Facility: Date of Exam:

Tier	Group	RO K/A Category Points												SRO-Only Points					
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	Total	A2		G*		Total
1. Emergency & Abnormal Plant Evolutions	1	3	4	3	N/A			3	4	N/A		3	20	4		3		7
	2	1	1	1				1	2			1	7	1		2		3
	Tier Totals	4	5	4				4	6			4	27	5		5		10
2. Plant Systems	1	3	2	2	2	2	3	2	2	2	3	3	26	3		2		5
	2	1	1	1	1	1	1	1	1	1	2	1	12		1	2		3
	Tier Totals	4	3	3	3	3	4	3	3	3	5	4	38	4		4		8
3. Generic Knowledge and Abilities Categories		1		2		3		4		10		1	2	3	4	7		
		3		2		2		3				1	2	2	2			

Note:
1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two).
2. The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ±1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points.
3. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems that are not included on the outline should be added. Refer to ES-401, Attachment 2, for guidance regarding the elimination of inappropriate K/A statements.
4. Select topics from as many systems and evolutions as possible; sample every system or evolution in the group before selecting a second topic for any system or evolution.
5. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
7.* The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

ES-401 BWR Examination OutlineForm ES-401-1

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4					X		AA2.01 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION :Power/flow map (CFR: 41.10 / 43.5 / 45.13)	3.5	1
295003 Partial or Complete Loss of AC / 6						X	2.1.14 Knowledge of system status criteria which require the notification of plant personnel. (CFR: 43.5 / 45.12)	2.5	2
295004 Partial or Total Loss of DC Pwr / 6					X		AA2.02 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF D.C. POWER :Extent of partial or complete loss of D.C. power (CFR: 41.10 / 43.5 / 45.13)	3.5	3
295005 Main Turbine Generator Trip / 3		X					AK2.02 Knowledge of the interrelationships between the MAIN TURBINE GENERATOR TRIP and the following: Feedwater temperature (CFR: 41.7 to 45.8)	2.9	4
295006 SCRAM / 1				X			AA1.06 Ability to operate and/or monitor the following as they apply to SCRAM : CRD hydraulic system. (CFR: 41.7 / 45.6)	3.5	5
295016 Control Room Abandonment / 7		X					AK2.01 Knowledge of the interrelations between CONTROL ROOM ABANDONMENT and the following: Remote shutdown panel: Plant-Specific (CFR: 41.7 / 45.8)	4.4	6
295018 Partial or Total Loss of CCW / 8	X						AK1.01 Knowledge of the operational implications of the following concepts as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : Effects on component/system operations. (CFR: 41.8 to 41.10)	3.5	7
295019 Partial or Total Loss of Inst. Air / 8			X				AK3.03 Knowledge of the reasons for the following responses as they apply to PARTIAL OR COMPLETE LOSS OF INSTRUMENT AIR : Service air isolations: Plant-Specific (CFR: 41.5 / 45.6)	3.2	8
295021 Loss of Shutdown Cooling / 4	X						AK1.02 Knowledge of the operational implications of the following concepts as they apply to LOSS OF SHUTDOWN COOLING : (CFR: 41.8 to 41.10) Thermal Stratification	3.6	9
295023 Refueling Acc / 8			X				AK3.02 Knowledge of the reasons for the following responses as they apply to REFUELING ACCIDENTS : Interlocks associated with fuel handling equipment.(CFR: 41.5 / 45.6)	3.4	10
295024 High Drywell Pressure / 5		X					EK2.18 Knowledge of the interrelations between HIGH DRYWELL PRESSURE and the following: Ventilation (CFR: 41.7 / 45.8)	3.3	11
295025 High Reactor Pressure / 3				X			EA1.05 Ability to operate and/or monitor the following as they apply to HIGH REACTOR PRESSURE: RCIC: Plant-Specific (CFR: 41.7 /	3.7	12

							45.6)		
295026 Suppression Pool High Water Temp. / 5	X						EK1.01 Knowledge of the operational implications of the following concepts as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE : (CFR: 41.8 to 41.10) Pump NPSH	3.0	13
~~295027 High Containment Temperature / 5~~							Note 1		
295028 High Drywell Temperature / 5				X			EA1.04 Ability to operate and/or monitor the following as they apply to HIGH DRYWELL TEMPERATURE : Drywell pressure (CFR: 41.7 / 45.6)	3.9	14
295030 Low Suppression Pool Wtr Lvl / 5			X				EK3.06 Knowledge of the reasons for the following responses as they apply to LOW SUPPRESSION POOL WATER LEVEL: Reactor SCRAM (CFR: 41.5 / 45.6)	3.6	15
295030 Low Suppression Pool Wtr Lvl / 5						X	G2.1.33 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications. (CFR: 43.2 / 43.3 / 45.3)	3.4	16
295031 Reactor Low Water Level / 2						X	G2.4.4 Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.0	17
295037 SCRAM Condition Present and Power Above APRM Downscale or Unknown / 1					X		EA2.07 Ability to determine and/or interpret the following as they apply to SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN : Containment conditions/isolations (CFR: 41.10 / 43.5 / 45.13)	4.0	18
295038 High Off-site Release Rate / 9					X		EA2.03 Ability to determine and/or interpret the following as they apply to HIGH OFF-SITE RELEASE RATE : Radiation levels (CFR: 41.10 / 43.5 / 45.13)	3.5	19
600000 Plant Fire On Site / 8		X					AK2.01Knowledge of the interrelations between PLANT FIRE ON SITE and the following: AK2.01 Sensors / detectors and valves	2.6	20
K/A Category Totals:	3	4	3	3	4	3	Group Point Total:		20

