ML21320A331

Facility:	Catawba Nuclear Station	Date of Examination:	Sep 2021
Examination Level:	RO ☒ SRO ☐	Operating Test Number:	2021301

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R, N	**Calculate Reactor Vessel Head Venting Time** G 2.1.23 Ability to perform specific system and integrated plant procedures during al modes of plant operation.
Conduct of Operations	R, N	**Determine Rod Insertion Limit Boration** G 2.1.43 Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc.
Equipment Control	R, D	**Determine NC Subcooling on a Loss of OAC** G 2.2.12 Knowledge of surveillance procedures.
Radiation Control	R, D, P	**Determine RP Requirements** G 2.3.14 Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities.
Emergency Plan		

NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).

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

Admin JPMs

JPM A.1-1R Calculate Reactor Vessel Head Vent Time – New JPM.

K/A Generic 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR 41.10 / 43.5 / 45.2 / 45.6) RO 4.3 SRO 4.4

Initial conditions are that a LOCA has occurred on Unit 1. The applicants are directed to calculate and record the maximum reactor vessel head venting time per EP/1/A/5000/FR-I.3 (Response to Voids in Reactor Vessel) Enclosure 2 (Allowable Hydrogen Venting Time). The applicants are given Enclosure 2 of FR-I.3 and pictures of control board meters for Containment Pressure, Hydrogen Concentration, Lower Containment Air Temperature, and Wide Range NC System Pressure which will be used in the calculation. Applicants will calculate the allowable head venting time of 2.1 – 4.4 minutes based on bounding values determined.

JPM A.1-2R Determine Rod Insertion Limit Boration – New JPM.

K/A Generic 2.1.43 Ability to use procedures to determine the effects on reactivity of plant changes, such as reactor coolant system temperature, secondary plant, fuel depletion, etc. (CFR 41.10 / 43.6 / 45.6) RO 4.1 SRO 4.3

Initial conditions are that Unit 1 has experienced a runback from 85% RTP following a Zone A Lockout. Applicants are given current power level, core life, current Control Bank D rod position, and current NC System boron concentration. The applicants are directed to determine the amount of boric acid required to restore control rods to 10 steps above the Rod Insertion Limits per AP/1/A/5500/003 (Load Rejection) Enclosure 3 (Rod Insertion Limit Boration). The applicants will use the Enclosure as well as the Unit 1 ROD Manual to determine that in order to restore control rods to 10 steps above the Insertion Limits that 308 – 411 gallons of boric acid must be added to the NC System.

JPM A.2R Determine NC Subcooling on a Loss of the Operator Aid Computer – Bank JPM CCM-003.

K/A Generic 2.2.12 Knowledge of surveillance procedures. (CFR 41.10 / 45.13) RO 3.7 SRO 4.1

Initial conditions are that Unit 1 is in Mode 3 and has experienced a loss of the Operator Aid Computer. PT/1/A/4600/009 (Loss of Operator Aid Computer) is in progress with both trains of the Plasma display monitors inoperable. The applicants are given a table of values for different NC system temperatures and pressures and are directed to complete Enclosure 13.8 (Subcooling Data Sheet) to determine the °F that the NC system is subcooled, and determine if the amount of subcooling margin meets the acceptance criteria of PT/1/A/4600/009. Applicants will determine the subcooling margin is 13°F – 21°F and that this does not meet the acceptance criteria of 30°F for a Mode 3 condition.

JPM A.3R Determine Radiation Protection Requirements for an activity – Bank JPM Previously used on 2019 NRC exam (JPM A.3R).

K/A Generic 2.3.14 Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities. (CFR 41.12 / 43.4 / 45.10) RO 3.4 SRO 3.8

Initial conditions are that Unit 1 has entered AP/1/A/5500/019 (Loss of Residual Heat Removal). The CRS has sent an AO to the 1A ND pump room to stand by in a low exposure waiting area and await word to vent 1A ND pump. The applicant is given a copy of RWP # 5021 (ECCS venting) and a copy of a plan view for 1A and 2A ND pump rooms and a timeline for the evolution. The applicant will calculate total dose received during the waiting period and pump vent to be 13 mR and then calculate allowable time at LEWA before exceeding 80% of the dose specified in the RWP to be 42 minutes.

Facility: Catawba Nuclear Station	Date of Examination: Sep 2021
Examination Level: RO ☐ SRO ☒	Operating Test Number: 2021301

Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R, D, P	**Calculate Boric Acid and Water Addition to FWST and determine Tech Spec actions** G 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation.
Conduct of Operations	R, D	**Determine License Status** G 2.1.4 Knowledge of individual licensed operator responsibilities related to shift staffing, such as medical records, “no-solo” operation, maintenance of active license status.
Equipment Control	R, N	**Determine Isolation Boundary** G 2.2.41 Ability to obtain and interpret station electrical and mechanical drawings.
Radiation Control	R, D	**Review Liquid Waste Release** G 2.3.6 Ability to approve release permits.
Emergency Plan	R, N	**Classify an Event and Fill Out the Emergency Notification Form** G 2.4.40 Knowledge of SRO responsibilities in emergency plan implementation.

NOTE: All items (five total) are required for SROs. RO applicants require only four items unless they are retaking only the administrative topics (which would require all five items).

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

Admin JPMs

JPM A.1-1S Calculate Boric Acid and Water Addition to FWST and determine Tech Spec Actions – Bank JPM previously used on 2017 NRC Exam (JPM A.1-2S).

K/A Generic 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. (CFR 41.10 / 43.5 / 45.2 / 45.6) RO 4.3 SRO 4.4

Initial conditions are that an improper valve lineup has decreased Unit 1 FWST level. The valve lineup issue has been corrected to stop the level decrease. The applicant is directed to calculate a makeup to the FWST to restore level to a value above the Tech Spec minimum. Following makeup calculation, the applicant is required to address Tech Specs action at the time of discovery and one hour later. The applicant will conclude an action statement existed at time of discovery due to level below minimum required. One hour later, with a given makeup flowrate, the applicant will determine that level remains below minimum. This will require entry into another action due to inability to restore operability within one hour, as well as remaining in original action statement.

JPM A.1-2S Determine License Status – Bank JPM (NS07-001)

K/A Generic 2.1.4 Knowledge of individual licensed operator responsibilities related to shift staffing, such as medical records, "no solo" operation, maintenance of active license status. (CFR 41.10 / 43.2) RO 3.3 SRO 3.8

Initial conditions have the applicants evaluating the work histories of 3 different licensed operators with Unit 1 in Mode 1 the entire time and Unit 2 in a refueling outage. Using AD-OP-ALL-0107 (Maintenance of RO and SRO Licenses), the applicants will determine that one of the reviewed individuals will have an active license and the two others will not on July 1.

JPM A.2S Use Flow Diagrams and Electrical Prints to Determine Work Isolation Boundary – New JPM.

K/A Generic 2.2.41 Ability to obtain and interpret station electrical and mechanical drawings. (CFR 41.10 / 45.12 / 45.13) RO 3.5 SRO 3.9

Initial conditions are that 2A motor driven Auxiliary Feedwater Pump has been shutdown in accordance with OP/2/A/6250/002 (Auxiliary Feedwater System) and is to be tagged out for pump casing disassembly and impeller replacement. The applicants are given mechanical flow diagrams for the Auxiliary Feedwater System as well as electrical one-line diagrams for 2ETA and 2ETB essential busses. Applicants are directed to determine the required boundary isolation for the required work. They are instructed to use the valves closest to the work being performed to minimize drain and fill time. Applicants need to determine the mechanical/electrical isolations as well as an applicable vent and drain path.

JPM A.3S Review Liquid Waste Release – Bank JPM (WL-002)

K/A Generic 2.3.6 Ability to approve release permits. (CFR 41.10 / 45.12 / 45.13) RO 2.0 SRO 3.8

Initial conditions are given to the applicants including Unit status, RC pumps in service, RL discharge flow, RN pump status, and that the LWR integrator is operable. An LWR has been delivered to the control room and approved by the previous shifts CRS. The BOP has notified the CRS that the LWR is ready to be released per OP/0/B/6500/013 (Operations Liquid Waste Release) Enclosure 4.1 (Liquid Waste Release from a Monitor Tank). Applicants are to review the LWR and determine if the release should be generated and, if not, list any issues that would prevent the release initiation. Applicants will determine that the LWR should not be initiated due to all of the following: incorrect EMF-49 Trip 2 setpoint, incorrect RL flow interlock setpoint, and incorrect 1WL-124 flowrate setpoint.

JPM A.4S Classify an Event and Fill Out the Emergency Notification Form – New JPM

K/A 2.4.40 Knowledge of SRO responsibilities in emergency plan implementation. (CFR 41.10 / 43.5 / 45.11) RO 2.7 SRO 4.5

Initial conditions are both Units are at 100% RTP when a seismic event is felt within the protected area. Annunciator 1AD-4, B/8 “OBE EXCEEDED” is received as well as a Loss of Offsite Power on Unit 2 with failure of 2B D/G to start. An auxiliary operator reports that the 1A NI (Safety Injection) pump discharge piping is cracked with water leaking out at 125 drops per minute. Applicants are to use AD-EP-ALL-0101 (Emergency Classification) and CSD-EP-CNS-0101-02 (EAL Wallcharts) to classify the event and fill out the Emergency Notification Form per AD-EP-ALL-0304 (State and County Notification). This JPM is time critical for both the classification ($\leq$ 15 minutes) and filling out the ENF form ($\leq$ 15 minutes).

