Facility: Susquehanna Date of Exam: January 2012

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	2	N/A			3	5	N/A		3	20			7
	2	2	1	1				1	1			1	7			3
	Tier Totals	5	5	3				4	6			4	27			10
2. Plant Systems	1	2	1	2	4	2	4	2	3	3	1	2	26			5
	2	3	1	1	2	2	0	0	1	0	2	0	12			3
	Tier Totals	5	2	3	6	4	4	2	4	3	3	2	38			8
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1	2	3	4	7
		2			3			2			3							

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/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 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. Refer to Section D.1.b of ES-401 for the applicable K/As.
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 Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (**RO** / SRO)							Form ES-401-1	
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						AK1.02 Knowledge of the operational implications of power/flow distribution as it applies to Partial or Complete Loss of Forced Core Flow Circulation	3.3/3.5	1
295003 Partial or Complete Loss of AC / 6			X				AK3.01 Knowledge of the reasons for the following responses as they apply to PARTIAL OR OMPLETE LOSS OF A.C. POWER : Manual and auto bus transfer	3.3/3.5	2
295004 Partial or Total Loss of DC Pwr / 6					X		AA2.04 Ability to determine and/or interpret system lineups as they apply to partial or complete loss of DC power	3.2/3.3	3
295005 Main Turbine Generator Trip / 3	X						AK1.03 Knowledge of the operational implications of the following concepts as they apply to MAIN TURBINE GENERATOR TRIP: Pressure effects on reactor level	3.5/3.7	4
295006 SCRAM / 1						X	G2.4.9 Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies	3.8/4.2	5
295016 Control Room Abandonment / 7				X			AA1.06 Ability to operate and/or monitor the following as they apply to CONTROL ROOM ABANDONMENT: Reactor water level	4.0/4.1	6
295018 Partial or Total Loss of CCW / 8	X						AK1.01 Knowledge of the operational implications of the effects on component/system operations as it applies to Partial or Complete Loss of Component Cooling Water	3.5/3.6	7
295019 Partial or Total Loss of Inst. Air / 8						X	2.4.11 Knowledge of abnormal condition procedures	4.0/4.2	8
295021 Loss of Shutdown Cooling / 4				X			AA1.04 Ability to operate and or monitor Alternate Heat Removal Methods as they apply to loss of Shutdown Cooling	3.7/3.7	9
295023 Refueling Acc / 8		X					AK2.03 Knowledge of the interrelations between REFUELING ACCIDENTS and the following: Radiation monitoring equipment	3.4/3.6	10

295024 High Drywell Pressure / 5					X		EA2.04 Ability to determine and/or interpret Suppression chamber pressure as it applies to high drywell pressure	3.9/3.9	11
295025 High Reactor Pressure / 3		X					EK2.08, Knowledge of the interrelations between HIGH REACTOR PRESSURE and the following: Reactor/turbine pressure regulating system	3.7/3.7	12
295026 Suppression Pool High Water Temp. / 5			X				EK3.02 Knowledge of the reasons for Suppression Pool Cooling as it applies to Suppression Pool high water temperature	3.9/4.0	13
295028 High Drywell Temperature / 5						X	2.4.6 Knowledge of the EOP mitigation strategies	3.7/4.7	14
295030 Low Suppression Pool Wtr Lvl / 5		X					EK2.07 Knowledge of the interrelations between Low Suppression Pool water level and Downcomer submergence	3.5/3.8	15
295031 Reactor Low Water Level / 2					X		EA2.04 Ability to determine and/or interpret the following as they apply to REACTOR LOW WATER LEVEL: Adequate core cooling	4.6/4.8	16
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		X					EK2.05 Knowledge of the interrelations between SCRAM condition present and reactor power above APRM downscale or unknown and the CRD hydraulic system	4.0/4.1	17
295038 High Off-site Release Rate / 9				X			EA1.03 Ability to operate and/or monitor the following as they apply to HIGH OFF-SITE RELEASE RATE: Process liquid radiation monitoring system.	3.7/3.9	18
600000 Plant Fire On Site / 8					X		AA2.17 Ability to determine and interpret systems that may be affected by the fire as it applies to Plant Fire on Site	3.1/3.6	19
700000 Generator Voltage and Electric Grid Disturbances / 6					X		AA2.01 Ability to determine and/or interpret the following as they apply to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES: Operating point on the generator capability curve	3.5/3.6	20
K/A Category Totals:	3	4	2	3	5	3	Group Point Total:		20/7

ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (**RO** / SRO)							Form ES-401-1	
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					AK 2.03 Knowledge of the interrelations between Low Reactor Water Level and the recirculation system	3.1/3.2	21
295010 High Drywell Pressure / 5				X			AA1.02 Ability to operate and/or monitor the following as they apply to HIGH DRYWELL PRESSURE: Drywell floor and equipment drain sumps.	3.6/3.6	22
295011 High Containment Temp / 5									
295012 High Drywell Temperature / 5	X						AK1.01 Knowledge of the operational implications of the pressure/temperature relationship is it applies to High Drywell Temperature	3.3/3.5	23
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1					X		AA2.03 Ability to determine and/or interpret the following as they apply to INADVERTENT REACTIVITY ADDITION: Cause of reactivity addition.	4.0/4.3	24
295015 Incomplete SCRAM / 1									
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7									
295022 Loss of CRD Pumps / 1						X	G2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation	4.3/4.4	25
295029 High Suppression Pool Wtr Lvl / 5									
295032 High Secondary Containment Area Temperature / 5	X						EK1.02 Knowledge of the operational implications of the following concepts as they apply to HIGH SECONDARY CONTAINMENT AREA TEMPERATURE: Radiation releases	3.6/4.0	26
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9									
295035 Secondary Containment High Differential Pressure / 5									

