOCA (operator action=3) (2)
Power Conversion System (PCS)	1/ 2 Main Feedwater trains (operator action = 3) (3)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Long Term AFW Makeup (LTAFWMU)	Automatic CST makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) (4)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LCCW - PCS - LTAFWMU (3) ■ 4 + 3 + 3	10	5	3 + 3	1	12
2 LCCW - PCS - AFW (4) ■ 4 + 3 + 4	11	5	3 + 4	1	13
3 LCCW - RCPTRIP (5) ■ 4 + 3	7	5	3	1	9

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.

Counting Rule Worksheet

Step	Instructions		
(1)	Enter the number of sequences with a risk significance equal to 9.	(1)	7
(2)	Divide the result of Step (1) by 3 and round down.	(2)	2
(3)	Enter the number of sequences with a risk significance equal to 8.	(3)	1
(4)	Add the result of Step (3) to the result of Step (2).	(4)	3
(5)	Divide the result of Step (4) by 3 and round down.	(5)	1
(6)	Enter the number of sequences with a risk significance equal to 7.	(6)	0
(7)	Add the result of Step (6) to the result of Step (5).	(7)	1
(8)	Divide the result of Step (7) by 3 and round down.	(8)	0
(9)	Enter the number of sequences with a risk significance equal to 6.	(9)	0
(10)	Add the result of Step (9) to the result of Step (8).	(10)	0
(11)	Divide the result of Step (10) by 3 and round down.	(11)	0
(12)	Enter the number of sequences with a risk significance equal to 5.	(12)	0
(13)	Add the result of Step (12) to the result of Step (11).	(13)	0
(14)	Divide the result of Step (13) by 3 and round down.	(14)	0
(15)	Enter the number of sequences with a risk significance equal to 4.	(15)	0
(16)	Add the result of Step (15) to the result of Step (14).	(16)	0

- 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

Exercise 5

Scenario

Use the Generic PWR Risk-Informed Inspection Notebook for this exercise. During an 18-month surveillance test, the 24 hour endurance run, the "B" diesel generator catastrophically failed 1.5 hours into the test. It was subsequently determined that the diesel generator failed because of improperly performed maintenance during the last overhaul of the diesel which had been performed during the last refueling outage. The "B" diesel generator successfully completed a 24 hour endurance run 18 months prior. The licensee had performed the required 1 hour monthly surveillance runs of the diesel generator since the last 24 hour endurance run. However, the monthly surveillance tests did not demonstrate that the "B" diesel generator would successfully perform its safety function for its mission time of 24 hours. The inspectors determined that the criteria for crediting operator recovery of the "B" diesel generator were not satisfied and that credit for recovery of the diesel generator was not appropriate.

1.6 Inspection Findings Involving Emergency Diesel Generators

For inspection findings that involve the unavailability of emergency diesel generators (EDGs), increase the Initiating Event Likelihood by two orders of magnitude for the loss of offsite power with loss of one AC bus (LEAC) special initiator, if applicable at the affected plant. 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.

Table 2 Initiators and System Dependency for Generic PWR Nuclear Power Plant

Affected Systems	Major Components	Support Systems	Initiating Event Scenarios
Auxiliary Feedwater (AFW)	Three MDPs[1,2]	4.16-kV, DC, ESFAS, dedicated room cooling	All except MLOCA, LLOCA
	One TDP[2]	DC, ESFAS	All except MLOCA, LLOCA, SGTR, MSLB
	Feedwater isolation valves for MDPs	480V	SGTR, MSLB
	Feedwater isolation valve for TDP	DC	
Chemical and Volume Control System (CVCS)	Two centrifugal charging pumps (CCP)[3], 160 gpm @ 2575 psi	4.16-kV, 480V, DC, CCW, room cooling[3]	SGTR, ATWS
	Two boric acid transfer pumps[3]		ATWS
Component Cooling Water System (CCW)	Three trains, each with one pump	4.16-kV, DC, ECW, ESFAS	LCCW
Electric Power System	Three Class 1E 4.16-kV buses	EAB HVAC, DC	All
	Three Standby Diesel Generators[4]	DC, ESFAS, ECW	**LOOP, LEAC**
	Three trains of Class 1E 480V load centers and motor control centers	4.16kV, DC, EAB HVAC	All
	Class 1E vital 120VAC (4 trains)	DC, 480V, EAB HVAC	All

Table 1 - Categories of Initiating Events for Generic PWR Nuclear Power Plant

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
I	> 1 per 1-10 yr	Loss of Power Conversion System (TPCS)	1	2	3
II	1 per 10-10^2 yr	Loss of offsite power **(LOOP)**, Loss of Class 1E 125V DC Bus A or B (LODC)	2	3	4
III	1 per 10^2 - 10^3 yr	Steam Generator Tube Rupture (SGTR), Stuck open PORV/SRV (SORV), Small LOCA including RCP seal failures (SLOCA), Main Steam Line Break Outside Containment (MSLB)	3	4	5
IV	1 per 10^3 - 10^4 yr	Medium LOCA (MLOCA), LOOP with Loss of One Class 1E 4.16-kV Bus **(LEAC)**	4	5	6
V	1 per 10^4 - 10^5 yr	Large LOCA (LLOCA), Loss of Component Cooling Water (LCCW)	5	6	7
VI	less than 1 per 10^5 yr	ATWS (1)	6	7	8
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