Facility: Catawba Nuclear Station Date of Examination: Sep 2021

Exam Level: RO ☒ SRO-I ☐ SRO-U ☐ Operating Test Number: 2021301

Control Room Systems:* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U		
System/JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System	A, L, P, D, S	1
b. Isolate Cold Leg Accumulators During Shutdown LOCA	A, L, M, S	3
c. Restore CA flow following Feed & Bleed (w/ 1CA-4 closed)	A, EN, L, N, S	4S
d. Perform E-0 Actions to Ensure Complete Containment Isolation	A, M, S	2
e. Align the NS System for Cold Leg Recirculation	A, D, L, S	5
f. Manual Alignment of 1FTB	D, S	6
g. Reset Radiation Monitor Trip Setpoints	D, P, S	7
h. Place KC in Parallel Operation	D, S	8
In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U		
i. Local ESPS alignment to 2ETB (2ATD) – AP-07 Encl. 52	E, L, N	6
j. Place Hydrogen Recombiner in Service	E, L, D, R	5
k. Break Main Condenser Vacuum Locally – Unit 1	E, D	4S

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

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	4–6/4–6 /2–3 **(5)**
(C)ontrol room	
(D)irect from bank	≤ 9/≤ 8/≤ 4 **(7)**
(E)mergency or abnormal in-plant	≥ 1/≥ 1/≥ 1 **(3)**
(EN)gineered safety feature	≥ 1/≥ 1/≥ 1 (control room system) **(1)**
(L)ow-Power/Shutdown	≥ 1/≥ 1/≥ 1 **(6)**
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/≥ 1 **(4)**
(P)revious 2 exams	≤ 3/≤ 3/≤ 2 (randomly selected) **(2)**
(R)CA	≥ 1/≥ 1/≥ 1 **(1)**
(S)imulator	

System JPMs

JPM A Emergency Borate the Reactor Coolant System – Bank JPM (Alternate Path) Previously used on 2017 NRC exam (JPM A)

K/A System 004 A2.14 Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct control, or mitigate the consequences of those malfunctions or operations: Emergency Boration. (CFR 41.5 / 43.5 / 45.3 / 45.5) RO 3.8 SRO 3.9

Initial conditions are that an ATWS is in progress following a valid reactor trip signal and failure of the reactor to trip automatically or manually. The applicants are directed to initiate emergency boration per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicants will begin by attempting to open 1NV-236B (Boric Acid to NV Pump Suction). This valve will not open and begins the alternate path for this JPM. The applicants will continue with the procedure and start both boric acid transfer pumps. With emergency boration flow not showing greater than 30 GPM, the applicants will align the suction of the NV pumps to the FWST and isolate the NV pump suction from the VCT.

JPM B Isolate Cold Leg Accumulators Following a Shutdown LOCA – Modified Bank JPM (Alternate Path). JPM was modified to change the Cold Leg Accumulators that could not be isolated.

K/A System 006 A1.13 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: Accumulator pressure (level, boron concentration). (CFR 41.5 / 45.5) RO 3.5 SRO 3.7

Initial conditions have the Unit in Mode 4 with a shutdown in progress for a refueling outage, when Pressurizer pressure and level begin to unexpectedly lower. The crew has entered AP/1/A/5500/027 (Shutdown LOCA) to address the Reactor Coolant System leak. The applicants are directed to isolate the Unit 1 Cold Leg Accumulators per AP/27 Enclosure 17 (Isolating Cold Leg Accumulators). The applicants will attempt to close all 4 Cold Leg Accumulator isolation valves, but the isolations for 1A and 1D Cold Leg Accumulators will not close. This begins the alternate path for this JPM. The applicants will go on to perform the steps to vent the 1A and 1D Cold Leg Accumulators to containment.

JPM C Restore CA flow following NC System Feed and Bleed – NEW JPM (Alternate Path)

K/A EPE05 EA1.1 Ability to operate and/or monitor the following as they apply to the Loss of Secondary Heat Sink: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR 41.7 / 45.5 / 45.6) RO 4.1 SRO 4.0

Initial conditions have Unit 1 in Mode 3 following a loss of all feedwater. NC system bleed and feed have been initiated per EP/1/A/5000/FR-H.1 (Loss of Secondary Heat Sink). A report from maintenance is received, informing the crew that 1A CA pump is ready to be started. The applicants are directed to perform Step 7 to establish CA flow from 1A CA pump. During the initial stages of restoring flow from 1A CA pump, it is discovered that 1CA-4 (CA Pmps Suct From UST) is closed and cannot be opened. This begins the alternate path for this JPM. The applicant will align suction from the RN system, and start the 1A CA pump. Since the CA flow control valves were previously closed when aligning for feed and bleed, the applicants will be sent to Enclosure 7 (S/G CA Flow Restoration) to initiate CA flow to 1A and/or 1B S/Gs.

JPM D Perform E-0 Actions to Ensure a Complete Containment Isolation – Modified Bank JPM (Alternate Path). JPM was modified by changing the containment penetration that the applicants will need to manually isolate.

K/A System 013 A4.01 Ability to manually operate and/or monitor in the control room: ESFAS-initiated equipment which fails to actuate. (CFR 41.7 / 45.5 to 45.8) RO 4.5 SRO 4.8

Initial conditions have the Unit in Mode 1, 100% RTP. The applicants are informed that they are the OATC, that the BOP has stepped out of the control room, and that the CRS is performing an IPTE brief on Unit 2, and to monitor their control boards. Once the applicants are ready, a Large Break LOCA is inserted. The applicants will verify the immediate actions of EP/1/A/5000/E-0 (Reactor Trip or Safety Injection). The applicants are then directed to continue the actions of E-0. When checking for proper Phase A containment isolation, the applicants will discover failure of automatic actuation and will manually initiate Phase A. This begins the alternate path for this JPM. When the applicants check for proper Monitor Light Panel alignment, they will discover that NV letdown isolation valves 1NV-10A and 1NV-15B and liquid waste penetration isolation valves 1WL-805A and 1WL-807B did not close on the Phase A initiation signal. The applicants will manually close these valves to complete the JPM.

JPM E Align the NS System for Cold Leg Recirculation – Bank JPM (Alternate Path)

K/A System 026 A4.01 Ability to manually operate and/or monitor in the control room: CSS controls (CFR 41.7 / 45.5 to 45.8) RO 4.5 SRO 4.3

Initial conditions are that a LOCA has occurred on Unit 1 and EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation) is in progress. The applicants are directed to align NS for Cold Leg Recirculation per ES-1.3 Enclosure 2 (Aligning NS for Recirculation). The applicants will close the NS pump suctions from the FWST and open the NS Spray header 1A containment isolation valves. The applicants will attempt to open the 1A NS pump suction from the containment sump, but the valve will not open. This begins the alternate path for this JPM. The applicants will then perform the steps to align and start the 1B NS pump and align cooling water to the 1B NS Heat Exchanger.

JPM F Manually Align Essential power to 1FTB from 1ETB per AP/1/A/5500/007 Case 1 Step 10 – Bank JPM

K/A System 062 A4.01 Ability to manually operate and/or monitor in the control room: All breakers (including available switchyard). (CFR 41.7 / 45.5 to 45.8) RO 3.3 SRO 3.1

Initial conditions are that Unit 1 is operating at 100% RTP when a blackout occurs on 1ETB due to a failure of 1ATD. The 1B D/G is supplying 1ETB. The crew has implemented AP/1/A/5500/007 Case 1 (Loss of Normal Power to an Essential Train). The applicants are directed to perform Step 10. Applicants will determine that 1FTB is de-energized and will use the procedure to reset the 1B D/G load sequencer and close breakers to energize 1FTB from 1ETB.

JPM G Reset Radiation Monitor Trip Setpoints – Bank JPM previously used on 2017 NRC Exam (JPM F)

K/A System 073 A4.02 Ability to manually operate and/or monitor in the control room: Radiation monitoring system control panel. (CFR 41.7 / 45.5 to 45.8) RO 3.7 SRO 3.7

Initial conditions are that following a discussion with RP on a premature gaseous waste release termination, that EMF-50L trip setpoints need to be changed. The applicants are directed to change the trip 1 setpoint to 6300 cpm and the trip 2 setpoint to 9000 cpm using OP/0/A/6500/080 (EMF RP86A Output Modules) Enclosure 4.2 (EMF RP86A and RM1000 Trip Setpoint Adjustment).

JPM H Place KC in Parallel Operation per OP/1/A/6400/005 – Bank JPM

K/A System 008 A4.01 Ability to manually operate and/or monitor in the control room: CCW indications and controls. (CFR 41.7 / 45.5) RO 3.3 SRO 3.1

Initial conditions are that Unit 1 is at 100% RTP and that a worklist item has been generated to place Unit 1 KC system in parallel operation in preparation for Aux Safeguards Testing early next shift. The applicants are directed to place KC in parallel operation per OP/1/A/6400/005 (Component Cooling System) Enclosure 4.4 (Operation of Additional KC Pumps/Parallel Operation). The applicants will ensure RN system miniflow from Unit 2, ensure proper flowpath on Unit 1, place the 1A KC outlet mode switch in the “KC TEMP” position, bypass the letdown mixed bed demineralizers, and start an ‘A’ train KC pump.

JPM I Local ESPS Alignment to 2ETB through 2ATD – NEW JPM

K/A Generic Emergency 055 EA2.03 Ability to determine or interpret the following as they apply to a Station Blackout: Actions necessary to restore power. (CFR 43.5 / 45.13) RO 3.9 SRO 4.7

Initial conditions are that Unit 2 is in Mode 3 following a Loss of All AC Power. EP/2/A/5000/ECA-0.0 (Loss of All AC Power) has been entered. Neither of the Emergency D/Gs could be started. Station management has determined that power will be restored to 2ETB from ESPS (Emergency Supplemental Power Supply) through 2ATD. The applicants are directed to perform ECA-0.0 Enclosure 52 (Local ESPS Alignment to 2ETB through 2ATD) beginning at Step 3. Applicants will ensure required breakers are open, start ESPS D/Gs 1 and 2, and close breakers required to align power from the ESPS D/Gs through 2ATD to 2ETB.

JPM J Place 1B Hydrogen Recombiner in Service – Bank JPM

K/A System 028 A2.01 Malfunctions or operations on the HRPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Hydrogen Recombiner power setting, determined by using plant data book. (CFR 41.5 / 43.5 / 45.3 / 45.13) RO 3.4 SRO 3.6

Initial conditions are that a LOCA has occurred on Unit 1. The applicants are directed to place Hydrogen Recombiner 1B in service at the required power level per OP/1/A/6450/010 (Containment Hydrogen Control System) Enclosure 4.10 (Operation of the Hydrogen Recombiners Following a LOCA) steps 3.1 through 3.3.14. Applicants are given current containment pressure and containment hydrogen concentration. When performing the steps to place 1B Hydrogen Recombiner in service, the applicants will be required to determine the required power level using Unit 1 Revised Databook Figure 10. With hydrogen concentration exceeding 3.5%, the applicants will be required to add 4 KW to the value determined from Figure 10 to determine the final power level.

JPM K Break Main Condenser Vacuum Locally – Bank JPM

K/A System 045 A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MT/G system controls including: Expected response of secondary plant parameters following a T/G trip.

Initial conditions are that Unit 1 is in Mode 3 following a reactor trip. The applicants are directed to perform AP/1/A/5500/006 (Loss of S/G Feedwater) Enclosure 3 (Local Actions to Break Condenser Vacuum). This JPM is time critical and must be performed in < 10 minutes. The time critical time will end when the first condenser vacuum breaker valve is opened. Once all 3 vacuum breaker valves are opened, the applicant will close Main and Aux Steam to the Air Ejectors.