295036 Secondary Containment High Sump/Area Water Level / 5			X				EK3.01 Knowledge of the reasons for emergency depressurization as it applies to Secondary Containment High Sump/Area Water Level	2.6/2.8	27
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:	2	1	1	1	1	1	Group Point Total:		7/3

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 1 (**RO** / SRO)												Form ES-401-1	
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	#
203000 RHR/LPCI: Injection Mode					X							K5.01 Knowledge of the operational implications of the following concepts as they apply to RHR/LPCI: Testable check valve operation	2.7/2.9	28
205000 Shutdown Cooling						X						K6.01 Knowledge of the effect that a loss or malfunction of A.C. electrical power will have on the Shutdown Cooling System (RHR Shutdown Cooling Mode)	3.3/3.4	29
206000 HPCI				X								K4.09 Knowledge of HIGH PRESSURE COOLANT INJECTION SYSTEM design feature(s) and/or interlocks which provide for the following: Automatic flow control: BWR-2,3,4	3.8/3.9	30
207000 Isolation (Emergency) Condenser														
209001 LPCS						X						K6.04 Knowledge of the effect that a loss or malfunction of the following will have on the LOW PRESSURE CORE SPRAY SYSTEM : D.C. power	2.8/2.9	32
209001 LPCS											X	2.4.50 Ability to verify system alarm setpoints and operate controls identified in he alarm response manual	4.2/4.0	33
209002 HPCS														
211000 SLC				X								A2.03 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: A.C. Power Failures	3.2/3.4	31

211000 SLC								X				K4.08 Knowledge of STANDBY LIQUID CONTROL SYSTEM design feature(s) and/or interlocks which provide for the following: System initiation upon operation of SBLC control switch.	4.2/4.2	34
212000 RPS		X										K2.01 Knowledge of electrical power supplies to the RPS motor-generator sets	3.2/3.3	35
215003 IRM	X											K1.01 Knowledge of the physical connections and/or cause-effect relationships between INTERMEDIATE RANGE MONITOR (IRM) SYSTEM and the following: RPS	3.9/3.9	36
215004 Source Range Monitor									X			A3.03 Ability to monitor automatic operations of the Source Range Monitor (SRM) System including RPS status	3.6/3.5	37
215005 APRM / LPRM				X								K4.02 Knowledge of AVERAGE POWER RANGE MONITOR/LOCAL POWER RANGE MONITOR SYSTEM design feature(s) and/or interlocks which provide for the following: Reactor SCRAM signals	4.1/4.2	38
215005 APRM / LPRM									X			A3.08 Ability to monitor automatic operations of the Average Power Range Monitor/Local Power Range Monitor System including control rod block status	3.7/3.6	39
217000 RCIC	X											K1.01 Knowledge of the physical connections and/or cause-effect relationships between REACTOR CORE ISOLATION COOLING SYSTEM (RCIC) and the following: Condensate storage and transfer system	3.5/3.5	40
217000 RCIC								X				A2.05 Ability to (a) predict the impacts of D.C. power loss on the Reactor Core Isolation Cooling System (RCIC); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations	3.3/3.3	41
218000 ADS											X	2.4.31 Knowledge of annunciator alarms, indications, or response procedures.	4.2/4.1	42

223002 PCIS/Nuclear Steam Supply Shutoff							X					A1.02 Ability to predict and/or monitor changes in parameters associated with operating the Primary Containment Isolation System/Nuclear Steam Supply Shut-Off controls including: Valve closures	3.7/3.7	43
239002 SRVs			X									K3.03 Knowledge of the effect that a loss or malfunction of the RELIEF/SAFETY VALVES will have on following: Ability to rapidly depressurize the reactor	4.3/4.4	44
259002 Reactor Water Level Control					X							K5.01 Knowledge of the operational implications of Foxboro controller operation as it applies to Reactor Water Level Control System	3.1/3.1	45
261000 SGTS									X			A3.02 Ability to monitor automatic operations of the STANDBY GAS TREATMENT SYSTEM including: Fan start	3.2/3.1	46
262001 AC Electrical Distribution			X									K3.01 Knowledge of the effect that a loss or malfunction of the A.C. Electrical Distribution will have on major system loads	2.7/2.9	47
262002 UPS (AC/DC)						X						K6.03 Knowledge of the effect that a loss or malfunction of the following will have on the UNINTERRUPTABLE POWER SUPPLY (A.C./D.C.): D.C. electrical power	2.7/2.9	74
263000 DC Electrical Distribution							X					A1.01 Ability to predict and/or monitor changes in parameters associated with operating the D.C. Electrical Distribution controls including battery charging/discharging rate	2.5/2.8	49
264000 EDGs								X				A2.07 Ability to (a) predict the impacts of the following on the EMERGENCY GENERATORS (DIESEL/JET) ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations: Loss of off-site power during full-load testing	3.5/3.7	48
264000 EDGs										X		A4.01 Ability to manually operate and/or monitor in the control room: adjustment of exciter voltage	3.3/3.4	51