Table 3.6 SDP Worksheet for Generic PWR Nuclear Power Plant — Loss of Offsite Power (LOOP) ¶

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Emergency AC Power (EAC)	**1/3 Standby Diesel Generators (1 multi-train system)**
Secondary Heat Removal (TDAFW)	1/1 TDAFW pump (1 ASD train) with 1/5 safety relief valves per SG that is fed by AFW
Secondary Heat Removal (AFW)	**1/3 MDAFW trains (1 multi-train system)** or 1/1 TDAFW train (1 ASD train)
Recovery of AC Power in < 2 hrs (REC2)	Recovery of AC power (operator action = 1) [1]
Recovery of AC power in < 5 hrs (REC5)	Recovery of AC power (operator action = 2) [3, 4]
Early Inventory, HP Injection (EIHP)	**1/3 HHSI pumps (1 multi-train system)**
Primary Heat Removal, Feed/Bleed (FB)	2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2)
Low Pressure Recirculation (LPR)	**1/3 LHSI trains and with the associated 1/3 RHR heat exchangers or 2/6 RCFCs with cooling flow aligned to CCW (1 multi-train system)**

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 LOOP - **AFW** - **LPR** (3)■ 2 + 4 + 3	9	2	4 + 3	0	9
2 LOOP - **AFW** - FB (4)■ 2 + 4 + 2	8	2	4 + 2	0	8
3 LOOP - **AFW** - **EIHP** (5)■ 2 + 4 + 3	9	2	4 + 3	0	9
4 LOOP - **EAC** - LPR (7, 11)■ 2 + 3 + 3■ (AC Recovered)	8	2	3 + 3	0	8
5 LOOP - **EAC** - EIHP (8, 13)■ 2 + 3 + 3■ (AC Recovered)	8	2	3 + 3	0	8
6 LOOP - **EAC** - REC5 (9)■ 2 + 3 + 2	7	2	3 + 2	0	7

7 LOOP - **EAC** - TDAFW - FB (12) 2 + 3 + 1 + 2	8	2	3+1+2	0	8
8 LOOP - **EAC** - TDAFW - REC2 (14) 2 + 3 + 1 + 1	7	2	3+1+1	0	7

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

None

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.

Table 3.12++ SDP Worksheet for Generic PWR Nuclear Power Plant — LOOP a
Loss of One Class 1E 4.16-kV Bus (LEAC)(1)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
PORV Recloses (PORV) **Secondary Heat Removal (AFW)** **High Pressure Injection for FB (EIHP)** **Primary Heat Removal, Feed/Bleed (FB)** **Low Pressure Recirculation (LPR)**	2/2 Pressurizer PORVs reclose after opening during transient (1 train) ½ MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with 1/5 safety relief valve per SG that is fed by AFW ½ HHSI pumps (1 multi-train system) 2/2 pressurizer PORVs open for Feed/Bleed (operator action = 2) ½ LHSI pumps with (associated ½ RHR heat exchangers or 2/4 RCFCs with cooling flow aligned to CCW) (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery of Failed Train	Results
1 **LEAC** - AFW - LPR (3)■ **4 + 4 + 3**	**11**	**2**	**4 + 3**	**0**	**9**
2 **LEAC** - AFW - FB (4)■ **4 + 4 + 2**	**10**	**2**	**4 + 2**	**0**	**8**
3 **LEAC** - AFW - EIHP (5)■ **4 + 4 + 3**	**11**	**2**	**4 + 3**	**0**	**9**
4 **LEAC** - PORV - LPR (7)■ **4 + 2 + 3**	**9**	**2**	**2 + 3**	**0**	**7**
5 **LEAC** - PORV - EIHP (8)■ **4 + 2 + 3**	**9**	**2**	**2 + 3**	**0**	**7**
6 **LEAC** - PORV - AFW (9)■ **4 + 2 + 4**	**10**	**2**	**2 + 4**	**0**	**8**

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

Counting Rule Worksheet

Step	Instructions		
(1)	Enter the number of sequences with a risk significance equal to 9.	(1)	4
(2)	Divide the result of Step (1) by 3 and round down.	(2)	1
(3)	Enter the number of sequences with a risk significance equal to 8.	(3)	6
(4)	Add the result of Step (3) to the result of Step (2).	(4)	7
(5)	Divide the result of Step (4) by 3 and round down.	(5)	2
(6)	Enter the number of sequences with a risk significance equal to 7.	(6)	4
(7)	Add the result of Step (6) to the result of Step (5).	(7)	6
(8)	Divide the result of Step (7) by 3 and round down.	(8)	2
(9)	Enter the number of sequences with a risk significance equal to 6.	(9)	0
(10)	Add the result of Step (9) to the result of Step (8).	(10)	2
(11)	Divide the result of Step (10) by 3 and round down.	(11)	0
(12)	Enter the number of sequences with a risk significance equal to 5.	(12)	0
(13)	Add the result of Step (12) to the result of Step (11).	(13)	0
(14)	Divide the result of Step (13) by 3 and round down.	(14)	0
(15)	Enter the number of sequences with a risk significance equal to 4.	(15)	0
(16)	Add the result of Step (15) to the result of Step (14).	(16)	0