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (SRO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4					1		AA2.03 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION : Actual core flow (CFR: 41.10 / 43.5 / 45.13)	3.3	S76
295003 Partial or Complete Loss of AC / 6						1	G2.1.33 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications. (CFR: 43.2 / 43.3 / 45.3)	4.0	S77
295004 Partial or Total Loss of DC Pwr / 6									
295005 Main Turbine Generator Trip / 3									
295006 SCRAM / 1						1	2.4.30 Knowledge of which events related to system operations/status should bereported to outside agencies. (CFR: 43.5 / 45.11)	3.6	S79
295016 Control Room Abandonment / 7									
295018 Partial or Total Loss of CCW / 8					1		AA2.01 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : Component temperatures (CFR: 41.10 / 43.5 / 45.13)	3.4	S78
295019 Partial or Total Loss of Inst. Air / 8									
295021 Loss of Shutdown Cooling / 4									
295023 Refueling Acc / 8									
295024 High Drywell Pressure / 5									
295025 High Reactor Pressure / 3									
295026 Suppression Pool High Water Temp. / 5					1		EA2.01 Ability to determine and/or interpret the following as they apply to SUPPRESSION POOL HIGH WATER TEMPERATURE: Suppression pool water temperature (CFR: 41.10 / 43.5 / 45.13)	4.2	S80
~~295027 High Containment Temperature / 5~~							Note 1		
295028 High Drywell Temperature / 5									
295030 Low Suppression Pool Wtr Lvl / 5									
295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Power Above APRM Downscale or Unknown / 1						1	G2.4.4 Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures. (CFR: 41.10 / 43.2 / 45.6)	4.3	S81
295038 High Off-site Release Rate / 9					1		EA2.03 Ability to determine and/or interpret the following as they apply to HIGH OFF-SITE RELEASE RATE : †Radiation levels (CFR: 41.10 / 43.5 / 45.13)	4.3	S82
600000 Plant Fire On Site / 8									
K/A Category Totals:					4	3	Group Point Total:		7

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295002 Loss of Main Condenser Vac / 3									
295007 High Reactor Pressure / 3									
295008 High Reactor Water Level / 2									
295009 Low Reactor Water Level / 2	X						AK1.02 Knowledge of the operational implications of the following concepts as they apply to LOW REACTOR WATER LEVEL : Recirculation pump net positive suction head: Plant-Specific (CFR: 41.8 to 41.10)	3.0	21
295010 High Drywell Pressure / 5									
~~295011 High Containment Temp / 5~~							Note 1		
295012 High Drywell Temperature / 5					X		AA2.02 Ability to determine and/or interpret the following as they apply to HIGH DRYWELL TEMPERATURE : Drywell pressure (CFR: 41.10 / 43.5 / 45.13)	3.9	22
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1			X				AK3.01 Knowledge of the reasons for the following responses as they apply to INADVERTENT REACTIVITY ADDITION: Reactor SCRAM (CFR: 41.5 / 45.6)	4.1	23
295015 Incomplete SCRAM / 1									
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7									
295022 Loss of CRD Pumps / 1						X	G2.1.30 Ability to locate and operate components / including local controls. (CFR: 41.7 / 45.7)	3.9	24
295029 High Suppression Pool Wtr Lvl / 5									
295032 High Secondary Containment Area Temperature / 5		X					EK2.06 Knowledge of the interrelations between HIGH SECONDARY CONTAINMENT AREA TEMPERATURE and the following: Area temperature monitoring system (CFR: 41.7 / 45.8)	3.3	25
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9									
295035 Secondary Containment High Differential Pressure / 5				X			EA1.02 Ability to operate and/or monitor the following as they apply to SECONDARY CONTAINMENT HIGH DIFFERENTIAL PRESSURE: SBGT/FRVS (CFR: 41.7 / 45.6)	3.8	26
295036 Secondary Containment High Sump/Area Water Level / 5					X		EA2.03 Ability to determine and/or interpret the following as they apply to Secondary Containment High Sump/Area Water Level. Cause of the high water level. ((CFR: 41.10/43.5/45.13)	3.4	27
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:	1	1	1	1	2	1	Group Point Total:		7

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Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (SRO)

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295002 Loss of Main Condenser Vac / 3									
295007 High Reactor Pressure / 3									
295008 High Reactor Water Level / 2									
295009 Low Reactor Water Level / 2									
295010 High Drywell Pressure / 5									
~~295011 High Containment Temp / 5~~							Note 1		
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1					1		AA2.03 Ability to determine and/or interpret the following as they apply to INADVERTENT REACTIVITY ADDITION : Cause of reactivity addition (CFR: 41.10 / 43.5 / 45.13)	4.3	S83
295015 Incomplete SCRAM / 1									
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7									
295022 Loss of CRD Pumps / 1									
295029 High Suppression Pool Wtr Lvl / 5									
295032 High Secondary Containment Area Temperature / 5									
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9						1	295034.G2.2.25 Knowledge of bases in technical specifications for limiting conditions for operations and safety limits. (CFR: 43.2)	3.7	S84
295035 Secondary Containment High Differential Pressure / 5						1	295035.G2.4.4 Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures.	4.3	S85
295036 Secondary Containment High Sump/Area Water Level / 5									
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:					1	2	Group Point Total:		3