300000 Instrument Air				X								K4.02 Knowledge of (INSTRUMENT AIR SYSTEM) design feature(s) and or interlocks which provide for the following: Cross-over to other air systems	3.0/3.0	50
400000 Component Cooling Water						X						K6.05 Knowledge of the effect that a loss or malfunction of the following will have on the CCWS: Pumps	3.0/3.1	53
K/A Category Point Totals:	2	1	2	4	2	4	2	3	3	1	2	Group Point Total:		26 /5

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 2 (**RO** / SRO)												Form ES-401-1	
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	X											K1.01 Knowledge of the physical connections and/or causeeffect relationships between REACTOR MANUAL CONTROL SYSTEM and the following: Control rod drive hydraulic system	3.2/3.2	56
201003 Control Rod and Drive Mechanism	X											K1.04 Knowledge of the physical connections and/or cause effect relationships between CONTROL ROD AND DRIVE MECHANISM and the following: Reactor vessel	3.0/3.0	52
201004 RSCS														
201005 RCIS														
201006 RWM								X				A2.07 Ability to (a) predict the impacts of RWM hardware/software failure on the Rod Worth Minimizer System (RWM); and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations	2.5/2.8	55
202001 Recirculation			X									K3.05 Knowledge of the effect that a loss or malfunction of the RECIRCULATION SYSTEM will have on following: Recirculation system MG sets	3.7/3.9	54
202002 Recirculation Flow Control														

204000 RWCU										X		A4.08 Ability to manually operate and/or monitor in the control room: reactor water level	3.4/3.4	57
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode		X										K2.02 Knowledge of electrical power supplies to the following: Pumps	3.1/3.3	59
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode										X		A4.06 Ability to manually operate and/or monitor in the control room: Valve logic reset following automatic initiation of LPCI/RHR in injection mode	4.0/3.9	58
233000 Fuel Pool Cooling/Cleanup				X								K4.06 Knowledge of Fuel Pool Cooling and Clean-Up design feature(s) and/or interlocks which provide for the following: Maintenance of adequate pool level	2.9/3.2	61
234000 Fuel Handling Equipment														
239001 Main and Reheat Steam														
239003 MSIV Leakage Control														
241000 Reactor/Turbine Pressure Regulator														
245000 Main Turbine Gen. / Aux.					X							K5.02 Knowledge of the operational implications of the following concepts as they apply to MAIN TURBINE GENERATOR AND AUXILIARY SYSTEMS: Turbine operation and limitations	2.8/3.1	60
256000 Reactor Condensate														

259001 Reactor Feedwater	X										K1.05 Knowledge of the physical connections and/or cause-effect relationships between Reactor Feedwater System and the following: Condensate system	3.2/3.2	63
268000 Radwaste													
271000 Offgas													
272000 Radiation Monitoring													
286000 Fire Protection				X							K4.02 Knowledge of FIRE PROTECTION SYSTEM design feature(s) and/or interlocks which provide for the following: Automatic system initiation	3.3/3.5	62
288000 Plant Ventilation					X						K5.02 Knowledge of the operational implications of the following concepts as they apply to Plant Ventilation Systems: Differential Pressure control	3.2/3.4	65
290001 Secondary CTMT													
290003 Control Room HVAC													
290002 Reactor Vessel Internals													
K/A Category Point Totals:	3	1	1	2	2	0	0	1	0	2	0	Group Point Total:		12/3

RO OUTLINE

Category	K/A #	Topic	RO	
			IR	#
1. Conduct of Operations	2.1.30	Ability to locate and operate components, including local controls	4.4/4.0	64
	2.1.32	Ability to explain and apply system limits and precautions	3.8/4.0	67
	Subtotal			**2**
2. Equipment Control	2.2.22	Knowledge of limiting conditions for operations and safety limits	4.0/4.7	66
	2.2.13	Knowledge of clearance and tagging procedures	4.1/4.3	69
	2.2.3	Knowledge of the design, procedural, and operational differences between units	3.8/3.9	70
	Subtotal			**3**
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions	3.2/3.7	68
	2.3.5	Ability to use radiation monitoring systems, such as fixed radiation monitors and alarms, portable survey instruments, personnel monitoring equipment, etc	3.9/2.9	71
	Subtotal			**2**
4. Emergency Procedures / Plan	2.4.45	Ability to prioritize and interpret the significance of each annunciator or alarm	4.1/4.3	73
	2.4.2	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions	4.6/4.8	72
	2.4.31	Knowledge of annunciator alarms, indications, or response procedures	4.2/4.1	75
	Subtotal			**3**
Tier 3 Point Total				**10**

SRO OUTLINE

ES-401 **BWR Examination Outline** **Form ES-401-1**

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				N/A					N/A			20	4	3	7
	2												7	1	2	3
	Tier Totals												27	5	5	10
2. Plant Systems	1												26	1	4	5
	2												12	0 / 1	2	3
	Tier Totals												38	2	6	8
3. Generic Knowledge and Abilities Categories		1			2			3			4		10	1 / 2	3 / 4	7
														2 / 2	2 / 1	

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/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 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. Refer to Section D.1.b of ES-401 for the applicable K/As.
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 Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / **SRO**)						Form ES-401-1		
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		AA1.01 Ability to operate and/or monitor the following as they apply to PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION: Recirculation system	3.6	76
295003 Partial or Complete Loss of AC / 6									
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	3.9	77
295005 Main Turbine Generator Trip / 3									
295006 SCRAM / 1									
295016 Control Room Abandonment / 7									
295018 Partial or Total Loss of CCW / 8					X		AA2.02 Ability to determine and/or interpret the following as they apply to PARTIAL OR COMPLETE LOSS OF COMPONENT COOLING WATER : Cooling water temperature	3.2	78
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						X	G 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc	4.2	79
295027 High Containment Temperature / 5									
295028 High Drywell Temperature / 5									
295030 Low Suppression Pool Wtr Lvl / 5						X	2.4.18 Knowledge of the specific bases for EOPs: Low Suppression Pool Water Level	4.4	80