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

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

Table 3.7 SDP Worksheet for Wolf Creek Generating Station — Loss of Offsite Power (LOOP)

(TWO TRAIN PWR EXAMPLE)

Safety Functions Needed:	Full Creditable Mitigation Capability for each Safety Function:
Emergency AC Power (EAC)	1/2 Emergency Diesel Generators (1 multi-train system)
Secondary Heat Removal, Turbine-driven pump of AFW (TDAFW)	1/1 TDAFW pump (1 ASD train) with 1/5 safety valves
Secondary Heat Removal (AFW)	1/2 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with 1/4 ARVs or 1/5 safety valves
Recovery of AC Power in < 2 hrs (REC2)	Recovery of AC power (operator action = 1) (1)
Recovery of AC power in < 5 hrs (REC5)	Recovery of AC power (operator action = 1) (1,2)
Early Inventory, HP Injection (EIHP1)	1/2 CCPs (1 multi-train system) or 1/2 SI pumps (1 multi-train system)
Early Inventory, HP Injection (EIHP2)	1/2 CCPs (3) (1 multi-train system)
Primary Heat Removal, Feed/Bleed (FB)	2/2 PORVs (and associated block valves) open for Feed/Bleed (operator action = 2)
High Pressure Recirculation (HPR)	(1/2 CCPs or 1/2 SI pumps) with 1/2 RHR pumps with operator switchover (operator action = 3)

Circle Affected Functions	IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LOOP - AFW - HPR	**2**	**3 + 2**	**0**	**7**

2 LOOP - AFW - FB (4) **2 + 4 + 2**	**8**	**2**	**3 + 2**	**0**	**7**
3 LOOP - AFW - EIHP1 (5) **2 + 4 + 6**	**12**	**2**	**3 + 4**	**0**	**9**
4 LOOP - EAC - HPR (7,11) (AC recovered)	**8**	**2**	**2 + 2**	**0**	**6**
5 LOOP - EAC - EIHP1 (8) (AC recovered)	**1**	**2**	**2 + 4**	**0**	**8**
6 LOOP - EAC - REC5 (9) **2 + 3 + 1**	**6**	**2**	**2 + 1**	**0**	**5**
7 LOOP - EAC - TDAFW - FB (12) (AC recovered)	**8**	**2**	**2 + 1 + 2**	**0**	**7**
8 LOOP - EAC - TDAFW - EIHP2 (13) (AC recovered)	**9**	**2**	**2 + 1 + 2**	**0**	**7**

Exercise 6

The Saint Lucie Nuclear Power Plant Unit 1 Risk-Informed Inspection Notebook will be used for this example. Consider a hypothetical inspection finding that involves the unavailability of the "A" train safety-related battery charger for 1 day. For this example assume no spare battery chargers are available. Assume that recovery credit is appropriate for the circumstances surrounding this hypothetical finding.

1.7 Inspection Findings Involving Safety-Related Battery Chargers

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

Table 2 Initiators and System Dependency St. Lucie Nuclear Power Plant, Unit 1 (1,2)

Affected Systems	Major Components	Support Systems	Initiating Event
AC Power System (AC)	AC Power Distribution (two safety related buses), AC Instrument Power, and fast transfer	*DC*, HVAC(3)	All
Auxiliary Feedwater (AFW)	Two MDPs (one per SG) with normally closed cross-connections, Unit 1 condensate storage tank (UICST)	AC, ESFAS, *DC*	All except MLOCA and LLOCA
	One TDP to both SGs, UICST	ESFAS, DC, Main Steam	
Long Term AFW Make up	Automatic CST make up from demineralized water through an air operated valve LCV-12-9	IA backed by EDG	
	AFW cross tie to Unit 2 CST through a manual valve	None	
	CST make up from Treated Water Storage Tank (TWST) through TWST pumps and manual valves	Non safety related AC	
CCW	Three pumps in two trains with one CCW heat exchanger in each train and the third pump as a swing pump	AC, ESFAS, ICW, *DC*	All except LICW
Condensate / MFW	Three Condensate pumps	AC, DC, TCW	TRANS, LCCW, SLOCA
	Two MFW pumps	AC, DC, IA, TCW	
Containment Cooling System (CCS)	Four fan coolers	AC, ESFAS, CCW.*DC*	All except LCCW and LICW