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Plant Systems - Tier 2/Group 1 (RO)

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
203000 RHR/LPCI: Injection Mode						X						K6.04 Knowledge of the effect that a loss or malfunction of the following will have on the RHR/LPCI: INJECTION MODE (PLANT SPECIFIC) : Keep Fill System(CFR: 41.7 / 45.7)	3.3	28
205000 Shutdown Cooling						X						K6.04 Knowledge of the effect that a loss or malfunction of the following will have on the SHUTDOWN COOLING SYSTEM (RHR SHUTDOWN COOLING MODE) : Reactor Water Level (CFR: 41.7 / 45.7)	3.6	29
206000 HPCI											X	G2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 43.2 / 45.2)	3.4	30
~~207000 Isolation (Emergency) Condenser~~												Note 2		
209001 LPCS								X				A2.02 **Ability to (a) predict the impacts of the following on the LOW PRESSURE CORE SPRAY SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations:** Valve closures (CFR: 41.5 / 45.6)	3.2	31
~~209002 HPCS~~												Note 3		
211000 SLC									X			A3.06 Ability to monitor automatic operations of the STANDBY LIQUID CONTROL SYSTEM including: RWCU: Plant-Specific (CFR: 41.7 / 45.7)	4.0	32
211000 SLC		X										K2.01 Knowledge of electrical power supplies to the following: SBLC pumps (CFR: 41.7)	2.9	33
212000 RPS					X							K5.02 Knowledge of the operational implications of the following concepts as they apply to REACTOR PROTECTION SYSTEM : Specific logic arrangements (CFR: 41.5 / 45.3)	3.3	34
215003 IRM										X		A4.04 **Ability to manually operate and/or monitor in the control room:** IRM back panel switches, meters, and indicating lights (CFR: 41.7 / 45.5 to 45.8)	3.7	35
215004 Source Range Monitor	X											K1.06 Knowledge of the physical connections and/or cause effect relationships between SOURCE RANGE MONITOR (SRM) SYSTEM and the following: Reactor vessel (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.8	36
215005 APRM / LPRM							X					A1.03 Ability to predict and/or monitor changes in parameters associated with operating the AVERAGE POWER RANGE MONITOR/LOCAL POWER RANGE MONITOR SYSTEM controls including: Control rod block status (CFR: 41.5 / 45.5)	3.6	37

217000 RCIC										X	G2.4.31 Knowledge of annunciators alarms and indications / and use of the response instructions.(CFR: 41.10 / 45.3)	3.3	38
218000 ADS				X							K4.04 Knowledge of AUTOMATIC DEPRESSURIZATION SYSTEM designfeature(s) and/or interlocks which provide for the following: Insures adequate air supply to ADS valves: Plant-Specific (CFR: 41.7)	3.5	39
218000 ADS		X									K2.01Knowledge of electrical power supplies to the following: ADS logic (CFR: 41.7)	3.1	40
223002 PCIS/Nuclear Steam Supply Shutoff									X		A4.03 Ability to manually operate and/or monitor in the control room: Reset system isolations (CFR: 41.7 / 45.5 to 45.8)	3.6	41
223002 PCIS/Nuclear Steam Supply Shutoff	X										K1.19 Knowledge of the physical connections and/or cause effect relationships between PRIMARY CONTAINMENT ISOLATION SYSTEM/NUCLEAR STEAM SUPPLY SHUT-OFF and the following: Component cooling water systems (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.7	42
239002 SRVs							X				A1.04 Ability to predict and/or monitor changes in parameters associated with operating the RELIEF/SAFETY VALVES controls including: Reactor pressure (CFR: 41.5 / 45.5)	3.8	43
259002 Reactor Water Level Control										X	G2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system components and controls. (CFR: 41.10 / 43.2 / 45.6)	4.0	44
261000 SGTS			X								K3.01 Knowledge of the effect that a loss or malfunction of the STANDBY GAS TREATMENT SYSTEM will have on following: Secondary containment and environment differential pressure (CFR: 41.7 /45.6)	3.3	45
261000 SGTS	X										K1.08 Knowledge of the physical connections and/or causeeffect relationships between STANDBY GAS TREATMENT SYSTEM and the following: Process radiation monitoring system (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.8	46
262001 AC Electrical Distribution					X						K5.01 Knowledge of the operational implications of the following concepts as they apply to A.C. ELECTRICAL DISTRIBUTION: Principle involved with paralleling two A.C. sources (CFR: 41.5 / 45.3)	3.1	47
262002 UPS (AC/DC)						X					K6.01 Knowledge of the effect that a loss or malfunction of the following will have on the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.) : A.C. electrical power (CFR: 41.7 / 45.7)	2.7	48
263000 DC Electrical Distribution								X			A3.01 Ability to monitor automatic operations of the D.C. ELECTRICAL DISTRIBUTION including: Meters, dials, recorders, alarms, and indicating lights (CFR: 41.7 / 45.7)	3.2	49
263000 DC Electrical Distribution				X							K4.01 Knowledge of D.C. ELECTRICAL DISTRIBUTION design feature(s) and/or interlocks which provide for the following: Manual/ automatic transfers of	3.1	50

												control: Plant-Specific (CFR: 41.7)		
264000 EDGs			X									K3.01 Knowledge of the effect that a loss or malfunction of the EMERGENCY GENERATORS (DIESEL/JET) will have on following: Emergency core cooling systems CFR: 41.7 / 45.4)	4.2	51
300000 Instrument Air										X		A4.01 Ability to manually operate and / or monitor in the control room: Pressure gauges (CFR: 41.7 / 45.5 to 45.8)	2.6	52
400000 Component Cooling Water								X				A2.02 Ability to (a) predict the impacts of the following on the CCWS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal operation: High/low surge tank level (CFR: 41.5 / 45.6)	2.8	53
K/A Category Point Totals:	3	2	2	2	2	3	2	2	2	3	3	Group Point Total:		26