295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1					X		A2.02 Ability to determine and/or interpret reactor water level as it applies to SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown	4.2	81
295038 High Off-site Release Rate / 9						X	2.1.20 Ability to interpret and execute procedure steps: High Off-Site Release Rate	4.6	82
600000 Plant Fire On Site / 8									
700000 Generator Voltage and Electric Grid Disturbances / 6									
K/A Category Totals:	0	0	0	0	4	3	Group Point Total:		20/7

ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / **SRO**)							Form ES-401-1	
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		AA2.01 Ability to determine and/or interpret the following as they apply to LOW REACTOR WATER LEVEL: Reactor water level.	4.2	84
295010 High Drywell Pressure / 5						X	G 2.4.30 Knowledge of events related to system operation/status that must be reported to internal organizations or external agencies, such as the State, the NRC, or the transmission system operator.	4.1	83
295011 High Containment Temp / 5									
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1									
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						X	G2.2.44 Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions	4.4	85
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9									
295035 Secondary Containment High Differential Pressure / 5									
295036 Secondary Containment High Sump/Area Water Level / 5									
500000 High CTMT Hydrogen Conc. / 5									

K/A Category Point Totals:	0	0	0	0	1	2	Group Point Total:		7/3

259002 Reactor Water Level Control													
261000 SGTS										X	G2.2.22 Knowledge of limiting conditions for operations and safety limits: SGTS	4.7	88
262001 AC Electrical Distribution										X	G2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits.	4.2	89
262002 UPS (AC/DC)													
263000 DC Electrical Distribution													
264000 EDGs										X	G2.2.40 Ability to apply Technical Specifications for a system: Emergency Generators	4.7	90
300000 Instrument Air													
400000 Component Cooling Water													
K/A Category Point Totals:	0	0	0	0	0	0	0	1	0	0	4	Group Point Total:	26/5

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / **SRO**)												Form ES-401-1	
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														
201005 RCIS														
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								X				A2.03 Ability to (a) predict the impacts of loss of electrical power on the Fuel Handling Equipment; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations	3.1	91
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														
271000 Offgas														
272000 Radiation Monitoring														

286000 Fire Protection										X	G.2.2.25 Knowledge of the bases in Technical Specifications for limiting conditions for operations and safety limits	4.2	92
288000 Plant Ventilation													
290001 Secondary CTMT													
290003 Control Room HVAC										X	G2.2.38 Knowledge of conditions and limitations in the facility license	3.4	93
290002 Reactor Vessel Internals													
K/A Category Point Totals:	0	0	0	0	0	0	0	1	0	0	2	Group Point Total:	12/3

SRO OUTLINE

Category	K/A #	Topic	RO	
			IR	#
1. Conduct of Operations	2.1.1	Knowledge of conduct of operations requirements	4.2	94
	2.1.45	Ability to identify and interpret diverse indications to validate the response of another indication	4.3	95
	Subtotal			**2**
2. Equipment Control	2.2.17	Knowledge of the process for managing maintenance activities during power operations, such as risk assessments, work prioritization, and coordination with the transmission system operator	3.8	96
	2.2.5	Knowledge of the process for making design or operating changes to the facility	3.2	97
	Subtotal			**2**
3. Radiation Control	2.3.11	Ability to control radiation releases	4.3	98
	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc	3.8	99
	Subtotal			**2**
4. Emergency Procedures / Plan	2.4.40	Knowledge of SRO responsibilities in emergency plan implementation	4.5	100
	Subtotal			**1**
Tier 3 Point Total				**7**

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	700000 G 2.1.28	For the original question generic K/A did not directly match, the question was retained and was assigned a new K/A that matched the question.
2/2	216000 G2.4.20	The original question was SRO level, replaced the question with different random K/A. A new question was written to match the K/A.
3	G2.3.12	The original question was a GET level question, replaced the question with different random K/A. Developed a replacement question for the new K/A.

ES-301 **Administrative Topics Outline** **Form ES-301-1**

Facility: SSES		Date of Examination:
Examination Level: **SRO-I**		Operating Test Number: 1
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations ★A-1.1	N, R	Heat up rate calculation General K/A – 2.1.25 RO 3.9 SRO 4.2
Conduct of Operations ★A-1.2	M, R	Review failed ST and determine required action General K/A – 2.2.12 RO 3.7 SRO 4.1
Equipment Control ★A-2	N, R	Blocking and tagging a pump General K/A – 2.2.41 RO 3.5 SRO 3.9
Radiation Control A-3	M, R	Review and approve a radioactive liquid release permit General K/A – 2.3.6 SRO 3.7
Emergency Procedures/Plan ★A-4	N, R	Make EAL classification General K/A – 2.4.44 SRO 4.4
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)	

1/10/12

★Note: Admin JPMs A-1.1, A-1.2, A-2 and ~~A-4~~ are common JPMs for both RO and SRO candidates. Ensure administration of these common JPMs occurs for all candidates during the same exam day for each of these JPMs. NOTE: Although these JPMs are similar the SRO JPMs test additional SRO RESPONSIBILITIES. 1/10/12