Containment Cooling System (CCS)	Four fan coolers	AC, ESFAS, CCW.*DC*	All except LCCW ¶ and LICW
Containment Spray System (CSS)¶	Two trains with normally closed cross-connections, each with one pump and one shutdown cooling (SDC) heat exchanger	AC, *DC*, ESFAS, HVAC(3), CCW¶	All except LCCW¶ and LICW¶
HPSI	Two HPSI trains, pumps shutoff at 1083 psi	AC, *DC*, ESFAS, CCW, HVAC(3)	All except LCCW ¶ and LICW
Charging Pumps (CHG)	Three Pumps	AC, *DC*, ESFAS	TRANS, TPCS, SLOCA, ¶ SORV, LDCBUS, SGTR, ¶ ATWS, MSLB, LIA
DC Power System	Buses, Battery Chargers(4) and Batteries	AC Dist. (without AC, battery capacity is 6 hrs.), HVAC	**All**
EDG	Two EDGs, fuel transfer pumps and storage tanks(5)	*DC*, ESFAS	LOOP
HVAC	Supply and Exhaust Fans	AC, ESFAS, *DC*, CCW (control room air conditioning)	All except LCCW ■ and LICW
Instrument Air (IA)	Two Inside Air Compressors and Four Outside Compressors	AC, TCW (backed by alternate cooling fans)	LIA

Intake Cooling Water (ICW)	Three Pumps in two trains with normally closed cross-connections	AC, ESFAS, *DC*	All
Turbine Cooling Water (TCW)	2 pumps, 2 heat exchangers	AC, DC, ICW	TRANS, LCCW, SLOCA
Main Steam(6)	Two SGs, each with one ARV (can be manually operated on loss of IA), eight safety valves, and one MSIV, Five turbine bypass valves with 45% capacity	*DC*, IA, AC	All except MLOCA ■ and LLOCA
Pressurizer Pressure Relief(6)	Three Safety valves open at 2500 psia, 2 PORVs with block valves open at 2335 psia	*DC*, AC (block valves)	All except MLOCA, LLOCA, LCCW and LICW
RCP	Seals	CCW to thermal barrier heat exchanger (loss on ESFAS), IA for CCW supply and return valves	SLOCA
Safety Injection Tank (SIT)	Four SITs	None	LLOCA

Table 1 Categories of Initiating Events for St. Lucie Nuclear Power Plant, Unit 1

Row	Approximate Frequency	Example Event Type	Initiating Event Likelihood (IEL)		
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**), Loss of Instrument Air (**LIA**)	2	3	**4**
III	1 per 10^2 - 10^3 yr	Steam Generator Tube Rupture (**SGTR**), Stuck open PORV/SRV (**SORV**), Small LOCA including RCP seal failures (**SLOCA**), Main Steam Line Break (**MSLB**)	3	4	**5**
IV	1 per 10^3 - 10^4 yr	Medium LOCA (**MLOCA**), Loss of CCW (**LCCW**), Loss of ICW (**LICW**), Loss of a DC Bus (**LDCBUS**)	4	5	**6**
V	1 per 10^4 - 10^5 yr	Large LOCA (**LLOCA**)	5	6	**7**
VI	less than 1 per 10^5 yr	**ATWS**, Interfacing System LOCA (ISLOCA)	6	7	**8**
			> 30 days	3-30 days	< 3 days
			Exposure Time for Degraded Condition		

Table 3.1 SDP Worksheet for St. Lucie, Unit 1 — Transients (Reactor Trip) (TRANS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Power Conversion System (PCS)	1/ 2 Main Feedwater trains and 1/3 condensate pumps (operator action = 3) (1)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (2)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operator action = 2)(4)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 TRANS - PCS - LTAFWMU - SDC - CHR(5) **1 + 3 + 5 + 2 + 3**	**14**	**3**	**3 + 5 + 2 + 2**	**1**	**16**
2 TRANS - PCS - LTAFWMU - SDC - HPR (6) **1 + 3 + 5 + 2 + 3**	**14**	**3**	**3 + 5 + 2 + 2**	**1**	**16**

3 TRANS - PCS - LTAFWMU - SDC - HPSI (7) 1 + 3 + 5 + 2 + 3	14	3	3 + 5 + 2 + 2	1	16
4 TRANS - PCS - LTAFWMU - SDC - FB1 (8) 1 + 3 + 5 + 2 + 2	13	3	3 + 5 + 2 + 2	1	16
5 TRANS - PCS - AFW - CHR (10) 1 + 3 + 4 + 3	11	3	3 + 3 + 2	1	12
6 TRANS - PCS - AFW - HPR (11) 1 + 3 + 4 + 3	11	3	3 + 3 + 2	1	12
7 TRANS - PCS -AFW - HPSI (12) 1 + 3 + 4 + 3	11	3	3 + 3 + 2	1	12
8 TRANS - PCS - AFW - FB (13) 1 + 3 + 4 + 2	10	3	3 + 3 + 0	1	10

Table 3.2 SDP Worksheet for St. Lucie, Unit 1 — Transients without PCS (TPCS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (1)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from trains Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers (operator action = 2) (3)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 TPCS - LTAFWMU - SDC - CHR (4) **1 + 5 + 2 + 3**	**11**	**3**	**5 + 2 + 2**	**1**	**13**
2 TPCS - LTAFWMU - SDC - HPR (5) **1 + 5 + 2 + 3**	**11**	**3**	**5 + 2 + 2**	**1**	**13**
3 TPCS - LTAFWMU - SDC - HPSI (6) **1 + 5 + 2 + 3**	**11**	**3**	**5 + 2 + 2**	**1**	**13**