Facility: Catawba Nuclear Station	Date of Examination: Sep 2021
Exam Level: RO ☐ SRO-I ☒ SRO-U ☐	Operating Test Number: 2021301

Control Room Systems:* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U

System/JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System	A, L, P, D, S	1
b. Isolate Cold Leg Accumulators During Shutdown LOCA	A, L, M, S	3
c. Restore CA flow following Feed & Bleed (w/ 1CA-4 closed)	A, EN, L, N, S	4S
d. Perform E-0 Actions to Ensure Complete Containment Isolation	A, M, S	2
e. Align the NS System for Cold Leg Recirculation	A, D, L, S	5
f. Manual Alignment of 1FTB	D, S	6
g. Reset Radiation Monitor Trip Setpoints	D, P, S	7

In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U

System/JPM Title	Type Code*	Safety Function
i. Local ESPS alignment to 2ETB (2ATD) – AP-07 Encl. 52	E, L, N	6
j. Place Hydrogen Recombiner in Service	E, L, D, R	5
k. Break Main Condenser Vacuum Locally – Unit 1	E, D	4S

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

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	4–6/4–6 /2–3 **(5)**
(C)ontrol room	
(D)irect from bank	≤ 9/≤ 8/≤ 4 **(6)**
(E)mergency or abnormal in-plant	≥ 1/≥ 1/≥ 1 **(3)**
(EN)gineered safety feature	≥ 1/≥ 1/≥ 1 (control room system) **(1)**
(L)ow-Power/Shutdown	≥ 1/≥ 1/≥ 1 **(6)**
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/≥ 1 **(4)**
(P)revious 2 exams	≤ 3/≤ 3/≤ 2 (randomly selected) **(2)**
(R)CA	≥ 1/≥ 1/≥ 1 **(1)**
(S)imulator	

System JPMs

JPM A Emergency Borate the Reactor Coolant System – Bank JPM (Alternate Path) Previously used on 2017 NRC exam (JPM A)

K/A System 004 A2.14 Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct control, or mitigate the consequences of those malfunctions or operations: Emergency Boration. (CFR 41.5 / 43.5 / 45.3 / 45.5) RO 3.8 SRO 3.9

Initial conditions are that an ATWS is in progress following a valid reactor trip signal and failure of the reactor to trip automatically or manually. The applicants are directed to initiate emergency boration per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicants will begin by attempting to open 1NV-236B (Boric Acid to NV Pump Suction). This valve will not open and begins the alternate path for this JPM. The applicants will continue with the procedure and start both boric acid transfer pumps. With emergency boration flow not showing greater than 30 GPM, the applicants will align the suction of the NV pumps to the FWST and isolate the NV pump suction from the VCT.

JPM B Isolate Cold Leg Accumulators Following a Shutdown LOCA – Modified Bank JPM (Alternate Path). JPM was modified to change the Cold Leg Accumulators that could not be isolated.

K/A System 006 A1.13 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: Accumulator pressure (level, boron concentration). (CFR 41.5 / 45.5) RO 3.5 SRO 3.7

Initial conditions have the Unit in Mode 4 with a shutdown in progress for a refueling outage, when Pressurizer pressure and level begin to unexpectedly lower. The crew has entered AP/1/A/5500/027 (Shutdown LOCA) to address the Reactor Coolant System leak. The applicants are directed to isolate the Unit 1 Cold Leg Accumulators per AP/27 Enclosure 17 (Isolating Cold Leg Accumulators). The applicants will attempt to close all 4 Cold Leg Accumulator isolation valves, but the isolations for 1A and 1D Cold Leg Accumulators will not close. This begins the alternate path for this JPM. The applicants will go on to perform the steps to vent the 1A and 1D Cold Leg Accumulators to containment.

JPM C Restore CA flow following NC System Feed and Bleed – NEW JPM (Alternate Path)

K/A EPE05 EA1.1 Ability to operate and/or monitor the following as they apply to the Loss of Secondary Heat Sink: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR 41.7 / 45.5 / 45.6) RO 4.1 SRO 4.0

Initial conditions have Unit 1 in Mode 3 following a loss of all feedwater. NC system bleed and feed have been initiated per EP/1/A/5000/FR-H.1 (Loss of Secondary Heat Sink). A report from maintenance is received, informing the crew that 1A CA pump is ready to be started. The applicants are directed to perform Step 7 to establish CA flow from 1A CA pump. During the initial stages of restoring flow from 1A CA pump, it is discovered that 1CA-4 (CA Pmps Suct From UST) is closed and cannot be opened. This begins the alternate path for this JPM. The applicant will align suction from the RN system, and start the 1A CA pump. Since the CA flow control valves were previously closed when aligning for feed and bleed, the applicants will be sent to Enclosure 7 (S/G CA Flow Restoration) to initiate CA flow to 1A and/or 1B S/Gs.

JPM D Perform E-0 Actions to Ensure a Complete Containment Isolation – Modified Bank JPM (Alternate Path). JPM was modified by changing the containment penetration that the applicants will need to manually isolate.

K/A System 013 A4.01 Ability to manually operate and/or monitor in the control room: ESFAS-initiated equipment which fails to actuate. (CFR 41.7 / 45.5 to 45.8) RO 4.5 SRO 4.8

> Initial conditions have the Unit in Mode 1, 100% RTP. The applicants are informed that they are the OATC, that the BOP has stepped out of the control room, and that the CRS is performing an IPTE brief on Unit 2, and to monitor their control boards. Once the applicants are ready, a Large Break LOCA is inserted. The applicants will verify the immediate actions of EP/1/A/5000/E-0 (Reactor Trip or Safety Injection). The applicants are then directed to continue the actions of E-0. When checking for proper Phase A containment isolation, the applicants will discover failure of automatic actuation and will manually initiate Phase A. This begins the alternate path for this JPM. When the applicants check for proper Monitor Light Panel alignment, they will discover that NV letdown isolation valves 1NV-10A and 1NV-15B and liquid waste penetration isolation valves 1WL-805A and 1WL-807B did not close on the Phase A initiation signal. The applicants will manually close these valves to complete the JPM.

JPM E Align the NS System for Cold Leg Recirculation – Bank JPM (Alternate Path)

K/A System 026 A4.01 Ability to manually operate and/or monitor in the control room: CSS controls (CFR 41.7 / 45.5 to 45.8) RO 4.5 SRO 4.3

> Initial conditions are that a LOCA has occurred on Unit 1 and EP/1/A/5000/ES-1.3 (Transfer to Cold Leg Recirculation) is in progress. The applicants are directed to align NS for Cold Leg Recirculation per ES-1.3 Enclosure 2 (Aligning NS for Recirculation). The applicants will close the NS pump suctions from the FWST and open the NS Spray header 1A containment isolation valves. The applicants will attempt to open the 1A NS pump suction from the containment sump, but the valve will not open. This begins the alternate path for this JPM. The applicants will then perform the steps to align and start the 1B NS pump and align cooling water to the 1B NS Heat Exchanger.

JPM F Manually Align Essential power to 1FTB from 1ETB per AP/1/A/5500/007 Case 1 Step 10 – Bank JPM

K/A System 062 A4.01 Ability to manually operate and/or monitor in the control room: All breakers (including available switchyard). (CFR 41.7 / 45.5 to 45.8) RO 3.3 SRO 3.1

> Initial conditions are that Unit 1 is operating at 100% RTP when a blackout occurs on 1ETB due to a failure of 1ATD. The 1B D/G is supplying 1ETB. The crew has implemented AP/1/A/5500/007 Case 1 (Loss of Normal Power to an Essential Train). The applicants are directed to perform Step 10. Applicants will determine that 1FTB is de-energized and will use the procedure to reset the 1B D/G load sequencer and close breakers to energize 1FTB from 1ETB.

JPM G Reset Radiation Monitor Trip Setpoints – Bank JPM previously used on 2017 NRC Exam (JPM F)

K/A System 073 A4.02 Ability to manually operate and/or monitor in the control room: Radiation monitoring system control panel. (CFR 41.7 / 45.5 to 45.8) RO 3.7 SRO 3.7

> Initial conditions are that following a discussion with RP on a premature gaseous waste release termination, that EMF-50L trip setpoints need to be changed. The applicants are directed to change the trip 1 setpoint to 6300 cpm and the trip 2 setpoint to 9000 cpm using OP/0/A/6500/080 (EMF RP86A Output Modules) Enclosure 4.2 (EMF RP86A and RM1000 Trip Setpoint Adjustment).

JPM I Local ESPS Alignment to 2ETB through 2ATD – NEW JPM

K/A Generic Emergency 055 EA2.03 Ability to determine or interpret the following as they apply to a Station Blackout: Actions necessary to restore power. (CFR 43.5 / 45.13) RO 3.9 SRO 4.7

Initial conditions are that Unit 2 is in Mode 3 following a Loss of All AC Power. EP/2/A/5000/ECA-0.0 (Loss of All AC Power) has been entered. Neither of the Emergency D/Gs could be started. Management has determined that power will be restored to 2ETB from ESPS (Emergency Supplemental Power Supply) through 2ATD. The applicants are directed to perform ECA-0.0 Enclosure 52 (Local ESPS Alignment to 2ETB through 2ATD) beginning at Step 3. Applicants will ensure required breakers are open, start ESPS D/Gs 1 and 2, and close breakers required to align power from the ESPS D/Gs through 2ATD to 2ETB.

JPM J Place 1B Hydrogen Recombiner in Service – Bank JPM

K/A System 028 A2.01 Malfunctions or operations on the HRPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Hydrogen Recombiner power setting, determined by using plant data book. (CFR 41.5 / 43.5 / 45.3 / 45.13) RO 3.4 SRO 3.6

Initial conditions are that a LOCA has occurred on Unit 1. The applicants are directed to place Hydrogen Recombiner 1B in service at the required power level per OP/1/A/6450/010 (Containment Hydrogen Control System) Enclosure 4.10 (Operation of the Hydrogen Recombiners Following a LOCA) steps 3.1 through 3.3.14. Applicants are given current containment pressure and containment hydrogen concentration. When performing the steps to place 1B Hydrogen Recombiner in service, the applicants will be required to determine the required power level using Unit 1 Revised Databook Figure 10. With hydrogen concentration exceeding 3.5%, the applicants will be required to add 4 KW to the value determined from Figure 10 to determine the final power level.

JPM K Break Main Condenser Vacuum Locally – Bank JPM

K/A System 045 A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the MT/G system controls including: Expected response of secondary plant parameters following a T/G trip.

Initial conditions are that Unit 1 is in Mode 3 following a reactor trip. The applicants are directed to perform AP/1/A/5500/006 (Loss of S/G Feedwater) Enclosure 3 (Local Actions to Break Condenser Vacuum). This JPM is time critical and must be performed in < 10 minutes. The time critical time will end when the first condenser vacuum breaker valve is opened. Once all 3 vacuum breaker valves are opened, the applicant will close Main and Aux Steam to the Air Ejectors.