ES-301 **Administrative Topics Outline** **Form ES-301-1**

Facility: SSES		Date of Examination:
Examination Level: **RO**		Operating Test Number: 1
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations ★A-1.1	N, R	Heat Up rate Calculation General K/A – 2.1.25 RO 3.9 SRO 4.2
Conduct of Operations ★A-1.2	M, R	Review failed ST and determine required action General K/A – 2.2.12 RO 3.7 SRO 4.1
Equipment Control ★A-2	N, R	Blocking and tagging a pump General K/A – 2.2.41 RO 3.5 SRO 3.9
Radiation Control		
Emergency Procedures/Plan ★A-4	N, S	State and local notifications General K/A – 2.4.39 RO 3.9
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)	

1/10/12

★Note: Admin JPMs A-1.1, A-1.2, A-2 and A-4 are common JPMs for both RO and SRO candidates. Ensure administration of these common JPMs occurs for all candidates during the same exam day for each of these JPMs.

ES-301 **Control Room/In-Plant Systems Outline** **Form ES-301-2**

Facility: SSES	Date of Examination: 1/17/12
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. CRD Mechanism/201003 Control Rod Withdrawals	A, N, S	1
b. Perform HPCI Quarterly Surveillance/206000	A, N, S	2
c. Quarterly Turbine Valve Cycling/241000	A, N, S	3
d. Core Spray System Shutdown/209001	N, S	4
e. PCIS/SDC restoration/223002	A, L, N, S	5
f. Manually Synchronize Diesel Generator B/264000	A, N, S	6
g. SBGT System Startup/288000	N, S	9
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Venting Scram Air Header during ATWS	D, E, R	1
j. Maintaining RCIC Suction Source during SBO	A, E, N, R	2
k. Secure Non-Class 1E 250 VDC loads IAW E0-100-030	N, E	6

@ 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
(EN)gineered safety feature	- / - / ≥1 (control room system)
(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: SSES	Date of Examination: 1/17/12
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. CRD Mechanism/201003 Control Rod Withdrawals	A, N, S	1
b. Perform HPCI Quarterly Surveillance/206000	A, N, S	2
c. Quarterly Turbine Valve Cycling/241000	A, N, S	3
d. Core Spray System Shutdown/209001	N, S	4
e. PCIS/SDC restoration/223002	A, L, N, S	5
f. Manually Synchronize Diesel Generator B/264000	A, N, S	6
g. SBGT System Startup/288000	N, S	9
h. APRM Gain Adjustment/215005	N, S	7
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Venting Scram Air Header during ATWS	D, E, R	1
j. Maintaining RCIC Suction Source during SBO	A, E, N, R	2
k. Secure Non-Class 1E 250 VDC loads IAW E0-100-030	N, E	6

@ 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
(EN)gineered safety feature	- / - / ≥1 (control room system)
(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: Susquehanna Scenario No.: 1 Op-Test No.: _____

Examiners: _____ Operators: _____

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Initial Conditions: Unit 1 68% power, EOL, 'B' Condensate Pump out of service for motor replacement Unit 2 60% for waterbox cleaning and rod pattern exchange

Turnover: Shift orders are to swap from 1A SW pump to 1C SW pump to allow vibration readings to be taken on 1C SW pump and maintain power with Recirc to compensate for Xenon.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	N	Swap running SW pumps from 1A to 1C
2	mfNM178007B f:125	I-ATC, TS-SRO	APRM 2 Fails High
3	mfHP152004	C-BOP, TS-SRO	Inadvertent start of HPCI
4	RD1550043027 RD1550063027	TS-SRO C-ATC C-BOP	Rod drifts in to position 10
5	mfFW144003D mfFW144005D	R-ATC	'D' Condensate Pump trip with failed runback
6	cmfAV01_XV147F011	C-ATC, TS-SRO	Loose SDV Inboard Drain Air Fitting
7	mfRD155017 SL153002 PM02_1P208A Additional rods stuck out, see malf page	M-ALL C-ATC C-BOP	Hydraulic ATWS / stuck rods, 'A' SLC pump relief valve lift, Failure of 'B' SLC pump on thermal overloads
8	cmfPM03_1P113A cmfPM07_1P113B cmfBR04_1A10101	C-ATC,	EHC pump failure causes turbine trip and loss of bypass valves, failure of 11A Aux Bus to fast transfer
9	cmfNB01_LISB211N031A2B, cmfRL01_e111K79B	C-BOP	RCIC Auto Initiation Failure
10	cmfPM03_1P132A	C-ATC	Running CRD Pump Trips

11	mfHP152015 IMF mfRC150011 IOR diHSC121S12 d:120 f:OFF IOR diHSC121S10 d:120 f:OFF	C-BOP	HPCI Turbine Trips requiring performance of ED RCIC trips on injection Prevent further rod insertion
*	(N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor		

Scenario Summary

Event 1: The crew begins with the plant at 68% power. As part of turnover, the crew is directed to swap running Service Water pumps from 1A to 1C to allow maintenance to take vibration readings on 1C Service Water pump.

Event 2: Once the Service Water pump swap is complete, APRM 2 fails Upscale. The crew will take action per alarm response to bypass the APRM and the SRO will reference Tech Specs. Priority is to declare APRM 2 inoperable and bypass APRM 2.

Event 3: Once the Tech Spec call is complete for the failed APRM, HPCI will start inadvertently. The crew will take action per ON-156-001 and OP-152-001 to override HPCI injection. The SRO will declare HPCI inoperable and ensure RCIC operability. Priority is to override HPCI, declare HPCI inoperable, and ensure RCIC operability.