4 TPCS - LTAFWMU - SDC - FB1 (7) 1 + 5 + 2 + 2	10	3	5 + 2 + 2	1	13
5 TPCS - AFW - CHR (9) ¶ 1 + 4 + 3	8	3	3 + 2	1	9
6 TPCS - AFW - HPR (10) ¶ 1 + 4 + 3	8	3	3 + 2	1	9
7 TPCS -AFW -HPSI (11) ¶ 1 + 4 + 3	8	3	3 + 2	1	9
8 TPCS - AFW - FB (12) ¶ 1 + 4 + 2	7	3	3 + 0	1	7

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:

Table 3.3 SDP Worksheet for St. Lucie, Unit 1 — Small LOCA (SLOCA) (1/ 2"<D<3")[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Secondary Heat Removal (SHR)	1/ 2 Main Feedwater trains and 1/3 condensate pumps (operator action = 1) [2] or 1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Feed and Bleed (FB)	2/2 PORV (operator action = 2) [3]
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers with long term AFW makeup and RCS makeup from BAM tanks and SITs (operator action = 2) [4]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation modes (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SLOCA - SDC - HPR (3) 3 + 2 + 3	8	5	2 + 2	1	10
2 SLOCA - SDC - CHR (4) 3 + 2 + 3	8	~~4~~ 5	2 + 2	1	10
3 SLOCA - HPSI (5, 10) 3 + 3	6	5	2	1	8
4 SLOCA - SHR - HPR (7) 3 + 5 + 3	11	5	4 + 2	1	12

5 SLOCA - SHR - CHR (8) **3 + 5 + 3**	**11**	**5**	**4 + 2**	**1**	**12**
6 SLOCA - SHR - FB (9) **3 + 5 + 2**	**10**	**5**	**4 + 0**	**1**	**10**

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.** The IPE calls this LOCA a small-small LOCA. ¶
2.** The HEP

Table 3.4 SDP Worksheet for St. Lucie, Unit 1 — Stuck Open Relief Valve (SORV)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Isolation (BLK)	Operator closes the block valve (1 train) (1)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Feed and Bleed (FB)	Operator conducts FB using the remaining 1/1 PORV (operator action = 2) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 SDC trains with shutdown heat exchangers and long term AFW makeup and RCS makeup from BAM tanks and SITs (operator action = 2) (3)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SORV - BLK - SDC - HPR (4) **3 + 2 + 2 + 3**	**10**	**5**	**2 + 2 + 2**	**1**	**12**
2 SORV - BLK - SDC - CHR (5) **3 + 2 + 2 + 3**	**10**	**5**	**2 + 2 + 2**	**1**	**12**
3 SORV - BLK - HPSI (6,11) **3 + 2 + 3**	**8**	**5**	**2 + 2**	**1**	**10**
4 SORV - BLK - AFW - HPR (8) **3 + 2 + 4 + 3**	**12**	**5**	**2 + 3 + 2**	**1**	**13**

5 SORV - BLK - AFW - CHR (9) **3 + 2 + 4 + 3**	**12**	**5**	**2 + 3 + 2**	**1**	**13**
6 SORV - BLK - AFW - FB (10) **3 + 2 + 4 + 2**	**11**	**5**	**2 + 3 + 2**	**1**	**13**

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.** The HEP

Table 3.5 SDP Worksheet for St. Lucie, Unit 1 — Medium LOCA (MLOCA) (3"<D<5")[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode[2] (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 MLOCA - CHR (2) **4** **+ 3**	**7**	**6**	**2**	**1**	**9**
2 MLOCA - HPR (3) **4** **+ 3**	**7**	**6**	**2**	**1**	**9**
3 MLOCA - HPSI (4) **4** **+ 3**	**7**	**6**	**2**	**1**	**9**

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)**

Table 3.6 SDP Worksheet for St. Lucie, Unit 1 — Large LOCA (LLOCA) (D > 5")

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Safety Injection Tank (SIT)	3/3 unaffected SITs (1 train)
Low Pressure Safety Injection (LPSI)	1/ 2 LPSI trains (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode(1) (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LLOCA - CHR (2) **5 + 3**	**8**	**7**	**2**	**1**	**10**
2 LLOCA - HPR (3) **5 + 3**	**8**	**7**	**2**	**1**	**10**
3 LLOCA - LPSI (4) **5 + 3**	**8**	**7**	**2**	**1**	**10**
4 LLOCA - SIT (5) **5 + 2**	**7**				