Facility: Catawba Nuclear Station	Date of Examination: Sep 2021
Exam Level: RO ☐ SRO-I ☐ SRO-U ☒	Operating Test Number: 2021301

Control Room Systems:* 8 for RO, 7 for SRO-I, and 2 or 3 for SRO-U

System/JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System	A, L, P, D, S	1
b. Isolate Cold Leg Accumulators During Shutdown LOCA	A, L, M, S	3
c. Restore CA flow following Feed & Bleed (w/ 1CA-4 closed)	A, EN, L, N, S	4S

In-Plant Systems:* 3 for RO, 3 for SRO-I, and 3 or 2 for SRO-U

System/JPM Title	Type Code*	Safety Function
i. Local ESPS alignment to 2ETB (2ATD) – AP-07 Encl. 52	E, L, N	6
j. Place Hydrogen Recombiner in Service	E, L, D, R	5

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

* Type Codes	Criteria for R /SRO-I/SRO-U
(A)lternate path	4–6/4–6 /2–3 **(3)**
(C)ontrol room	
(D)irect from bank	≤ 9/≤ 8/≤ 4 **(2)**
(E)mergency or abnormal in-plant	≥ 1/≥ 1/≥ 1 **(2)**
(EN)gineered safety feature	≥ 1/≥ 1/≥ 1 (control room system) **(1)**
(L)ow-Power/Shutdown	≥ 1/≥ 1/≥ 1 **(5)**
(N)ew or (M)odified from bank including 1(A)	≥ 2/≥ 2/≥ 1 **(3)**
(P)revious 2 exams	≤ 3/≤ 3/≤ 2 (randomly selected) **(1)**
(R)CA	≥ 1/≥ 1/≥ 1 **(1)**
(S)imulator	

System JPMs

JPM A Emergency Borate the Reactor Coolant System – Bank JPM (Alternate Path) Previously used on 2017 NRC exam (JPM A)

K/A System 004 A2.14 Ability to (a) predict the impacts of the following malfunctions or operations on the CVCS; and (b) based on those predictions, use procedures to correct control, or mitigate the consequences of those malfunctions or operations: Emergency Boration. (CFR 41.5 / 43.5 / 45.3 / 45.5) RO 3.8 SRO 3.9

> Initial conditions are that an ATWS is in progress following a valid reactor trip signal and failure of the reactor to trip automatically or manually. The applicants are directed to initiate emergency boration per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicants will begin by attempting to open 1NV-236B (Boric Acid to NV Pump Suction). This valve will not open and begins the alternate path for this JPM. The applicants will continue with the procedure and start both boric acid transfer pumps. With emergency boration flow not showing greater than 30 GPM, the applicants will align the suction of the NV pumps to the FWST and isolate the NV pump suction from the VCT.

JPM B Isolate Cold Leg Accumulators Following a Shutdown LOCA – Modified Bank JPM (Alternate Path). JPM was modified to change the Cold Leg Accumulators that could not be isolated.

K/A System 006 A1.13 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the ECCS controls including: Accumulator pressure (level, boron concentration). (CFR 41.5 / 45.5) RO 3.5 SRO 3.7

> Initial conditions have the Unit in Mode 4 with a shutdown in progress for a refueling outage, when Pressurizer pressure and level begin to unexpectedly lower. The crew has entered AP/1/A/5500/027 (Shutdown LOCA) to address the Reactor Coolant System leak. The applicants are directed to isolate the Unit 1 Cold Leg Accumulators per AP/27 Enclosure 17 (Isolating Cold Leg Accumulators). The applicants will attempt to close all 4 Cold Leg Accumulator isolation valves, but the isolations for 1A and 1D Cold Leg Accumulators will not close. This begins the alternate path for this JPM. The applicants will go on to perform the steps to vent the 1A and 1D Cold Leg Accumulators to containment.

JPM C Restore CA flow following NC System Feed and Bleed – NEW JPM (Alternate Path)

K/A EPE05 EA1.1 Ability to operate and/or monitor the following as they apply to the Loss of Secondary Heat Sink: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. (CFR 41.7 / 45.5 / 45.6) RO 4.1 SRO 4.0

> Initial conditions have Unit 1 in Mode 3 following a loss of all feedwater. NC system bleed and feed have been initiated per EP/1/A/5000/FR-H.1 (Loss of Secondary Heat Sink). A report from maintenance is received, informing the crew that 1A CA pump is ready to be started. The applicants are directed to perform Step 7 to establish CA flow from 1A CA pump. During the initial stages of restoring flow from 1A CA pump, it is discovered that 1CA-4 (CA Pmps Suct From UST) is closed and cannot be opened. This begins the alternate path for this JPM. The applicant will align suction from the RN system, and start the 1A CA pump. Since the CA flow control valves were previously closed when aligning for feed and bleed, the applicants will be sent to Enclosure 7 (S/G CA Flow Restoration) to initiate CA flow to 1A and/or 1B S/Gs.

JPM I Local ESPS Alignment to 2ETB through 2ATD – NEW JPM

K/A Generic Emergency 055 EA2.03 Ability to determine or interpret the following as they apply to a Station Blackout: Actions necessary to restore power. (CFR 43.5 / 45.13) RO 3.9 SRO 4.7

Initial conditions are that Unit 2 is in Mode 3 following a Loss of All AC Power. EP/2/A/5000/ECA-0.0 (Loss of All AC Power) has been entered. Neither of the Emergency D/Gs could be started. Management has determined that power will be restored to 2ETB from ESPS (Emergency Supplemental Power Supply) through 2ATD. The applicants are directed to perform ECA-0.0 Enclosure 52 (Local ESPS Alignment to 2ETB through 2ATD) beginning at Step 3. Applicants will ensure required breakers are open, start ESPS D/Gs 1 and 2, and close breakers required to align power from the ESPS D/Gs through 2ATD to 2ETB.

JPM J Place 1B Hydrogen Recombiner in Service – Bank JPM

K/A System 028 A2.01 Malfunctions or operations on the HRPS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Hydrogen Recombiner power setting, determined by using plant data book. (CFR 41.5 / 43.5 / 45.3 / 45.13) RO 3.4 SRO 3.6

Initial conditions are that a LOCA has occurred on Unit 1. The applicants are directed to place Hydrogen Recombiner 1B in service at the required power level per OP/1/A/6450/010 (Containment Hydrogen Control System) Enclosure 4.10 (Operation of the Hydrogen Recombiners Following a LOCA) steps 3.1 through 3.3.14. Applicants are given current containment pressure and containment hydrogen concentration. When performing the steps to place 1B Hydrogen Recombiner in service, the applicants will be required to determine the required power level using Unit 1 Revised Databook Figure 10. With hydrogen concentration exceeding 3.5%, the applicants will be required to add 4 KW to the value determined from Figure 10 to determine the final power level.

Facility: Catawba												Exam Date: September, 2021	
Admin JPMs	1 ADMIN Topic and K/A	2 LOD (1-5)	3 Attributes							4 Job Content		5 U/E/S	6 Explanation
			I/C Focus	Cues	Critical Steps	Scope (N/B)	Overlap	Perf. Std.	Key	Minutia	Job Link		
(A.1-1R): Calculate Reactor Vessel Head Vent Time	G 2.1.23	2			x							E	See Attachment for all comments
(A.1-2R): Determine Rod Insertion Limit Boration	G 2.1.43	4			x							E	
(A.2R): Determine NC Subcooling on a Loss of OAC	G 2.2.12	3		x								E	
(A.3R): Determine RP Requirements	G 2.3.14	2			x							E	
(A.1-1S): Calculate Boric Acid and Water Addition to FWST and determine Tech Spec actions	G 2.1.23	3		X								E	
(A.1-2S): Determine License Status	2.1.4	3										S	
(A.2S): Determine Isolation Boundary	2.2.41	3										S	
(A.3S): Review Liquid Waste Release	G 2.3.6	1										U	
(A.4S): Classify an Event and Fill Out the Emergency Notification Form	2.4.40	3										S	
Simulator/In-Plant JPMs	1 Safety Function and K/A												
a. Emergency Borate the Reactor Coolant System	004 A2.14	3										S	
b. Isolate Cold Leg Accumulators During Shutdown LOCA	006 A1.13	3			X							E	
c. Restore CA flow following Feed & Bleed (w/ 1CA-4 closed)	EPE05 EA1.1	3										S	

d. Perform E-0 Actions to Ensure Complete Containment Isolation	013 A4.01	3							X			E	
e. Align the NS System for Cold Leg Recirculation	026 A4.01	3										S	
f. Manual Alignment of 1FTB	062 A4.01	2										S	
g. Reset Radiation Monitor Trip Setpoints	073 A4.02	2										S	
h. Place KC in Parallel Operation	008 A4.01	3										S	
i. Local ESPS alignment to 2ETB (2ATD) – AP-07 Encl. 52	055EA2.03	3		X								E	
j. Place Hydrogen Recombiner in Service	028 A2.01	3		X								E	
k. Break Main Condenser Vacuum Locally – Unit 1	045 A1.06	3		X								E	

Instructions for Completing This Table:

Check or mark any item(s) requiring a comment and explain the issue in the space provided using the guide below.

1. Check each JPM for appropriate administrative topic requirements (COO, EC, Rad, and EP) or safety function requirements and corresponding K/A. Mark in column 1. (ES-301, D.3 and D.4)

2. Determine the level of difficulty (LOD) using an established 1–5 rating scale. Levels 1 and 5 represent an inappropriate (low or high) discriminatory level for the license that is being tested. Mark in column 2 (Appendix D, C.1.f)

3. In column 3, "Attributes," check the appropriate box when an attribute is **not met**:
   - ☐ The initial conditions and/or initiating cue is clear to ensure the operator understands the task and how to begin. (Appendix C, B.4)
   - ☐ The JPM contains appropriate cues that clearly indicate when they should be provided to the examinee. Cues are objective and not leading. (Appendix C, D.1)
   - ☐ All critical steps (elements) are properly identified.
   - ☐ The scope of the task is not too narrow (N) or too broad (B).
   - ☐ Excessive overlap does not occur with other parts of the operating test or written examination. (ES-301, D.1.a, and ES-301, D.2.a)
   - ☐ The task performance standard clearly describes the expected outcome (i.e., end state). Each performance step identifies a standard for successful completion of the step.
   - ☐ A valid marked up key was provided (e.g., graph interpretation, initialed steps for handouts).
4. For column 4, "Job Content," check the appropriate box if the job content flaw **does not meet** the following elements:
   - ☐ Topics are linked to the job content (e.g., not a disguised task, task required in real job).
   - ☐ The JPM has meaningful performance requirements that will provide a legitimate basis for evaluating the applicant's understanding and ability to safely operate the plant. (ES-301, D.2.c)

5. Based on the reviewer's judgment, is the JPM as written (U)nacceptable (requiring repair or replacement), in need of (E)nhancement, or (S)atisfactory? Mark the answer in column 5.