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Plant Systems - Tier 2/Group 1 (SRO)

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
203000 RHR/LPCI: Injection Mode														
205000 Shutdown Cooling											)	G2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 43.2 / 45.2)	4.1	S86
206000 HPCI														
~~207000 Isolation (Emergency) Condenser~~												Note 2		
209001 LPCS														
~~209002 HPCS~~												Note 3		
211000 SLC								)				A2.05 Ability to (a) predict the impacts of the following on the STANDBY LIQUID CONTROL SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of SBLC tank heaters (CFR: 41.5 / 45.6)	3.4	S87
212000 RPS											)	G2.2.25 Knowledge of bases in technical specifications for limiting conditions for operations and safety limits. (CFR: 43.2)	2.9	S88
215003 IRM														
215004 Source Range Monitor								)				A2.03 Ability to (a) predict the impacts of the following on the SOURCE RANGE MONITOR (SRM) SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Stuck detector (CFR: 41.5 / 45.6)	3.3	S89
215005 APRM / LPRM														
217000 RCIC														
218000 ADS														
223002 PCIS/Nuclear Steam Supply Shutoff														
239002 SRVs														
259002 Reactor Water Level Control														
261000 SGTS														
262001 AC Electrical Distribution								)				262001.A2.10 Ability to (a) predict the impacts of the following on the A.C. ELECTRICAL DISTRIBUTION ; and (b) based on those predictions, use procedures to correct,	3.4	S90

											control, or mitigate the consequences of those abnormal conditions or operations: Exceeding current limitations (CFR: 41.5 / 45.6)		
262002 UPS (AC/DC)													
263000 DC Electrical Distribution													
264000 EDGs													
300000 Instrument Air													
400000 Component Cooling Water													
K/A Category Point Totals:							3			2	Group Point Total:		5

ES-401BWR Examination OutlineForm ES-401-1

Plant Systems - Tier 2/Group 2 (RO)

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic									X			A3.10 Ability to monitor automatic operations of the CONTROL ROD DRIVE HYDRAULIC SYSTEM including: Lights and alarms (CFR: 41.7 / 45.7)	3.0	54
201002 RMCS							X					A1.03 Ability to predict and/or monitor changes in parameters associated with operating the REACTOR MANUAL CONTROL SYSTEM controls including: Rod movement sequence lights (CFR: 41.5 / 45.5)	3.0	55
201003 Control Rod and Drive Mechanism										X		A4.02 Ability to manually operate and/or monitor in the control room: CRD mechanism position: (CFR: 41.7 / 45.5 to 45.8)	3.5	56
~~201004 RSCS~~												Note 4		
~~201005 RCIS~~												Note 5		
201006 RWM														
202001 Recirculation								X				A2.06 Ability to (a) predict the impacts of the following on the RECIRCULATION SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Inadvertent recirculation flow decrease (CFR: 41.5 / 45.6)	3.6	57
202002 Recirculation Flow Control				X								K4.02 Knowledge of RECIRCULATION FLOW CONTROL SYSTEM design feature(s) and/or interlocks which provide for the following: Recirculation pump speed control: Plant-Specific (CFR: 41.7)	3.0	58
204000 RWCU											X	G2.4.49 Ability to perform without reference to procedures those actions that require immediate operation of system components and controls. (CFR: 41.10 / 43.2 / 45.6)	4.0	59
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.			X									K3.16 Knowledge of the effect that a loss or malfunction of the NUCLEAR BOILER Instrumentation will have on following: Main turbine (CFR: 41.7 / 45.4)	3.0	60
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray														

Mode													
230000 RHR/LPCI: Torus/Pool Spray Mode													
233000 Fuel Pool Cooling/Cleanup													
234000 Fuel Handling Equipment	)										K1.09 Knowledge of the physical connections and/or cause effect relationships between FUEL HANDLING EQUIPMENT and the following: Fuel pool ventilation: Plant-Specific (CFR: 41.2 to 41.9 / 45.7 to 45.8)	2.8	61
239001 Main and Reheat Steam													
239003 MSIV Leakage Control											~~Note~~		
241000 Reactor/Turbine Pressure Regulator													
245000 Main Turbine Gen. / Aux.													
256000 Reactor Condensate													
259001 Reactor Feedwater										X	A4.04 Ability to manually operate and/or monitor in the control room: System valves (CFR: 41.7 / 45.5 to 45.8)	3.1	63
268000 Radwaste													
271000 Offgas					X						K5.08 Knowledge of the operational implications of the following concepts as they apply to OFFGAS SYSTEM : Charcoal absorption of fission product gases (CFR: 41.7 / 45.4)	2.5	64
272000 Radiation Monitoring													
286000 Fire Protection		X									K2.03 Knowledge of electrical power supplies to the following: Fire detection system: Plant-Specific (CFR: 41.7)	2.5	65
288000 Plant Ventilation													
290001 Secondary CTMT													
290003 Control Room HVAC						X					K6.04 Knowledge of the effect that a loss or malfunction of the following will have on the CONTROL ROOM HVAC : Fire protection (CFR: 41.7 / 45.7)	2.6	62
290002 Reactor Vessel Internals													
K/A Category Point Totals:	1	1	1	1	1	1	1	1	1	2	1	Group Point Total:	12