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

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Table 3.7 SDP Worksheet for St. Lucie, Unit 1 — Loss of Offsite Power (LOOP) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Emergency Diesel Generator (EDG)	1/ 2 Emergency Diesel Generators (1 multi-train system) or crosstie other unit EDG (operator action=1) [2]
Turbine-driven AFW pump (TDAFW)	1/1 TDP trains of AFW (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves (Operator action = 1) [3]
Recovery of AC Power in < 2 hrs (REC2)	
Auxiliary Feedwater (AFW)	[1/ 2 MDAFW trains (1 multi-train system) or 1/1 TDAFW train (1 ASD train) with steam relief through 1/ 2 ARVs or 1/16 safety valves] with [long term AFW make up from demineralized water or unit 2 CST [4]]
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Recovery of AC Power in < 7 hrs (REC7)	Recovery of offsite power and establishment of long term AFW make up from demineralized water or unit 2 CST(Operator action = 2) [5]
Feed and Bleed (FB)	2/2 PORV (operator action = 2) [6]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or ½ containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LOOP - AFW - CHR (3) ¶ **2 + 4 + 3**	**9**	**4**	**3 + 2**	**1**	**10**
2 LOOP - AFW - HPR (4) ¶ **2 + 4 + 3**	**9**	**4**	**3 + 2**	**1**	**10**
3 LOOP - AFW - FB (5) ¶ **2 + 4 + 2**	**8**	**4**	**3 + 0**	**1**	**8**

4 LOOP - AFW - HPSI (6) ¶ 2 + 4 + 3	9	4	3 + 2	1	10
5 LOOP - EDG - REC7 (8) ¶ 2 + 4 + 2	8	4	3 + 2	1	10
6. LOOP - EDG - TDAFW - CHR (10) ¶ 2 + 4 + 1 + 3	10	4	3 + 1 + 2	1	11
7 LOOP - EDG - TDAFW - HPR (11) 2 + 4 + 1 + 3	10	4	3 + 1 + 2	1	11
8 LOOP - EDG - TDAFW - FB (12) 2 + 4 + 1 + 2	9	4	3 + 1 + 0	1	9
9 LOOP - EDG - TDAFW - HPSI (13) 2 + 4 + 1 + 3	10	4	3 + 1 + 2	1	11
10 LOOP - EDG - TDAFW - REC2 (14) 2 + 4 + 1 + 1	8	4	3 + 1 + 1	1	10

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.

Table 3.8 SDP Worksheet for St. Lucie, Unit 1 — Steam Generator Tube Rupture (SGTR)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MDPs of AFW (1 multi-train system) or 1/1 TDP of AFW (1 ASD Train) to the unaffected SGs and steam relief through 1/1 ARV or 1/8 safety valves
Pressure Equalization (EQ)	Operator isolates the ruptured SG (MSIV, SG blowdown line, main steam bypass valve. AFW steam supply) and depressurizes RCS using SG RV and pressurizer spray to less than setpoint of SG relief valves (operator action = 3) (1)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection train (1 multi-train system)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2) (2)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (2)
Long Term AFW Makeup (LTAFWMU)	Automatic make up from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operator action = 2) (4)
Shutdown Cooling (SDC2)	1/ 2 LPSI trains with SDC heat exchangers with long term RCS makeup from BAM tanks using 1/3 charging pumps and SITs and ultimate isolation of the faulted SG (operator action = 2) (1, 4)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
High Pressure Recirculation (HPR2)	1/ 2 high pressure safety injection trains in recirculation mode with long term RCS makeup from BAM tanks and SITs via 1/3 charging pumps and ultimate isolation of the faulted SG (operator action = 3) (1)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 SGTR - LTAFWMU - SDC - CHR (4) **3 + 5 + 2 + 3**	**13**	**5**	**5 + 2 + 2**	**1**	**15**
[illegible]				**1**	**15**

1 SGTR - LTAFWMU - SDC - CHR (4) 3 + 5 + 2 + 3	13	5	5 + 2 + 2	1	15
2 SGTR - LTAFWMU - SDC - HPR (5) 3 + 5 + 2	13	5	5 + 2 + 2	1	15
3 SGTR - LTAFWMU - SDC - FB1 (6) 3 + 5 + 2	12	5	5 + 2 + 2	1	15
4 SGTR - LTAFWMU - SDC - HPSI (7) 3 + 5 +	13	5	5 + 2 + 2	1	15
5 SGTR - EQ - SDC2 (9) 3 + 3 + 2	8	5	3 + 2	1	11
6 SGTR - EQ - HPSI (10) 3 + 3 + 3	9	5	3 + 2	1	11
7 SGTR - AFW - CHR (12) 3 + 4 + 3	10	5	3 + 2	1	11
8 SGTR - AFW - HPR2 (13) 3 + 4 + 3	10	5	3 + 2	1	11