6. In column 6, provide a brief description of any (U)nacceptable or (E)nhancement rating from column 5.

Save initial review comments and detail subsequent comment resolution so that each exam-bound JPM is marked by a (S)atisfactory resolution on this form.

Facility: Catawba					Scenario: 1				Exam Date: September 20, 2021
1 Event	2 Realism/Cred.	3 Required Actions	4 Verifiable actions	5 LOD	6 TS	7 CTs	8 Scen. Overlap	9 U/E/S	10 Explanation
1								S	See Attachment for all comments
2								S	
3					X			E	
4								S	
5								S	
6					X			E	
7								S	
8								S	
9								S	

Facility: Catawba				Scenario: 2					Exam Date: September 20, 2021
1 Event	2 Realism/Cred.	3 Required Actions	4 Verifiable actions	5 LOD	6 TS	7 CTs	8 Scen. Overlap	9 U/E/S	10 Explanation
1								S	See Attachment for all comments
2					X			E	
3								S	
4					X			E	
5								S	
6								S	
7						X		E	
8								S	
9								S	
10								S	

Facility: Catawba				Scenario: 3					Exam Date: September 20, 2021
1 Event	2 Realism/Cred.	3 Required Actions	4 Verifiable actions	5 LOD	6 TS	7 CTs	8 Scen. Overlap	9 U/E/S	10 Explanation
1								S	See Attachment for all comments
2					X			E	
3								S	
4					X			E	
5								S	
6								S	
7			X					U	
8								S	

Facility: Catawba				Scenario: 4				Exam Date: September 20, 2021	
1 Event	2 Realism/Cred.	3 Required Actions	4 Verifiable actions	5 LOD	6 TS	7 CTs	8 Scen. Overlap	9 U/E/S	10 Explanation
1								S	See Attachment for all comments
2								S	
3		E						E	
4								S	
5								S	
6								S	
7								S	
8								S	
9								S	

Instructions for Completing This Table:

Use this table for each scenario for evaluation.

2 Check this box if the events are not related (e.g., seismic event followed by a pipe rupture) **OR** if the events do not obey the laws of physics and thermodynamics.

3, 4 In columns 3 and 4, check the box if there is **no** verifiable or required action, as applicable. Examples of required actions are as follows: (ES-301, D.5f)

- opening, closing, and throttling valves
- starting and stopping equipment
- raising and lowering level, flow, and pressure
- making decisions and giving directions
- acknowledging or verifying key alarms and automatic actions (Uncomplicated events that require no operator action beyond this should **not** be included on the operating test unless they are necessary to set the stage for subsequent events. (Appendix D, B.3).)

5 Check this box if the level of difficulty is **not** appropriate.

6 Check this box if the event has a TS.

7 Check this box if the event has a critical task (CT). If the same CT covers more than one event, check the event where the CT started **only.**

8 Check this box if the event overlaps with another event on any of the last two NRC examinations. (Appendix D, C.1.f)

9 Based on the reviewer's judgment, is the event as written (U)nacceptable (requiring repair or replacement), in need of (E)nhancement, or (S)atisfactory? Mark the answer in column 9.

10 Record any explanations of the events here.

In the shaded boxes, sum the number of check marks in each column.

- In column 1, sum the number of events.
- In columns 2–4, record the total number of check marks for each column.
- In column 5, based on the reviewer's judgement, place a checkmark only if the scenario's LOD is not appropriate.
- In column 6, TS are required to be ≥ 2 for each scenario. (ES-301, D.5.d)
- In column 7, preidentified CTs should be ≥ 2 for each scenario. (Appendix D; ES-301, D.5.d; ES-301-4)
- In column 8, record the number of events not used on the two previous NRC initial licensing exams. A scenario is considered unsatisfactory if there is < 2 new events. (ES-301, D.5.b; Appendix D, C.1.f)
- In column 9, record whether the scenario as written (U)nacceptable, in need of (E)nhancement, or (S)atisfactory from column 11 of the simulator scenario table.

Facility:							Exam Date:		
Scenario	1 Event Totals	2 Events Unsat.	3 TS Total	4 TS Unsat.	5 CT Total	6 CT Unsat.	7 % Unsat. Scenario Elements	8 U/E/S	11 Explanation

Instructions for Completing This Table:

Check or mark any item(s) requiring comment and explain the issue in the space provided.

1, 3, 5 For each simulator scenario, enter the **total** number of events (column 1), TS entries/actions (column 3), and CTs (column 5). This number should match the respective scenario from the event-based scenario tables (the sum from columns 1, 6, and 7, respectively).

2, 4, 6 For each simulator scenario, evaluate each event, TS, and CT as (S)atisfactory, (E)nhance, or (U)nsatisfactory based on the following criteria:

a. Events. Each event is described on a Form ES-D-2, including all switch manipulations, pertinent alarms, and verifiable actions. Event actions are balanced between at-the-controls and balance-of-plant applicants during the scenario. All event-related attributes on Form ES-301-4 are met. Enter the total number of unsatisfactory events in column 2.

b. TS. A scenario includes at least two TS entries/actions across at least two different events. TS entries and actions are detailed on Form ES-D-2. Enter the total number of unsatisfactory TS entries/actions in column 4. (ES-301, D.5d)

c. CT. Check that a scenario includes at least two preidentified CTs. This criterion is a target quantitative attribute, not an absolute minimum requirement. Check that each CT is explicitly bounded on Form ES-D-2 with measurable performance standards (see Appendix D). Enter the total number of unsatisfactory CTs in column 6.

7 In column 7, calculate the percentage of unsatisfactory scenario elements: $\left(\frac{2+4+6}{1+3+5}\right)100\%$

8 If the value in column 7 is > 20%, mark the scenario as (U)nsatisfactory in column 8. If column 7 is ≤ 20%, annotate with (E)nhancement or (S)atisfactory.

9 In column 9, explain each unsatisfactory event, TS, and CT. Editorial comments can also be added here.

Save initial review comments and detail subsequent comment resolution so that each exam-bound scenario is marked by a (S)atisfactory resolution on this form.

Site name:						Exam Date:
OPERATING TEST TOTALS						
	Total	Total Unsat.	Total Edits	Total Sat.	% Unsat.	Explanation
Admin. JPMs	9	1	5	8		
Sim./In-Plant JPMs	11	0	5	11		
Scenarios	4	0	9	4		
Op. Test Totals:	24	1	19	23	4.1%	

Instructions for Completing This Table:

Update data for this table from quality reviews and totals in the previous tables and then calculate the percentage of total items that are unsatisfactory and give an explanation in the space provided.

1. Enter the total number of items submitted for the operating test in the "Total" column. For example, if nine administrative JPMs were submitted, enter "9" in the "Total" items column for administrative JPMs. For scenarios, enter the total number of simulator scenarios.

2. Enter the total number of (U)nsatisfactory JPMs and scenarios from the two JPMs column 5 and simulator scenarios column 8 in the previous tables. Provide an explanation in the space provided.

3. Enter totals for (E)nhancements needed and (S)atisfactory JPMs and scenarios from the previous tables. This task is for tracking only.

4. Total each column and enter the amounts in the "Op. Test Totals" row.

5. Calculate the percentage of the operating test that is (U)nsatisfactory (Op. Test Total Unsat.)/(Op. Test Total) and place this value in the bolded "% Unsat." cell.

   Refer to ES-501, E.3.a, to rate the overall operating test as follows:
   - satisfactory, if the "Op. Test Total" "% Unsat." is ≤ 20%
   - unsatisfactory, if "Op. Test Total" "% Unsat." is > 20%

6. Update this table and the tables above with post-exam changes if the "as-administered" operating test required content changes, including the following:
   - The JPM performance standards were incorrect.
   - The administrative JPM tasks/keys were incorrect.
   - CTs were incorrect in the scenarios (not including postscenario critical tasks defined in Appendix D).
   - The EOP strategy was incorrect in a scenario(s).
   - TS entries/actions were determined to be incorrect in a scenario(s).

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

JPM Comments

Generic Comments:

- JPM's need to have the task standard s more closely match those Critical Steps within the JPM. This prevents an applicant from missing a Critical Strep, yet still meeting the Task Standard. This creates difficulty for the examiner to determine if the applicant passed the JPM.

  Example: RO A1R. The applicant could improperly calculate any of steps 1-3, yet get the correct answer in step 4 based on tolerances provided within the JPM steps. Either those steps that are leading up to the final calculated answer are not critical, or they are critical and need to be part of the Task Standard. In this case I would think these steps are Critical to correctly calculate the vent time and should be part of the standard.

Highlighted items were identified during onsite validation.

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

<u>ADMIN JPM Comments</u>

RO CONDUCT OF OPS (A.1-1R): Calculate Reactor Vessel Head Vent Time

- Student Handout #2 has A and B Train Sump Level. This is not included in the Simulator Instructions of digital readouts to provide. It doesn't appear to be required to answer the JPM correctly? Is this added as a distraction or is this how the panel is laid out and what the operator would expect to see?
- LOD is low. Seems to be direct plug and chug with the digital values. Other than reading the graph incorrectly, how could an applicant perform this wrong? Recommend removing digital values provided, unless these digital values are provided on the control boards below the analog indication as shown. We want to maintain operational validity if this is how the control board indications look with the digital reading below the analog pointer.
- See General Comments about Task Standards
-

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

RO CONDUCT OF OPS (A.1-2R): Determine Rod Insertion Limit Boration

- The procedure requires the use of “The R.O.D. Book, section 4.8” for Reactivity Data Sheets. Is the R.O.D book going to be provided as a reference? It isn’t listed in References for the JPM. Is this reference going to be paper copy or on the computer? All the applicable sections as called out in AP/1/A/5500/003 (Load Rejection) Enclosure 3, step 2 need to be available. Even Section 4.8, as to not cue the applicant that step 2.a is N/A. Recommend providing the entire R.O.D. Book on a computer for the applicants during administration.
- See General Comments on Task Standards.
-

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

RO EQUIPMENT CONTROL (A.2R): Determine NC Subcooling on a Loss of OAC

- PT/1/A/4600/009 (Loss of Operator Aid Computer), Unit 1 Revised Databook Figures 57 & 58 listed as a reference. Is this to be provided as paper copy or on computer?
- Task Standard and Critical Steps.

Highlighted items were identified during onsite validation.

JPM A.2R; Eliminate boxes between values on Applicant Cue Sheet. It is misleading how it is built.

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

RO RAD CONTROL (A.3R): Determine RP Requirements

- Given that both the correct and incorrect survey maps only provide a General Area value in the are of the work, this makes it very unlikely that the applicant could choose an incorrect value for the general area dose. Recommend providing an on contact reading in the area and/or a smear survey value to provide some plausible distraction from the obvious correct answer. Otherwise, this is a direct calculation with no critical thought required.