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Plant Systems - Tier 2/Group 2 (SRO)

System # / Name	K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic														
201002 RMCS														
201003 Control Rod and Drive Mechanism														
~~201004 RSCS~~												Note: 4		
~~201005 RCIS~~												Note: 5		
201006 RWM														
202001 Recirculation														
202002 Recirculation Flow Control														
204000 RWCU														
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode														
233000 Fuel Pool Cooling/Cleanup														
234000 Fuel Handling Equipment														
239001 Main and Reheat Steam														
239003 MSIV Leakage Control														
241000 Reactor/Turbine Pressure Regulator														
245000 Main Turbine Gen. / Aux.														
256000 Reactor Condensate														
259001 Reactor Feedwater														
268000 Radwaste											)	G2.1.33 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.c(CFR: 43.2 / 43.3 / 45.3)	3.3	S91
271000 Offgas														
272000 Radiation Monitoring														

286000 Fire Protection										1	G2.2.22 Knowledge of limiting conditions for operations and safety limits. (CFR: 43.2 / 45.2)	4.0	S92
288000 Plant Ventilation													
290001 Secondary CTMT													
290003 Control Room HVAC													
290002 Reactor Vessel Internals							1				A2.05 Ability to (a) predict the impacts of the following on the REACTOR VESSEL INTERNALS ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: †Exceeding Thermal Limits CFR: 41.5 / 45.6)	3.7	S93
K/A Category Point Totals:							1			2	Group Point Total:		3

Facility: Date of Exam:

Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
1. Conduct of Operations	2.1.32	Ability to explain and apply system limits and precautions. (CFR: 41.10 / 43.2 / 45.12)	3.4	66		
	2.1.30	Ability to locate and operate components / including local controls. (CFR: 41.7 / 45.7)	3.9	67		
	2.1.16	Ability to operate plant phone / paging system / and two-way radio. (CFR: 41.10 / 45.12)	2.9	68		
	2.1.34	Ability to maintain primary and secondary plant chemistry within allowable limits. (CFR: 41.10 / 43.5 / 45.12)			2.9	S94
	Subtotal			3		1
2. Equipment Control	2.2.13	Knowledge of tagging and clearance procedures. (CFR: 41.10 / 45.13)	3.6	69		
	2.2.1	2.2.1 Ability to perform pre-startup procedures for the facility / including operating those controls associated with plant equipment that could affect reactivity. (CFR: 45.1)	3.7	70		
	2.2.18	Knowledge of the process for managing maintenance activities during shutdown operations. (CFR: 43.5 / 45.13)			3.6	S95
	2.2.32	Knowledge of the effects of alterations on core configuration. (CFR: 43.6)			3.3	S96
	Subtotal			2		2
3. Radiation Control	2.3.11	Ability to control radiation releases. (CFR: 45.9 / 45.10)	2.7	71		
	2.3.4	Knowledge of radiation exposure limits and contamination control / including permissible levels in excess of those authorized. (CFR: 43.4 / 45.10)	2.5	72		
	2.3.1	Knowledge of 10 CFR: 20 and related facility radiation control requirements. (CFR: 41.12 / 43.4. 45.9 / 45.10)			3.0	S97
	2.3.3	Knowledge of SRO responsibilities for auxiliary systems that are outside the control room (e.g. / waste disposal and handling systems). (CFR: 43.4 / 45.10)			2.9	S98
	Subtotal			2		2
4. Emergency Procedures / Plan	2.4.39	Knowledge of the RO's responsibilities in emergency plan implementation. (CFR: 45.11)	3.3	73		
	2.4.34	Knowledge of RO tasks performed outside the main control room during emergency operations including system geography and system implications. (CFR: 43.5 / 45.13)	3.8	74		
	2.4.48	Ability to interpret control room indications to verify the status and operation of system / and understand how operator action s and directives affect plant and system conditions. (CFR: 43.5 / 45.12)	3.5	75		
	2.4.11	Knowledge of abnormal condition procedures. (CFR: 41.10 / 43.5 / 45.13)			3.6	S99
	2.4.3	Ability to identify post-accident instrumentation. (CFR: 41.6 / 45.4)			3.8	S100
	Subtotal			3		2

Tier 3 Point Total		10		7

Note 1: Cooper Nuclear Station does not have a Mark III containment.

Note 2: Cooper Nuclear Station does not have an isolation condenser.

Note 3: Cooper Nuclear Station does not have a High Pressure Core Spray System (HPCS).

Note 4: Cooper Nuclear Station has abandoned the Rod Sequence Control System (RSCS).

Note 5: Cooper Nuclear Station does not have a Rod Control and Information System (RCIS).

Note 6: Cooper Nuclear Station does not have an automated MSIV leakage control system.

Facility: __Cooper Nuclear Station_____ Date of Examination: __10-02-06__

Examination Level: RO ■ SRO □ Operating Test Number: ___1____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R, N	Perform Jet Pump Operability Surveillance SKL034-20-XX
Conduct of Operations	R, N	Reactor Recirc Pump Startup. Procedure 2.2.68.1 Attachment 1
Equipment Control	R, N	Surveillance Testing – Review 6.HPCI.201 HPCI Valve Operability Test (IST) (SKL034-50-49)
Radiation Control	R, N	Determine ALARA requirements for two workers.
Emergency Plan	N/A	N/A

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.