Event 4: Once the crew overrides HPCI injection, the scram outlet valve for control rod 30-27 leaks by, causing control rod 30-27 to slowly drift in. However, due to high channel friction, the control rod stops at position 10 and must be fully inserted. The crew will respond by using ON-155-001, control rod problems. Since the rod drifted in and did not go to position 00, ON-155-001 and Tech Specs direct insertion of the rod to 00 and disarming of the HCU. This will be accomplished by sequentially raising drive header D/P until the control rod inserts. CRS will address Tech Specs for the inoperable control rod. Priority is to declare rod inoperable, fully insert, and disarm it.

Event 5: Once the control rod Tech Spec call is complete, the 'D' Condensate Pump will trip on overcurrent. Both recirc pumps will fail to runback, and the crew must perform this manually. Additional actions require monitoring for position on power/flow map and for indications of power oscillations. Priority is to initiate manual recirc runback and monitor power/flow map and APRM for indications of power/flow instabilities.

Event 6: During the manual recirc runback, an air fitting for SV-147-F009 disconnects, causing the inboard SDV drain valve to fail closed. CRS will address Tech Specs for the failed closed valve. With the SDV drain valve closed, the SDV will slowly fill due to normal HCU valve leak-by and the leaking outlet scram valve for control rod 30-27. The disconnected air fitting cannot be quickly remedied, and the scram discharge volume level quickly fills to the rod block and eventually the scram setpoints. The crew will respond proactively to the SDV filling by scramming the reactor. Due to a partially plugged SDV, when the mode switch is taken to SHUTDOWN, control rods only partially insert, resulting in a hydraulic ATWS. Priority is to take decisive action to scram the reactor before the automatic scram from high scram discharge volume level.

Events 7-11: The crew will enter EO-100-113 for power/level control. During power reduction actions, the recirc pumps will be tripped. When the B recirc pump is tripped, the 1B CRD pump trips, requiring operators to later start the 1A CRD pump to enable control rod insertion. The CRS will then direct injection of SBLC. The 'A' SBLC discharge relief valve will lift, preventing injection. The crew will recognize this and swap to the 'B' SBLC pump which will run for approximately 30 seconds, and then trip on thermal overloads. The crew will then direct SBLC injection using RCIC in accordance with ES-150-002. When ATC has stabilized reactor water level with feedwater, the 1A EHC pump will trip and the 1B EHC pump will fail to start, resulting in a turbine trip with loss of bypass capability. This will result in use of SRV's for pressure control and entry into EO-100-103, PC control due to rising suppression pool temperature, and

direction to place suppression pool cooling in service. Additionally, 11A Aux Bus auto transfer will fail during the turbine trip, resulting in the loss of the two remaining condensate pumps and transition of level control to HPCI/RCIC.

EO-100-113 will direct insertion of control rods by multiple means. A malfunction of the CRD flow control valve will prevent raising cooling water D/P; preventing drifting in of control rods using the cooling header. Manual control rod insertion per EO-100-113 will be performed to insert control rods. Once approximately four control rods have been inserted, HPCI will trip, requiring the crew to use RCIC for level control. RCIC was overridden per procedure for level reduction, but will also fail to auto initiate. RCIC will start via manual operator actions and trip once the turbine comes up to speed and begins injecting. Further rod insertion will also no longer be possible due to malfunction of the rod insertion pushbuttons. RPV will lower to -161" (TAF) forcing the crew to enter EO-100-112 Rapid Depressurization due to inability to restore and maintain level >-161".

Actions will be directed in the field to bypass ARI and RPS. Once the rapid depressurization is performed and level control is being established using low pressure ECCS, the ATC will be able to reset the Scram to begin venting and draining the SDV, and then re-SCRAM the reactor to insert all control rods. The scenario may be terminated when the ATWS has been terminated with low pressure ECCS injection being used for level control.

Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1. Total malfunctions (5–8)	7
2. Malfunctions after EOP entry (1–2)	2
3. Abnormal events (2–4)	3
4. Major transients (1–2)	1
5. EOPs entered/requiring substantive actions (1–2) EO-100-102/EO-100-103	2
6. EOP contingencies requiring substantive actions (0–2) EO-100-113/EO-100-112	2
7. Critical tasks (2–3)	3

Facility: Susquehanna Scenario No.: 2 Op-Test No.: _____

Examiners: _____ Operators: _____

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Initial Conditions:
Unit at 11% power with Drywell N2 Purge In Progress

Turnover: Unit 1 is at 950 psig and ~ 11% power A2SU Step 256, continuing plant startup with containment purge in progress. 'A' RFP is in Discharge Pressure Mode and 'B' RFP is in Standby. The main turbine has been on turning gear for 5.5 hours. The crew is expected to resume startup actions IAW GO-100-002 step 5.64.1 to ensure 3 element control is ready, place the first RFP in flow control mode in accordance with OP-145-001, and continue with subsequent actions in GO-100-002.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	N-ATC	Place first RFP in flow control mode.
2	N/A	R-ATC SRO	Raise power until reactor power is close to but less than ~ 16%.
3	mfRM179011A f:100, cmfAV03_HV15713	I -BOP TS - SRO	SGTS A Rad Monitor instrument fails high with failure of the one of the inboard purge and make-up valve to isolate.
4	rfDB105101_f:open	C- BOP TS- SRO	Failure of MCC 1B217, which causes loss of 'A' loop of DW spray and ½ Scram which requires a transfer of the RPS Bus power supply and reset of the ½ Scram.
5	N/A	C- BOP SRO	RBCCW pump swap due to excessive seal leakage on running pump.
6	+8.1 set fx1RRPB_B21.SETPT=45 +9.11 set fx1RRPA_B21.SETPT=90	C- ATC SRO	'A' Recirc pump speed oscillation/Lock up the 'A' Recirc pump.
7	mfMS183011B mfMS183010B d:1 f:45	C – BOP TS- SRO	SRV 'B' inadvertently opens (TS)/ initiate Suppression Pool cooling (ON-183-001, Stuck Open Safety Relief Valve)
8	mfMS183013B d:2:00 i:40 f:100 r:720	M – ALL	SRV 'B' SUPP Chamber Tailpipe Break.