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

ADMIN JPM Comments

SRO CONDUCT OF OPS (A.1-1S): Calculate Boric Acid and Water Addition to FWST and determine Tech Spec actions

- I am assuming the applicants will have a digital copy of Tech Specs?
- Typo in the Key for step 3.3.5. 277,646 gallons should be 377,646. Calculated answer is correct.

Add section numbers to be performed in the initial conditions to prevent applicant from continuing on in the procedure and doing more than required.

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

ADMIN JPM Comments

SRO CONDUCT OF OPS (A.1-2S): Determine License Status

-

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

SRO EQUIPMENT CONTROL (A.2S): Determine Isolation Boundary

-

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

SRO Radiation Control (A.3S): Review Liquid Waste Release

- The task standard states that the applicant should not allow the release and identify "one or all of the following" issues with the permit. The Cue states to list any issues that may prevent the release. Providing 3 Critical Steps and allowing only one to be required to complete the JPM makes the overall LOD low due to only one Critical Step to pass the JPM. Recommend changing the cue to require all the deficiencies to be identified

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

ADMIN JPM Comments

SRO EMERGENCY PLAN (A.4S): Classify an Event and Fill Out the Emergency Notification Form

-

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

Simulator JPMs

JPM A: Emergency Borate the Reactor Coolant System

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Simulator JPMs

JPM B: Isolate Cold Leg Accumulators During Shutdown LOCA

- JPM Step 7 is not listed as a Critical Step. 1NI-47A Opened and then closed later in STEP 10, which is critical to allow depressurization. I am assuming that this valve gets opened to minimize DP across the N2 valves when opening to align a vent path. Is this required to get the valves to open or just a proceduralized good practice? If required to prevent DP binding, this step could also be Critical.
- Step 8 of the JPM has a cue for Key #11. Is this key not required to be obtained to access 1MC-6? Is this a simulator difference from the plant?

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Simulator JPMs

JPM C: Restore CA flow following Feed & Bleed (w/ 1CA-4 closed)

-

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

Simulator JPMs

JPM D: Perform E-0 Actions to Ensure Complete Containment Isolation

- With only a single operator in the control room area during this transient, would it not be expected that the OATC perform all IOAs from memory and report this verification to the CRS? This should be included in the JPM actions. The flow up to the trip seems abnormal, but we can see how it looks during validation.

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Simulator JPM

JPM E: Align the NS System for Cold Leg Recirculation

-

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

Simulator JPMs

JPM F: Manual Alignment of 1FTB

-

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

<u>Simulator JPMs</u>

JPM G: Reset Radiation Monitor Trip Setpoints

-

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Simulator JPMs

JPM H: Place KC in Parallel Operation

-

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

<u>In-Plant JPMs</u>

JPM I: Local ESPS alignment to 2ETB (2ATD) – AP-07 Encl. 52

- The Examiner cue and the Standard do not seem to match. It is not clear if this switch is a pistol grip per the cue or a pushbutton based on the standard.

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

In-Plant JPMs

JPM J: Place Hydrogen Recombiner in Service

- Is there a corresponding potentiometer setting for the power output settings? Example 200 on potentiometer equal 20KW. This may be required for cuing purposes should the applicant take the potentiometer to the setpoint and wait for power indication.

Range for calculated value on KW to allow the applicant some error in reading the graph.

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

In-Plant JPMs

JPM K: Break Main Condenser Vacuum Locally – Unit 1

- How does the applicant perform JPM step 4 to verify absence of air flow into the condenser? Is the expectation to wait until there is no longer flow noise from the valve or is there some check to see that there is no longer a DP across the valve? I suspect there would still be air flow into the condenser with low air flow as pressures equalize. Is there a vacuum pressure indication that is to be checked?

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Schedule Comments

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

Scenario Comments

Generic Comments:

- General Comment:

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

NRC Scenario #1: Raise power from 50%, L/D HX temp control failure, Stator Cooling pump trip, steam leak in containment, MSIV's fail to close.

Turnover

Event 1 – Raise Reactor Power

Event 2 – Letdown HX Temp Control valve controller fail. Valve closes

- Is this how the controller works in the plant? Would the controller automatically shift to manual with this type of failure? We want to make sure we are not introducing an implausible failure.

Event 3 – 'A' Train CCW Miniflow valve fails open

- Delete the AFW Tech Spec pages in the back attachment for this event

Event 4 – Generator Stator Cooling Pump trip. Standby fails to start

- Is there controls for the Gen Stator Cooling Pump in the control room? If so, what if the crew takes manual action to start the standby pump? Concern for invalidating CT.
- For CT-1. Is it required to get both less than 332 MW and 0.9 Power Factor within 3.5 minutes to prevent a turbine trip? Is the PF modeled into the turbine trip on the simulator?
- D-2 indicates that the Rx Power will have been >56% prior to the event (Load Reject step 5). Is it necessary that the crew get to >56% for the flow of the scenario? If they do not get to 56% does this invalidate anything or cause other critical responses? We may need a not to evaluator to allow power increase to greater than 56%.

Event 5 – Loss of power to the 1A NS Pump (TS Only)

Event 6 – Steam Leak I/C from 1C S/G

  - Add TS for Containment Pressure for Event 6 should they cross the threshold of 3#

Event 7 – Leak increases requiring Rx Trip

Event 8 – MSIVs fail to close on automatic signal

  - CT-2. What is the expected time to Orange Path if the MSIV's are not closed?
  - Are CSFST required to be monitored at any time in E-0 prior to step 25 RNO? This leads to a concern on CT-2. If the MSIV's are closed prior to E-0 step 25 RNO, even if there is an Orange Path, is this a failed CT when they weren't yet required to be monitored?

Event 9 – Aux Building Unfiltered Exhaust Fans fail to automatically secure on SI

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Critical Tasks:

Critical Task 1 – Runback the Main Turbine prior to Main Turbine Trip (must be below amps for 332 MW @ 0.9 Power Factor within 3.5 minutes).

Critical Task 2 – Close MSIVs prior to a severe challenge (Orange Path) on NC system Integrity CSF.

Add Critical Task for securing AFW Flow to 1C SG prior to Orange path or 275#

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

NRC Scenario #2: 1B RN PUMP Trip, Main Gen Volt Reg Failure, 1C SGTL, Rapid Downpower, Rod failure, Tube rupture

Event 1 – Swap operating LCVUs

- The note on page 4 of OP/001 talks about waiting for 15 to 30 minutes before starting the 1C LCVU to prevent challenging the TS Low limit for air temperature. Do we intend on letting the crew make this determination or prompting them in some manner? Possibly something we can add to the turnover.
- Do we expect them to challenge the Low Limit Air Temp TS if they don't take 15 minutes? May need to be cued in the DS-2

Event 2 – 1B RN Pump trip

- Add TS 3.7.11 to Attachment 11

Event 3 – Main Generator Voltage Regulator Failure

Event 4 – 1C SGTL

- Include Tech Spec 3.4.18 Condition A

Event 5 – AP/09 Rapid Downpower

Event 6 – Rods fail to insert in automatic during AP/09 Rapid Shutdown

Event 7 - 1C Steam Generator Tube Rupture

Event 8 - 1C CA Flow Control Valve will not close

Event 9 - 1NI-9A and 1NI-10B fail to open automatically on S/I

Event 10 - MSIVs fail to close manually

Critical Tasks:

Critical Task 1 - Restore RN flow prior to any NC pump motor bearing reaching 195°F.

Critical Task 2 – Establish high head ECCS flow prior to transition from E-0.

Critical Task 3 – Initiate Cooldown at less than 100°F/hour.

- Bounding Criteria for CT-3. Ex: Initiate cooldown prior to SG being full as indicated by 100% WR Indication.

Catawba 2021 Draft Exam
Comments (Attachment to ES-301-7)

NRC Scenario #3: Downpower to 85%, Charging flow control valve fails open, PORV fails open, Blackout 1ETA, Control rod insert continuously, Loss Heat Sink, TS for AFW Pump that is out for maintenance needs to be added to the Turnover Sheet

Event 1 – Unit 1 Downpower to ~85%

Event 2 – 1NV-294 fails open

- Insert the procedure (AP or ARP) in the D2 for Manual Control of Charging Flow
- Remove TS from PZR Htrs
- Manual Control of Auto Function, there is only 1. Do not have SRO(I) perform this scenario OATC if this is the only RO Eval for SRO(I) he will not get Manual Control of Automatic Function.

Event 3 – 1NC-32B fails open, able to be manually closed

Event 4 – 1ETA Blackout (D/G does not start)

- Loss of bus and therefore loose B CA. This is a 6hr TS that needs to be added to the DS-2 for evaluation.

Event 5 – Continuous rod motion / 2 stuck rods on reactor trip

Event 6 – CAPT#1 Overspeed Trip / Loss of Heat Sink

Event 7 - Loss of CFPT Vacuum

- Loss of Vacuum is not a Malfunction. It is a condition that drives actions associated with the major. Does not by itself have a verifiable action that is not part of the major. Combine with Major. Event 8 will be only post Major event

Event 8 - 1NV-37A failed closed

Critical Tasks:

Critical Task 1 – Control charging line flow to prevent a reactor trip on Pressurizer Hi level (2/3 Pressurizer Levels > 92%).

Critical Task 2 – Close Pressurizer PORV prior to a reactor trip on Pressurizer low pressure.

Critical Task 3 – Establish feedwater flow to at least one S/G before NC feed and bleed is required (<24% W/R level in 3 out of 4 S/G).

Add words to Crit Task for AUTO or Manual trip caused by the event for CT 1 and 2.

Catawba 2021 Draft Exam Comments (Attachment to ES-301-7)

Scenario #4 designated as SPARE. Delete from ES-301-7 prior to ADAMS submittal if not used.

NRC Scenario #4: Raise power to power range, 1B NV Pump trip, Letdown fails to isolate, 1C SG PORV fails open, LBLOCA, AUTO SI Failure; Add AFW Pump TS to Turnover

Event 1 – NCDT Pump Swap

Event 2 – Withdraw Control Rods to begin power increase

Event 3 – 1B NV pump Trip
- Credit control of 1NV-294 for Manual Control of Automatic Function
- Add Critical Task tag for 1NV-294 (Pg 23)
-

Event 4 – Letdown fails to isolate automatically
-

Event 5 – 1TL-3 fails closed

Event 6 – 1C S/G PORV (1SV-7) fails open

Event 7 - Large Break LOCA

Event 8 - Tempering flow isolation valve (1CA-185) fails to close on FWI

Event 9 - Auto S/I failure / ND pumps fail to start in auto on S/I

Critical Tasks:

Critical Task 1 – Restore charging flow prior to Pressurizer Level lowering to 4%.