* Type Codes & Criteria:

(C)ontrol room, (S)imulator, or Class(R)oom
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1; randomly selected)

Facility: Cooper Nuclear Station | Date of Examination: 10/02/2006

Exam Level: RO ■ SRO-I □ SRO-U □ | Operating Test No.: 1

Control Room Systems@ (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)

System / JPM Title	Type Code*	Safety Function
a. Manually Start SLC Injection per 2.2.74	A,E,P,S	1
b. Perform HPCI Full Test Surveillance	N,S	2
c. Manually Start up the RCIC System in Pressure Control SKL034-20-21	A,E,S	3
d. Perform quick Restart of RFPT B (Hard Card) Alternate Path SKL034-21-50 (7426)	A,N,S	4
e. Startup Suppression Pool Cooling Mode Of RHR	A,N,S	5
f. Adjust Generator Voltage Regulator In Manual to Maximum allowed	N,S	6
g. Perform the Panel 9-5 section of 6-RWM-301	L,N,S	7
h. Perform the Control Room Operator Actions for a fire per 5.4FIRE	A,E,N,C	8
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. 5.3ALT-STRATEGY -SENSITIVE INFORMATION	D,E,R	4
j. Startup RPS Motor Generator Set	N,C	7
k. Manually Vent the Scram Air Header, per 5.8.3	E,N,R	1

@ All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: _Cooper Nuclear Station_____ Date of Examination: _10-02-06____

Examination Level: RO ☐ SRO ■ Operating Test Number: ___1_____

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R,N	Mode change requirements reviewed. Procedure 2.1.1
Conduct of Operations	R,N	Review Reactor Recirc Idle Loop Startup.
Equipment Control	R,D	Develop, Verify & Implement Tagouts (2) SKL034-50-XX
Radiation Control	R,D	Determine the Rad Exposure during Emergency
Emergency Plan	S,D	EAL Tabletop

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.

* Type Codes & Criteria:

(C)ontrol room, (S)imulator, or Class(R)oom
(D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
(N)ew or (M)odified from bank (≥ 1)
(P)revious 2 exams (≤ 1; randomly selected)

Facility: Cooper Nuclear Station | Date of Examination: 10/02/2006

Exam Level: RO ☐ SRO-I ☐ SRO-U ■ | Operating Test No.: 1

Control Room Systems@ (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)

System / JPM Title	Type Code*	Safety Function
a. Manually Start SLC Injection per 2.2.74	A,E,P,S	1
b.		
c.		
d. Perform quick Restart of RFPT B (Hard Card) Alternate Path SKL034-21-50 (7426)	A,D,S	4
e.		
f.		
g.		
h. Perform the Control Room Operator Actions for a fire per 5.4FIRE	A,E,N,C	8
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i.		
j. Startup RPS Motor Generator Set	N,C	7
k. Manually Vent the Scram Air Header, per 5.8.3	E,N,R	1

@ All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Facility: Cooper Nuclear Station | Date of Examination: 10/02/2006

Exam Level: RO ☐ SRO-I ■ SRO-U ☐ | Operating Test No.: 1

Control Room Systems@ (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)

System / JPM Title	Type Code*	Safety Function
a. Manually Start SLC Injection per 2.2.74	A,E,P,S	1
b. Perform HPCI Full Test Surveillance	N,S	2
c. Manually Start up the RCIC System in Pressure Control SKL034-20-21	A,E,S	3
d. Perform quick Restart of RFPT B (Hard Card) Alternate Path SKL034-21-50 (7426)	A,N,S	4
e. Startup Suppression Pool Cooling Mode Of RHR	A,N,S	5
f. Adjust Generator Voltage Regulator In Manual to Maximum allowed	N,S	6
g.		
h. Perform the Control Room Operator Actions for a fire per 5.4FIRE	A,E,N,C	8
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. 5.3ALT-STRATEGY -SENSITIVE INFORMATION	D,E,R	4
j. Startup RPS Motor Generator Set	N,C	7
k. Manually Vent the Scram Air Header, per 5.8.3	E,N,R	1

@ All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

* Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1
(P)revious 2 exams	≤ 3 / ≤ 3 / ≤ 2 (randomly selected)
(R)CA	≥ 1 / ≥ 1 / ≥ 1
(S)imulator	

Appendix D **Scenario Outline** **Form ES-D-1**

Facility: _CNS_____ Scenario No.: _1_____ Op-Test No.: _____

Examiners: _____ Operators: _____

_____ _____

Initial Conditions: __ The plant is operating at 100% power near the end of the current fuel cycle when the crew takes the shift. The plant is in a normal configuration with the B REC Heat Exchanger in Standby, and the A REC Heat Exchanger in service. The crew is instructed to swap the in-service heat exchanger. After the evolution is complete, a single LPRM fails downscale. The operators must bypass the LPRM in the APRM channel, but the APRM remains operable. The operators receive an urgent call from the turbine building that the condensate booster pump bearing temperature is climbing, and that the oil is leaking out of the bearing. The NLO feels that the pump must be shut down soon. The operators commence a rapid power reduction and remove the pump from service. The power reduction is with Recirc only, and no rods will need to be moved immediately. After the plant has stabilized, HPCI inadvertently starts. The operators respond by securing the system. However, the controller is damaged so that the system will not restart. An EHC failure cases the turbine bypass valves and the turbine governer valves to open simultaneously, causing a swell to level 8. MSIVs close due to the drop in pressure, and most of the control rods do not scram. HPCI will not restart, but RCIC starts and injects. However, the Reactor is at approximately 10% power, so the crew is forced to Emergency Depressurize. When the crew Emergency Depressurizes, three ADS valves do not open. The crew opens the other SRVs for a total of five. The Scenario ends with RCIC and condensate controlling level, boric acid injected, and rods driven in.