9	cmfPM06_1P202B(D) r:4:00_f:100	C-BOP/ATC	Running RHR pump trips on pre-overload (shaft seizure).
10		ALL	Initiate SC and DW Spray.

	Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1.	Total malfunctions (5–8)	7
2.	Malfunctions after EOP entry (1–2)	1
3.	Abnormal events (2–4)	3
4.	Major transients (1–2)	1
5.	EOPs entered/requiring substantive actions (1–2)	2
6.	EOP contingencies requiring substantive actions (0–2)	1
7.	Critical tasks (2–3)	2

Scenario Summary

Event 1: The scenario begins with Unit 1 at ~950 psig and ~11% power during reactor startup with containment (DW) purge in progress. Following turnover the crew is expected to resume startup actions IAW GO-100-002 by ensuring 3 element control is ready and placing the first RFP in flow control mode.

Event 2: After the first RFP is placed in flow control mode, the crew will continue with subsequent actions in GO-100-002 to raise power until reactor is close to but less than ~ 16%.

Event 3: After the power increase, a radiation monitor in the SGTS common exhaust vent duct will fail high causing isolation signals to inboard purge and makeup valves. One of the inboard purge and makeup valves will fail to isolate, crew should recognize and take actions to close the valve and reference TS.

Event 4: After manual isolation of the inboard valve, the essential MCC 1B217 will trip on a fault causing RPS MG set to trip creating ½ scram. The crew will swap RPS to alternate power supply, reset the half-scram, and restore cooling to the Reactor Recirc Pumps. TS will be referenced.

Event 5: Following the reset of ½ scram, the crew will be required to swap RBCCW pump due to a report from the field indicating excessive seal leakage from the running RBCCW pump.

Event 6: After swapping the RBCCW pump, a failure in the controller for the 'A' Recirc M-G set will cause the Recirc pump speed to oscillate. The crew should recognize the changes in core and jet pump flows and lock the 'A' Recirc pump scoop tube to prevent further speed changes.

Event 7-8: Following the Recirc pump speed oscillation, the 'B' SRV will inadvertently open, requiring the crew to take actions to close the valve in accordance with ON-183-001and place suppression pool cooling in service. The crew will not be successful in closing the SRV (per ON requiring manual scram), and a rupture of its tail pipe in the suppression pool chamber will occur. The crew will initiate a manual scram and execute PC control E0-100-103 due to DW pressure increase.

Event 9: The running Div 2 RHR pump will trip on pre-overload due to shaft seizure the crew should recognize that the loop has drained down and only one RHR pump is available for Drywell sprays due to the loss of MCC 1B217 taking out 'A' loop of DW spray. The crew will perform a slow fill of the loop, start the other RHR pump, initiate Suppression chamber spray and when suppression chamber pressure exceeds 13 psig, the crew will initiate drywell sprays. The scenario will be terminated after DW spray has been initiated.

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

Facility: Susquehanna Scenario No.: 3 Op-Test No.: _____

Examiners: _____ Operators: _____

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Initial Conditions: Unit 1 100% power, EOL, Div II Core Spray Pumps out of service

Turnover: Maintain power / generator capability curve limits in accordance with the CRC Book

Event No.	Malf. No.	Event Type*	Event Description
1	mfFW145012	I-ATC	Leading Edge Flow Meter Computer Failure
2	mfMS1460013A	C-BOP TS-SRO, R-ATC	3A Feedwater Heater Extraction Steam Isolation, Power Reduction
3	cmf CN02_TIC11028 f:0	C-BOP	RBCCW Temperature Controller Fails in Auto
4	annAR103B01 f:ALARM_ON	I-ATC, TS-SRO	Drywell Pressure Instrument Failure Without ½ Scram
5	mfDB157001	C-BOP	Loss of 1Y218
6	mfHP152009 f:.7	M-All	HPCI Equipment Room Steam Leak, HPCI Isolation Failure
7	mfRP158007B	C-BOP	Failure of 'B' RPS, ARI Completion of Scram
8	IMF cmfBR04_1A10204 IMF cmfPM04_1P113A IMF cmfTR02_PT10101A f:0 IMF cmfTR02_PT10101B f:0	C-ALL	11B Aux Bus fails to auto transfer Loss of EHC Bypass valves fail to auto operate
9	See Malfunction Page	C-BOP	Failure of all but one SRV, Depress Using BPV

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

Scenario Summary

Event 1: After the crew takes the shift, a failure of the LEFM computer will require entry into ON-100-006. The crew will take action to suspend all activities affecting core reactivity, reduce core flow using recirc by 0.5 Mlbm/hr, and swap feedwater flow input to the core thermal power calculation from LEFM to venturis. Priority for this event is to restore heat balance by changing feedwater flow instruments from LEFM to venturi.