Critical Task 2 – Initiate Safety Injection on at least one train prior to exiting E-0.

Critical Task 3 – Initiate low head ECCS flow by starting ND pumps prior to exiting E-0

<table>
<tr><td colspan="3">1Facility:</td><td colspan="17">Date of Exam:</td></tr>
<tr><td rowspan="2">Tier</td><td rowspan="2">Group</td><td colspan="12">RO K/A Category Points</td><td colspan="4">SRO-Only Points</td></tr>
<tr><td>K1</td><td>K2</td><td>K3</td><td>K4</td><td>K5</td><td>K6</td><td>A1</td><td>A2</td><td>A3</td><td>A4</td><td>G*</td><td>Total</td><td colspan="2">A2</td><td>G*</td><td>Total</td></tr>
<tr><td rowspan="3">1.
Emergency and Abnormal Plant Evolutions</td><td>1</td><td>3</td><td>3</td><td>3</td><td colspan="3" rowspan="3">N/A</td><td>3</td><td>3</td><td colspan="2" rowspan="3">N/A</td><td>3</td><td>18</td><td colspan="2">3</td><td>3</td><td>6</td></tr>
<tr><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>1</td><td>9</td><td colspan="2">2</td><td>2</td><td>4</td></tr>
<tr><td>Tier Totals</td><td>4</td><td>4</td><td>5</td><td>5</td><td>5</td><td>4</td><td>27</td><td colspan="2">5</td><td>5</td><td>10</td></tr>
<tr><td rowspan="3">2.
Plant Systems</td><td>1</td><td>2</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>28</td><td colspan="2">3</td><td>2</td><td>5</td></tr>
<tr><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>10</td><td>0</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Tier Totals</td><td>3</td><td>4</td><td>4</td><td>4</td><td>3</td><td>3</td><td>4</td><td>4</td><td>3</td><td>3</td><td>3</td><td>38</td><td colspan="2">5</td><td>3</td><td>8</td></tr>
<tr><td colspan="5" rowspan="2">3. Generic Knowledge and Abilities Categories</td><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">4</td><td rowspan="2">10</td><td>1</td><td>2</td><td>3 | 4</td><td rowspan="2">7</td></tr>
<tr><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">2</td><td colspan="2">3</td><td>2</td><td>2</td><td>2 | 1X</td></tr>
</table>

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 outline sections (i.e., except for one category in Tier 3 of the SRO-only section, the “Tier Totals” in each K/A category shall not be less than two). (One Tier 3 radiation control K/A is allowed if it is replaced by a K/A from another Tier 3 category.)

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 outline. Systems or evolutions that do not apply at the facility should be deleted with justification. 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’ 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 a category 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.

G* Generic K/As

* These systems/evolutions must be included as part of the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan. They are not required to be included when using earlier revisions of the K/A catalog.

** These systems/evolutions may be eliminated from the sample (as applicable to the facility) when Revision 3 of the K/A catalog is used to develop the sample plan.

ES-401 PWR Examination Outline Form ES-401-2 Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (RO/SRO)									
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000007 (EPE 7; BW E02&E10; CE E02) Reactor Trip, Stabilization, Recovery / 1	X						007EK1.02: Shutdown margin	3.4	1
000008 (APE 8) Pressurizer Vapor Space Accident / 3		X					008AK2.02: Sensors and detectors	2.7	2
000009 (EPE 9) Small Break LOCA / 3	X						009EK1 .02: Use of steam tables	3.5	3
000011 (EPE 11) Large Break LOCA / 3						X	011EG2.4.21: Knowledge of the parameters and logic used to assess the status of safety functions	4.0	4
000015 (APE 15) Reactor Coolant Pump Malfunctions / 4						X	015AG2.2.42 : Ability to recognize system parameters that are entry level conditions for Technical Specifications	3.9	5
000022 (APE 22) Loss of Reactor Coolant Makeup / 2			X				022AK3.06: RCP thermal barrier cooling	3.2	6
000025 (APE 25) Loss of Residual Heat Removal System / 4		X					025AK2.01: RHR heat exchangers	2.9	7
000026 (APE 26) Loss of Component Cooling Water / 8				X			026AA1.04: CRDM high-temperature alarm system	2.7	8
000027 (APE 27) Pressurizer Pressure Control System Malfunction / 3						X	027AG2.2.4: (multi-unit) Ability to explain the variations in control board layouts, systems, instrumentation and procedural actions between units at a facility.	3.6	76
000029 (EPE 29) Anticipated Transient Without Scram / 1				X			029EA1.11: Manual opening of the CRDS breakers	3.9	9
000038 (EPE 38) Steam Generator Tube Rupture / 3					X		038EA2.17: RCP restart criteria	4.4	77
000040 (APE 40; BW E05; CE E05; W E12) Steam Line Rupture—Excessive Heat Transfer / 4					X		040AA2.02: Conditions requiring a reactor trip	4.6	10
000054 (APE 54; CE E06) Loss of Main Feedwater /4	X						054AK1.01: MFW line break depressurizes the SIG (similar to a steam line break)	4.1	11
000055 (EPE 55) Station Blackout / 6					X		055EA2.03: Actions necessary to restore power	4.7	78
000056 (APE 56) Loss of Offsite Power / 6						X	056AG2.1.30	4.4	12
000057 (APE 57) Loss of Vital AC Instrument Bus / 6						X	057AG2.2.44: 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	4.2	79
000058 (APE 58) Loss of DC Power / 6						X	058AG2.4.41: Knowledge of the emergency action level thresholds and classifications	2.9	80
000062 (APE 62) Loss of Nuclear Service Water / 4					X		062AA2.01: Location of a leak in the SWS	2.9	13
000065 (APE 65) Loss of Instrument Air / 8			X				065AK3.04: Cross-over to backup air supplies	3.0	14
000077 (APE 77) Generator Voltage and Electric Grid Disturbances / 6				X			077 AA1.03: Voltage regulator controls	3.8	15
(W E04) LOCA Outside Containment / 3					X		WE04EA2.2: Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.	3.6	16

(W E05) Inadequate Heat Transfer—Loss of Secondary Heat Sink / 4		X					WE05EK2.2: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems and relations between the proper operation of these systems to the operation of the facility	3.9	17
(W E11) Loss of Emergency Coolant Recirculation / 4			X		X		WE11EK3.4 : Loss of Emergency Coolant Recrc./4 WET1EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations.	3.6 4.2	18 81
K/A Category Totals:	3	3	3	3	3/3	3/3	Group Point Total:		18/6

ES-401 PWR Examination Outline Form ES-401-2

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

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G*	K/A Topic(s)	IR	#
000001 (APE 1) Continuous Rod Withdrawal / 1							N/A		
000003 (APE 3) Dropped Control Rod / 1							N/A		
000005 (APE 5) Inoperable/Stuck Control Rod / 1						X	005AG2.2.12:	4.1	82
000024 (APE 24) Emergency Boration / 1							N/A		
000028 (APE 28) Pressurizer (PZR) Level Control Malfunction / 2					X		028AA2.11: Leak in PZR	3.6	83
000032 (APE 32) Loss of Source Range Nuclear Instrumentation / 7							N/A		
000033 (APE 33) Loss of Intermediate Range Nuclear Instrumentation / 7						X	033AG2.4.46: Ability to verify that the alarms are consistent with the plant conditions.	4.2	84
000036 (APE 36; BW/A08) Fuel-Handling Incidents / 8	X						036AK1.03: Indications of approaching criticality	4.0	19
000037 (APE 37) Steam Generator Tube Leak / 3				X			037AA1.07: CVCS letdown flow indicator	3.1	20
000051 (APE 51) Loss of Condenser Vacuum / 4			X				051AK3.01: Loss of steam dump capability upon loss of condenser vacuum	2.8	21
000059 (APE 59) Accidental Liquid Radwaste Release / 9					X		059AA2.03: Failure modes, their symptoms and the causes of misleading indications on a radioactive-liquid monitor	3.1	22
000060 (APE 60) Accidental Gaseous Radwaste Release / 9							N/A		
000061 (APE 61) Area Radiation Monitoring System Alarms / 7							N/A		
000067 (APE 67) Plant Fire On Site / 8					X		067AA2.07: Whether malfunction is due to common-mode electrical failures	3.1	85
000068 (APE 68; BW A06) Control Room Evacuation / 8							N/A		
000069 (APE 69; W E14) Loss of Containment Integrity / 5			X				WE14EK3.2: Normal, abnormal and emergency operating procedures associated with (High Containment Pressure).	3.1	23
000074 (EPE 74; W E06 & E07) Inadequate Core Cooling / 4		X					074EK2.09: Controllers and positioners	2.6	24
000076 (APE 76) High Reactor Coolant Activity / 9							N/A		
000078 (APE 78*) RCS Leak / 3							N/A		
(W E02) SI Termination / 3				X			WEO2EA1.3: Desired operating results during abnormal and emergency situations	3.8	25
(W E13) Steam Generator Overpressure / 4							N/A		
(W E15) Containment Flooding / 5					X		WE15EA2.2: Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments	2.9	26
(W E16) High Containment Radiation /9							N/A		
(W E03) LOCA Cooldown—Depressurization / 4						X	WE03EG2.1.20: Ability to execute procedure steps	4.6	27
K/A Category Point Totals:	1	1	2	2	2/2	1/2	Group Point Total:		9/4

ES-401												PWR Examination Outline Plant Systems—Tier 2/Group 1 (RO/SRO)		Form ES-401-2
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
003 (SF4P RCP) Reactor Coolant Pump									X			003A3.01: Seal injection flow	3.3	28
004 (SF1; SF2 CVCS) Chemical and Volume Control		X										004K2.06: Control instrumentation	2.6	29
											X	004G2.2.22: Knowledge of limiting conditions for operations and safety limits.	4.7	86
005 (SF4P RHR) Residual Heat Removal						X						005K6.03: RHR heat exchanger	2.5	30
006 (SF2; SF3 ECCS) Emergency Core Cooling							X					006A1 .15: RWST Level and temperature	3.3	31
007 (SF5 PRTS) Pressurizer Relief/Quench Tank			X									007K3.01: Containment	3.3	32
				X								007K4.01: Quench tank cooling	2.6	33
008 (SF8 CCW) Component Cooling Water				X								008K4.02: Operation of the surge tank, including the associated valves and controls	2.9	34
010 (SF3 PZR PCS) Pressurizer Pressure Control		X										010K2.01: PZR heaters	3.0	35
						X						010K6.01: Pressure detection systems	2.7	36
012 (SF7 RPS) Reactor Protection										X		012A4.04: Bistable, trips, reset and test switches	3.3	37
013 (SF2 ESFAS) Engineered Safety Features Actuation	X											013K1.13: HVAC	2.8	38
								X				013A2.04: Loss of instrument bus	4.2	87
022 (SF5 CCS) Containment Cooling										X		022A4.04: Valves in the CCS	3.1	39
025 (SF5 ICE) Ice Condenser							X					025A1.03: Glycol flow to ice condenser air handling units	2.5	40
					X							025K5 01: Relationships between pressure and temperature	3.0	41
026 (SF5 CSS) Containment Spray								X				026A2.07: Loss of containment spray pump suction when in recirculation mode, possibly caused by clogged sump screen, pump inlet high temperature exceeded cavitation, voiding) or sump level below cutoff (interlock) limit	3.6	42
			X									026K3.02: Recirculation spray system	4.2	43
039 (SF4S MSS) Main and Reheat Steam							X					039A1 .06: Main steam pressure	3.0	44
								X				039A2.03: Indications and alarms for main steam and area radiation monitors (during SGTR)	3.4	45