Turnover: The plant is operating at 100% power near the end of the current fuel cycle. The plant is in a normal configuration with the B REC Heat Exchanger in Standby, and the A REC Heat Exchanger in service. Procedure 2.2.65.1 is to be used to swap heat exchangers. REC HX B is in Standby in accordance with Section 19, and an Operator is standing by in R-931-REC HX area. River temperature is below 65F so that the plant will only be using one REC HX. REC temperature will be locally controlled after the HX swap.

Event No.	Malf. No.	Event Type*	Event Description
1		N	Swap REC Heat Exchangers.
2		I TS	LPRM fails downscale.
3		C	Condensate Booster Pump A failure. Rapidly decrease Reactor power using Recirculation.
4		C TS	HPCI inadvertently starts due to controller problems. (Damaged so that it will not start if needed.)
5		MAJ	All Bypass Valves open. Reactor reaches level 8. MSIVs shut. Reactor does not scram (ATWS).
6		C	During Emergency Depressurization, an ADS solenoid indicates open, but three valves do not open. Alternate ED by other SRVs.

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS) Tech Spec

Facility: _CNS_____ Scenario No.: _2_____ Op-Test No.: _____

Examiners: _____ Operators: _____
_____ _____

Initial Conditions: __The plant is operating at 30% power at the end of the fuel cycle with a normal reactor shutdown in progress. The rod sequence is at RWM group??????, rod ???? at position ?????. A power reduction to 22% has been directed, at which point, a MSIV closure surveillance will be performed. DPIC-835B, Reactor Building differential pressure control is out of service due to an unknown failure.

The crew reduces power by inserting control rods. While they are inserting rods, the A Rod Block Monitor fails "INOP". The channel must be bypassed to finish inserting rods. Once reactor power is reduced to 22%, the MSIV surveillance is commenced. The outboard MSIV will fail mid-position and will not reopen. The Shift Manager will order the CRS to close the inboard MSIV in order to satisfy the TS. After the plant has stabilized, a malfunction of differential pressure controller DPIC-835A on the Reactor Building HVAC system results in high reactor building pressure and entry into EOP Secondary Containment Control.

An earthquake results in a total loss of offsite power and a Medium Break LOCA simultaneously. Emergency Bus 1F locks out and the Diesel Generator Output Breaker 1GS does not automatically close. This forces the operator to manually close the breaker to make all of the equipment on the bus available. An ECST leak develops from the earthquake, and the HPCI automatic suction transfer is disabled. The operator must manually initiate the suction transfer before the pump cavitates.

Turnover: The plant is operating at 30% power with a normal reactor shutdown in progress. Procedure 2.1.4, Normal Shutdown has been completed up to step 5.10. You are to reduce power to 22% by inserting control rods according to Attachment 2 of procedure 10.13 and reducing recirculation flow when necessary. Once at 22%, hold until procedure steps 5.11 and 5.12 are completed by other people on shift. While waiting for these to be completed, complete MSIV IST testing Section 5 for valve 86D. The procedure, 6.MS.201 is complete through step 3.9. The rod sequence is currently at RWM group ???? , rod ??? at position ????. The Shift Manager has approved an exception to 2.1.4 so that an extra operator will not be dedicated to inserting control rods. DPIC-835B, Reactor Building differential pressure control is out of service due to an unknown failure.

Attachment 2 and 9 of Procedure 10.13 will be handed to candidates.

Event No.	Malf. No.	Event Type*	Event Description
1		R	Reactor power reduction by inserting control rods and reducing recirc flow.
2		I TS	Rod Block Monitor fails "INOP", requiring the RO to bypass the unit.
3		N C TS	RO performs MSIV slow close surveillance. MSIV fails in midposition during test.
4		C TS	Normal ventilation malfunction causes RB pressure to go positive.

5		M	Earthquake causes LOOP-MBLOCA.
		C	Emergency bus lockout. Other bus requires manually closing DG output breaker.
		C	ECST leak with HPCI automatic suction transfer disabled.
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor, (TS) Tech Spec			

Battery Room Fan trip, CRD Discharge Filter Failure, RR Pump Seal Failure, Large Break LOCA /Loss of Startup Transformer/Lock out of 4160 1G, manually align RHR to inject

Facility: _____ **Scenario No.: 3** **No.:** _____

Examiners: _____ **Operators:** _____
_____ _____
_____ _____

Initial Conditions: The plant is operating at 100% power at the middle of the fuel cycle. The plant is in a 7 day LCO due to 1A SLC pump being out of service to replace the discharge relief valve that has failed open. CRD pump 1A is out of service due to a pump motor ground.

Turnover: Today is not a red light day. Coordinate with the load dispatcher to reduce power to 75% in order to facilitate control rod exchange and perform a swap of the SW pumps.