Table 3.9 SDP Worksheet for St. Lucie, Unit 1 — Anticipated Transients without Scram (ATWS)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Turbine Trip (TTP)	Manually trip the turbine (operator action = 2)(1)
Auxiliary Feedwater System (AFW)	2/2 MDPs of AFW (1 train) or 1/1 TDP of AFW (1 ASD Train) to both SGs and steam relief through 2/2 ARVs or 2/16 safety valves
Primary Safety Valves Open (SRVO)	3/3 SRVs and 2/2 PORVs open (1 train)
Emergency Boration (EB)	Operator conducts emergency boration using 1/3 charging pumps from boric acid tank (operator action = 2)(2)
Primary Safety Valves Reclose (SRVR)	3/3 SRVs and 2/2 PORVs reclose (1 train)
Long Term AFW Makeup (LTAFWMU)	Automatic make up from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) (3)
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers (operatoraction = 2) (4)
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection train (1 multi-train system)
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 ATWS - TTP (11) **6 + 2**	**8**				
2 ATWS - AFW (10) **6 + 3**	**9**	**8**	**1**	**1**	**10**
3 ATWS - SRVO (9) **6 + 2**	**8**	**8**	**0**	**1**	**9**
4 ATWS - EB (8) **6 + 2**	**8**	**8**	**2**	**1**	**11**

4 ATWS - EB (8) **6 + 2**	**8**	**8**	**2**	**1**	**11**
5 ATWS - SRVR - HPSI (7) **6 + 2 + 3**	**11**	**8**	**2 + 2**	**1**	**13**
6 ATWS - SRVR - HPR (6) **6 + 2 + 3**	**11**	**8**	**2 + 2**	**1**	**13**
7 ATWS - SRVR - CHR (5) **6 + 2 + 3**	**11**	**8**	**2 + 2**	**1**	**13**
8 ATWS - LTAFWMU - SDC (3) **6 + 5 + 2**	**13**	**8**	**5 + 2**	**1**	**16**

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. The IPE

Table 3.10 SDP Worksheet for St. Lucie, Unit 1 — Main Steam Line Break Outside (MSLB)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Closure of 1 MSIV (MSIV)	Closure of ½ MSIVs (1 multi-train system)
Isolation of Feed to Faulted SG (ISOF)	Isolation of feedwater to the faulted SG (1 train)
Auxiliary Feedwater System (AFW)	1/1 MD AFW trains (1 train) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
High Pressure Injection (HPSI)	1/ 2 HPSI trains (1 multi-train system)
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action=2)(1)
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) (1)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) (2)
Shutdown Cooling (SDC)	1/3 charging pumps and ½ LPSI trains with SDC heat exchangers (operator action = 2)(3)
High Pressure Recirculation (HPR)	1/ 2 high pressure recirculation trains (1 multi-train system)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 MSLB - LTAFWMU - SDC - CHR (4) 3 + 5 + 2 + 3	13	5	5 + 2 + 2	1	15
2 MSLB - LTAFWMU - SDC - HPR (5) 3 + 5 + 2 + 3	13	5	5 + 2 + 2	1	15
3 MSLB - LTAFWMU - SDC - FB1 (6) 3 + 5 + 2 + 2	12	5	5 + 2 + 2	1	15
4 MSLB - LTAFWMU - SDC - HPSI (7) 3 + 5 + 2 + 3	13	5	5 + 2 + 2	1	15

5 MSLB - AFW - CHR (9) 3 + 3 + 3	9	5	1+2	1	9
6 MSLB - AFW - HPR (10) 3 + 3 + 3	9	5	1+2	1	9
7 MSLB - AFW - FB (11) 3 + 3 + 2	8	5	1+0	1	7
8 MSLB - AFW - HPSI (12) 3 + 3 + 3	9	5	1+2	1	9
9 MSLB - ISOF (13) 3 + 2	5				
10 MSLB - MSIV (14) 3 + 3	6				

Table 3.11 SDP Worksheet for St. Lucie, Unit 1 — Loss of a DC Bus (LDCBUS)[1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Isolate Open PORV (ISO)	Closing the block valve (1 train) [2]
Auxiliary Feedwater System (AFW)	1/1 MD AFW trains (1 train) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/1 ARV and 1/16 safety valves
High Pressure Injection (HPSI)	1/1 HPSI trains (1 train)
Long Term AFW Makeup (LTAFWMU)	Automatic makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank (operator action = 3) [3]
Shutdown Cooling (SDC)	1/ 2 charging pumps and 1/1 LPSI train with SDC heat exchangers with RCS makeup from BAM tanks and SITs (operator action = 2) [4]
High Pressure Recirculation (HPR)	1/1 high pressure recirculation train (1 train)
Containment Heat Removal (CHR)	2/4 fan coolers or 1/1 containment spray train (1 multi-train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LDCBUS - LTAFWMU - SDC (3) 4 + 5 + 2	11	5	5 + 0	1	11
2 LDCBUS - AFW (4,10) 4 + 3	7	5	0	1	6
3 LDCBUS - ISO - SDC - CHR (7) 4 + 2 + 2 + 3	11	5	2 + 0 + 2	1	10
4 LDCBUS - ISO - SDC - HPR (8) 4 + 2 + 2 + 2	10	5	2 + 0 + 0	1	8
5 LDCBUS - ISO - HPSI (9)	8	5	2 + 0	1	8