Event 2: Once the feedwater input to the heat balance calculation has been changed from LEFM to Venturi, the 3A Feedwater Heater Extraction Steam Isolation Valve will spuriously close. The crew will take action per ON-147-001 Loss of Feedwater Heating Extraction Steam to lower reactor power ≤71% power and isolate extraction steam and drain input to 4A and 5A heaters; SRO will address thermal limit Tech Specs. Priority for this event is reduce reactor power ≤71% to prevent feedwater heater mechanical damage and isolation of extraction steam and the feedwater string if extraction steam cannot be restored within 2 hours (consistent with the 2 hours required to restore MCPR per Tech Specs).

Event 3: Once the Tech Spec call is complete, the RBCCW temperature controller will fail in automatic, causing a rise in temperatures on all RBCCW cooled components and an isolation of RWCU. The crew will take action in accordance with ON-114-001 to begin monitoring Recirc Pump motor bearing and seal cavity temperatures. The crew will diagnose a failure of the temperature controller in AUTO and take manual control to restore system temperatures. Priority for this event is diagnosis of the problem, monitoring of affected components (most importantly Recirc Pump seal temperatures) and restoration of temperature control by taking manual control of the temperature controller or directing control of the TCV bypass valve.

Event 4: When RBCCW cooled component temperatures begin to recover, a drywell pressure transmitter will fail high without an accompanying ½ scram. The crew will respond per alarm response, dispatch NPO and I&C to the field, diagnose a failed transmitter and failure to ½ scram, and the SRO will consult Tech Specs. The crew will insert a ½ scram on 'A' RPS and contact I&C to insert a trip on the failed instrument. Priority for this event is diagnosis of the failed components, determining that the A RPS subsystem will not generate a scram, declare it inoperable and insert a ½ scram.

Event 5: Once ½ scram insertion is complete, the main breaker for 1Y218 will trip, resulting in a loss of instrument bus 1Y218 and 1Y219, requiring the crew to enter ON-117-001. The crew will take action in accordance with ON-117-001 to restore power to 1Y218, place Refueling Water Pumps in service to supply Condensate Transfer System in accordance with OP-037-003, direct an NPO to take local manual control of the in-service CRD flow control valve, and respond to a loss of Zone 1 and U1 Zone 3 ventilation. They will also note that they have lost several wide range level indicators, ARM's, full core display, and other ancillary indications. Partial restoration of the instrument panels will be successful, but the crew will be unable to restore 1Y219. Priority for this event is restoration of power to 1Y218 to restore vital plant instrumentation, restoration of condensate transfer to ensure ECCS keepfill, and controlling drywell cooling to ensure proper cooling to Recirc Pumps and drywell.

Event 6/7: When the crew has stabilized the plant and restored power to 1Y218, a steam leak starts in the HPCI pump/equipment room. The crew will respond per alarm response to high room temperatures and will diagnose the steam leak. The crew will enter EO-100-104 Secondary Containment Control, focusing on the Secondary Containment Temperature leg. Efforts to isolate the leak will be ineffective by automatic and manual means due to a loss of

control power for the inboard isolation valve and mechanically bound outboard isolation valve. When the decision is made that a primary system is discharging into a table 8 RB area, the SRO will direct a reactor scram prior to room temperatures exceeding Max Safe; however 'B' RPS will not generate a SCRAM signal, requiring the use of ARI to complete the SCRAM. Priority for this event is to scram the reactor once it is determined that a primary system is discharging into the reactor building and before temperatures have exceeded max safe.

Event 8: The SRO will enter EO-100-102 for RPV level and pressure control, both from EO-100-104 and also +13" RPV water level entry conditions. When the turbine trips, the 11B Aux Bus will fail to transfer resulting in loss of two Condensate Pumps, two Circ Water Pumps, two Service Water pumps, and the loss of power to the 1B & C RFP Discharge Valves. The crew will need to restore power to the 11B Aux Bus, crosstie load centers, or trip Condensate pumps to prevent uncontrolled Condensate injection during the cooldown. In addition, the 'A' EHC Pump fails to auto start and the bypass valves fail to auto open. The crew will start the 'A' EHC pump and use the bypass valve jack to open bypass valves as necessary to force a cooldown. Priority for this event is to restore EHC, prevent uncontrolled condensate injection, and begin cooldown to reduce reactor pressure.

Event 9: Once the cooldown is in progress, RCIC room temperatures will rise and the crew will receive a report that the door to RCIC was unable to be re-closed after entering HPCI room for attempted leak isolation. It will be reported that there is steam leaking into the RCIC Room. When reactor building temperatures exceed max safe values in two areas (HPCI & RCIC), the SRO will enter EO-100-112 Rapid Depressurization. The SRO will direct opening of all ADS valves; upon discovering that no ADS and only 1 other SRV will open, the SRO will direct alternate depressurization using bypass valves. Priority for this event is to direct rapid depressurization once two areas exceed max safe. Upon discovery of only one SRV operating, direct alternate depressurization using bypass valves.

The scenario can be terminated once emergency depressurization using bypass valves or alternate systems has commenced.

	Target Quantitative Attributes (Per Scenario; See Section D.5.d)	Actual Attributes
1.	Total malfunctions (5–8)	7
2.	Malfunctions after EOP entry (1–2)	2
3.	Abnormal events (2–4)	4
4.	Major transients (1–2)	1
5.	EOPs entered/requiring substantive actions (1–2) EO-100-104/EO-100-102	2
6.	EOP contingencies requiring substantive actions (0–2) EO-100-112	1
7.	Critical tasks (2–3)	2