Event No.	Malf. No.	Event Type*	Position	Event Description
1.	N/A	R	RO/CRS	Reduce power
2.	N/A	N	BOP	Swap Service Water Pumps
3.	N/A	C	BOP/CRS	Service Water Pump D trip and LCO
4.	1	C	BOP/CRS	Battery Room Ventilation Fan Failure TLCO
5.	2	C	RO/CRS	CRD discharge filter clogging
6.	3	C	RO/CRS	Recirc Pump Seal Failure
7.	4	M	All	Scram Isolate the Recirc Loop/ Large Break LOCA
8.	6	C	BOP/RO	Loss of the Startup Transformer and Lockout of 4160 1G,
9.	7	C**	BOP/RO	Failure of RHR injection valve to auto open. Use of RHR and CS to restore reactor water level
10.	N/A	C**	ALL	Control Restore Reactor water level/Cool Containment

**** CT (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor**

SCENARIO SUMMARY

The plant is operating at 100% power with “A” SLC pump and the 1A CRD pump tagged out when the crew assumes the shift.

Power is reduced in anticipation of a control rod exchange. Following the power reduction the crew performs a swap of the operating Service Water Pumps. After the SW pumps are swapped the D SW Pump trips on overload requiring the CRS to declare one loop SW inop per T.S. 3.7.2. After the T.S. call is made the operating Battery Room Fan Fails requiring the alternate to be started and the CRS to address the TRM.

After the Battery Room Ventilation is restored a burst of corrosion products in the CRD suction piping system clogs the in-service discharge filter. The crew places the opposite filter in service and restores CRD system flow. Some debris carries over to the RR pump seals and causes initially the A RR pump #1 seal to fail. The crew responds per 2.4RR. After the initial actions have been taken both seals catastrophically fail. The reactor scrams on high DW pressure and the turbine trips.

When the crew isolates the RR loop the transient causes a preexisting flaw in the RR pipe to fail resulting in a large RR pump discharge line break that is not isolable. The Startup Transformer then locks out and the emergency transformer picks up only 4160 1F. The CS and RHR pumps powered from 4160 1F automatically start but the CS injection fails to automatically open and must be manually opened. The leak is large enough so that RHR alone has insufficient capacity to refill the RPV and the RHR valve must be opened to restore level.

The scenario ends when RPV level is being maintained 3" to 54", and an RHR HX is in service.

CREW CRITICAL TASKS
The crew shall restore 41601F to service to provide containment and core cooling.
The crew shall align CS injection valve to restore and maintain reactor water level greater than TAF.

CW pump failure, RHR discharge line break, APRM Failure, DEH failure/Group 1 isolation, Containment steam leak and ED due to PSP.

Facility: Cooper Nuclear Station **Scenario No.: 4** **No.:**

Examiners: _____ **Operators:** _____
_____ _____
_____ _____

Initial Conditions:

Power is at approximately 80% following maintenance on CBP. Operation is near the end of the fuel cycle. The plant is in day 1 of a 7 day LCO with SLC pump 1A inoperable due to a stuck open discharge relief valve.

Turnover:

Today is not a red light day. Raise power to 690 MW to support line testing when requested by the dispatcher.

Event No.	Malf. No.	Event Type*	Position	Event Description
1.	1	C N	BOP/CRS	CW pump 1A trips and 2A is started
2.	2	C	BOP/CRS	RHR Loop A discharge leak, Tech Spec
3.	N/A	R	RO/CRS	Power raise to support Line testing.
4.	3	C	RO/CRS	APRM A fails upscale / half scram. Tech Spec
5.	4	C**	ALL	DEH Failure Depressurization, Group 1 isolation Failure
6.	5	M	ALL	Containment Steam Leak, Pressure suppression function fails.
7.	6	C**	ALL	Loss of RHR spray valve permissives, Spray/Cool containment
8.	N/A	M**	ALL	Emergency Depressurization

**** CT (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor**

The plant is operating at 80% power near the end of the fuel cycle with 1A SLC pump out of service. One of the operating CW pumps trips. The crew responds and starts additional pump and enters 2.4VAC.

After idle CW pump is running a maintenance activity breaks a drain nipple off the discharge side of A loop RHR. The crew responds per EOP 5A and isolates Aux Condensate to the affected loop. When the plant is stable, APRM C fails upscale and causes a half scram. The crew addresses Technical Specifications for the failure and bypasses the affected APRM and resets the half scram.

A DEH failure then occurs resulting in a maximum signal for the turbine control valves. Reactor pressure decreases and the group 1 isolation failures. Only prompt action by the crew to scram the reactor and/or close the MSIVs prevents exceeding a reactor safety limit.

The transient causes a preexisting flaw at an SRV weld to fail resulting in a steam leak directly to the drywell atmosphere. The stress from the steam flow and condensation causes a corroded weld an a downcomer to fail. This allows the steam to discharge to torus atmosphere. This is a failure of the pressure suppression function of containment. Containment pressure rises rapidly. The crew initiates drywell sprays and initially controls drywell pressure. After the sprays are in service and drywell pressure decreases a malfunction occurs in the control circuit for spray valve control that results in a closure of the RHR drywell spray valve.

Drywell pressure increases eventually requiring the crew to emergency depressurize the reactor vessel when drywell pressure approaches the Pressure Suppression Pressure limit.

The scenario ends when the reactor vessel is depressurized and reactor water level is being controlled 3” to 54”.

CREW CRITICAL TASKS
The crew shall scram the reactor before reactor pressure safety limit is exceeded.
The crew shall close the MSIVs to prevent exceeding a 100°F/hr cooldown rate.
The crew shall emergency depressurize the RPV when PSP is exceeded or shall rapidly depressurize the RPV to prevent exceeding PSP.