Table 3.12 SDP Worksheet for St. Lucie, Unit 1 — Loss of Instrument Air (LIA) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains(1 multi-train system) or 1/1 TD AFW train (1 ASD train) with 1/16 secondary safety valves
Feed and Bleed with 1 PORV (FB1)	1/ 2 PORVs (operator action = 2) [2]
Feed and Bleed (FB)	2/2 PORVs (operator action = 2) [2]
High Pressure Safety Injection (HPSI)	1/ 2 high pressure injection trains (1 multi-train system)
Long Term AFW Makeup (LTAFWMU))	Align AFW to take suction from Unit 2 CST or makeup to CST from treated wate tank. (operator action = 3) [3]
Shutdown Cooling (SDC)	1/3 charging pumps and 1/ 2 LPSI trains with SDC heat exchangers; manual loc action to open the heat exchanger outlet valve (operator action=2) [4]
High Pressure Recirculation (HPR)	1/ 2 high pressure safety injection trains in recirculation mode (1 multi-train syst
Containment Heat Removal (CHR)	2/4 fan coolers or 1/ 2 containment spray trains with SDC heat exchangers (1 m train system)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LIA - LTAFWMU - SDC - CHR (4) 2 + 3 + 2 + 3	10	4	3 + 2 + 2	1	12
2 LIA - LTAFW MU - SDC - HPR (5) 2 + 3 + 2	10	4	3 + 2 + 2	1	12
3 LIA - LTAFW MU - SDC - HPSI (6) 2 + 3 +	10	4	3 + 2 + 2	1	12
4 LIA - LTAFW MU - SDC - FB1 (7) 2 + 3 + 2 +	9	4	3 + 2 + 2	1	12
5 LIA - AFW - CHR (9) 2 + 4 + 3	9	4	3 + 2	1	10

6 LIA - AFW - HPR (10) 2 + 4 + 3	9	4	3 + 2	1	10
7 LIA - AFW - HPSI (11) 2 + 4 + 3	9	4	3 + 2	1	10
8 LIA - AFW - FB (12) 2 + 4 + 2	8	4	3 + 0	1	8

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

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Table 3.13 SDP Worksheet for St. Lucie, Unit 1 — Loss of Component Cooling Water (LCCW) (1)

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Tripping RCPs (RCPTRIP)	Operator trips RCPs to prevent a seal LOCA (operator action=3) (2)
Power Conversion System (PCS)	1/ 2 Main Feedwater trains (operator action = 3) (3)
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1/1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Long Term AFW Makeup (LTAFWMU)	Automatic CST makeup from demineralized water (1 train) or operator aligns AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) (4)

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LCCW - PCS - LTAFWMU (3) **4 + 3 + 3**	**10**				
2 LCCW - PCS - AFW (4) **4 + 3 + 4**	**11**	**6**	**3 + 3**	**1**	**13**
3 LCCW - RCPTRIP (5) **4 + 3**	**7**				

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

Table 3.14 SDP Worksheet for St. Lucie, Unit 1 — Loss of Intake Cooling Water (LICW) [1]

Safety Functions Needed:	Full Creditable Mitigation Capability for Each Safety Function:
Tripping RCPs (RCPTRIP)	Operator trips RCPs to prevent a seal LOCA (operator action = 3) [2]
Auxiliary Feedwater System (AFW)	1/ 2 MD AFW trains (1 multi-train system) or 1 TD AFW train (1 ASD train) and steam relief through 1/ 2 ARVs or 1/16 safety valves
Long Term AFW Makeup (LTAFWMU)	Automatic CST makeup from demineralized water (1 train) or operator align AFW to take suction from Unit 2 CST or makeup to CST from treated water tank. (operator action = 3) [3]

Circle Affected Functions		IEL	Remaining Mitigation Capability Rating for Each Affected Sequence	Recovery Credit	Results
1 LICW - LTAFWMU (2) **4 + 5**	**9**				
2 LICW - AFW (3) **4 + 4**	**8**	**6**	**3**	**1**	**10**
3 LICW - RCPTRIP (4) **4 + 3**	**7**				

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)

Counting Rule Worksheet			
Step	**Instructions**		
(1)	Enter the number of sequences with a risk significance equal to 9.	(1)	12
(2)	Divide the result of Step (1) by 3 and round down.	(2)	3
(3)	Enter the number of sequences with a risk significance equal to 8.	(3)	5
(4)	Add the result of Step (3) to the result of Step (2).	(4)	8
(5)	Divide the result of Step (4) by 3 and round down.	(5)	2
(6)	Enter the number of sequences with a risk significance equal to 7.	(6)	2
(7)	Add the result of Step (6) to the result of Step (5).	(7)	4
(8)	Divide the result of Step (7) by 3 and round down.	(8)	1
(9)	Enter the number of sequences with a risk significance equal to 6.	(9)	1
(10)	Add the result of Step (9) to the result of Step (8).	(10)	2
(11)	Divide the result of Step (10) by 3 and round down.	(11)	0
(12)	Enter the number of sequences with a risk significance equal to 5.	(12)	0
(13)	Add the result of Step (12) to the result of Step (11).	(13)	0
(14)	Divide the result of Step (13) by 3 and round down.	(14)	0
(15)	Enter the number of sequences with a risk significance equal to 4.	(15)	0
(16)	Add the result of Step (15) to the result of Step (14).	(16)	0

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

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

Table 6 - Counting Rule Worksheet