059 (SF4S MFW) Main Feedwater				X				X				059K4.08: Feedwater regulatory valve operation (on basis of steam flow, feed flow mismatch) 059A2.11: Failure of feedwater control system	2.5 3.3	46 88
061 (SF4S AFW) Auxiliary/Emergency Feedwater					X						X	061K5.02: Decay heat sources and magnitude 061G2.4.30: Knowledge of events related to system operations/status that must be reported to internal organizations or outside agencies.	3.2 4.1	47 89
062 (SF6 ED AC) AC Electrical Distribution		X										062K2.01: Major system loads	3.3	48
063 (SF6 ED DC) DC Electrical Distribution									X			063A3.01: Meters, annunciators, dials, recorders and indicating lights	2.7	49
064 (SF6 EDG) Emergency Diesel Generator								X X				064A2.15: Water buildup in cylinders 064A2.06: Operating unloaded, lightly loaded and highly loaded time limit	2.6 3.3	50 90
073 (SF7 PRM) Process Radiation Monitoring											X	073G2.1.25: Ability to interpret reference materials such as graphs, monographs and tables which contain performance data	3.9	51
076 (SF4S SW) Service Water	X											076K1.19: SWS emergency heat loads	3.6	52
078 (SF8 IAS) Instrument Air			X									078K3.03: Cross-tied units	3.0	53
103 (SF5 CNT) Containment									X		X	103A3.01: Containment isolation 103G2.4.50: Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.	3.9 4.2	54 55
053 (SF1; SF4P ICS*) Integrated Control														
K/A Category Point Totals:	2	3	3	3	2	2	3	3/3	3	2	2/2	Group Point Total:		28/5

ES-401												PWR Examination Outline Plant Systems—Tier 2/Group 2 (RO/SRO)		Form ES-401-2
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G*	K/A Topic(s)	IR	#
001 (SF1 CRDS) Control Rod Drive		X										001K2.02: One-line diagram of power supply to trip breakers	3.6	56
002 (SF2; SF4P RCS) Reactor Coolant								X				002A2.04: Loss of heat sinks	4.6	91
011 (SF2 PZR LCS) Pressurizer Level Control				X								011K4.07: Cold-calibrated channel	2.9	57
014 (SF1 RPI) Rod Position Indication								X				014A2.03: Dropped rod	4.1	92
015 (SF7 NI) Nuclear Instrumentation	X											015K1 .02: Vital ac systems	3.4	58

016 (SF7 NNI) Nonnuclear Instrumentation											X	016G2.2.39: Knowledge of less than one hour technical specification action statements for systems	3.9	59
017 (SF7 ITM) In-Core Temperature Monitor											X	017G2.2.3: (multi-unit license) Knowledge of the design, procedural and operational differences between units.		93
027 (SF5 CIRS) Containment Iodine Removal												N/A		
028 (SF5 HRPS) Hydrogen Recombiner and Purge Control					X							028K5.03: Sources of hydrogen within containment	2.9	60
029 (SF8 CPS) Containment Purge												N/A		
033 (SF8 SFPCS) Spent Fuel Pool Cooling												N/A		
034 (SF8 FHS) Fuel-Handling Equipment												N/A		
035 (SF 4P SG) Steam Generator												N/A		
041 (SF4S SDS) Steam Dump/Turbine Bypass Control												N/A		
045 (SF 4S MTG) Main Turbine Generator								X				045A2.12: Control rod insertion limits exceeded (stabilize secondary	2.5	61
055 (SF4S CARS) Condenser Air Removal			X									055K3.01: Main condenser	2.5	62
056 (SF4S CDS) Condensate												N/A		
068 (SF9 LRS) Liquid Radwaste												N/A		
071 (SF9 WGS) Waste Gas Disposal												N/A		
072 (SF7 ARM) Area Radiation Monitoring							X					072A1.01: Radiation levels	3.4	63
075 (SF8 CW) Circulating Water										X		075A4.01: Emergency/essential SWS pumps	3.2	64
079 (SF8 SAS**) Station Air												N/A		
086 Fire Protection						X						086K6.04: Fire, smoke and heat detectors	2.6	65
050 (SF 9 CRV*) Control Room Ventilation														
K/A Category Point Totals:	1	1	1	1	1	1	1	1/2	0	1	1/1	Group Point Total:		10/3

Facility:		Date of Exam:				
Category	K/A #	Topic	RO		SRO-only	
			IR	#	IR	#
1. Conduct of Operations	2.1.15	Knowledge of administrative requirements for temporary management directives such as standing orders, night orders, Operations memos, etc.	2.7	66		
	2.1.37	Knowledge of procedures, guidelines or limitations associated with reactivity management	4.3	67		
	2.1.1	Knowledge of conduct of operations requirements			4.2	94
	2.1.25	Ability to interpret reference materials such as graphs, curves, tables, etc			4.2	95
	Subtotal					
2. Equipment Control	2.2.1	Ability to perform pre-startup procedures for the facility, including operating those controls associated with plant equipment that could affect reactivity.	4.5	68		
	2.2.22	Knowledge of limiting conditions for operations and safety limits.	4.0	69		
	2.2.43	Knowledge of the process used to track inoperable alarms	3.0	70		
	2.2.13	Knowledge of tagging and clearance procedures			4.3	96
	2.2.18	Knowledge of the process for managing maintenance activities during shutdown operations.			3.8	97
	Subtotal					
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal and emergency conditions	3.2	71		
	2.3.5	Ability to use radiation monitoring systems	2.9	72		
	2.3.11	Ability to control radiation releases			4.3	98
	2.3.12	Knowledge'of radiological safety principles pertaining to licensed operator duties			3.7	99
	2.3.					
	Subtotal					
4. Emergency Procedures/Plan	2.4.29	Knowledge of the emergency plan.	3.1	73		
	2.4.3	Ability to identify post-accident instrumentation	3.7	74		
	2.4.9	Knowledge of low power / shutdown implications in accident (e.g. LOCA or loss of RHR) mitigation strategies	3.8	75		
	2.4.5	Knowledge of the organization of the operating procedures network for normal, abnormal and emergency evolutions.			4.3	100
	Subtotal					
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
1/1	APE026 AA1.04	Control Rods at CNS are air cooled and do not have Component Cooing Water cooling or a direct alarm associated with a loss of CCW. Therefore, an operationally valid question cannot be generated. Request that a replacement K/A be generated. K/A replaced with APE026 AA1.06
1/1	APE027 G 2.2.4	Pressurizer Pressure Control systems are identical between both units at CNS. Therefore, an operationally valid question cannot be generated. Request a replacement K/A be generated. K/A replaced with APE027 G 2.2.22
1/2	APE067 AA2.07	Request to replace K/A due to inability to develop an operationally valid SRO level Tier 1 question that meets the K/A. K/A replaced with APE067 AA2.15
2/2	017 G 2.2.3	In Core Temperature Monitoring systems are identical between both units at CNS. Therefore, an operationally valid question cannot be generated. Request a replacement K/A be generated. K/A replaced with 017 G 2.1.7

Facility: **Catawba Nuclear Station** Date of Exam: **09/20/21** Exam Level: RO ☑ SRO ☑

	Item Description				Initial a	Initial b*	Initial c*#
1.	Questions and answers are technically accurate and applicable to the facility.				RM	WW	KK
2.	a. NRC K/As are referenced for all questions. b. Facility learning objectives are referenced as available. c. Correct answer explanation and distractor analysis provided (ES-401, D.2.g)				RM	WW	KK
3.	SRO questions are appropriate in accordance with Section D.2.d of ES-401				RM	WW	KK
4	The sampling process was random and systematic. (If more than four RO or two SRO questions were repeated from the last two NRC licensing exams, consult the NRR/NRO OL program office).				RM	WW	KK
5.	Question duplication from the licensee screening/audit exam was controlled as indicated below (check the item that applies) and appears appropriate. __ The audit exam was systematically and randomly developed, or __ the audit exam was completed before the license exam was started, or __ the examinations were developed independently, or ✓ the licensee certifies that there is no duplication, or __ other (explain).				RM	WW	KK
6.	Bank use meets limits (no more than 75% from the bank, at least 10% new, and the rest new or modified); enter the actual RO/SRO-only question distribution(s) at right.	Bank **48/48**	Modified **20/20**	New **32/32**	RM	WW	KK
7.	Between 38 and 45 questions of the questions on the RO exam and at least 13 questions of the questions on the SRO-only portion of the exam are written at the comprehension/analysis level (see ES-401, D.2.c); enter the actual RO/SRO-only question distribution(s) at right.	Memory **35/8**	C/A **40/17**		RM	WW	KK
8.	References/handouts provided do not give away answers or aid in the elimination of distractors.				RM	WW	KK
9.	Question content conforms to specific K/A statements in the previously approved examination outline and is appropriate for the tier to which they are assigned; deviations are justified.				RM	WW	KK
10.	Question psychometric quality and format meet the guidelines in Appendix B.				RM	WW	KK
11.	The exam contains the required number of one-point, multiple-choice items; the total is correct and agrees with the value on the cover sheet.				RM	WW	KK

		Printed Name/Signature	Date
a.	Author	Rusty Miller [signature]	09/01/21
b.	Facility Reviewer (*)	RP Jones [signature]	9.2.21
c.	NRC Chief Examiner (#)	KEVIN KIRCHBAUM [signature]	9/8/21
d.	NRC Regional Supervisor	Gerald J. McCoy — Digitally signed by Gerald J. McCoy Date: 2021.09.16 08:55:25 -04'00'	

Note: * The facility reviewer's initials or signature are not applicable for NRC-developed examinations.
Independent NRC reviewer initials items in Column "c"; chief examiner concurrence is required.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
1	H	3				X								N	E	EPE007 EK1.02 1. Q=K/A, Q=RO 2. The correct answer as per the discussion is D. Yet the applicable pages on the top right indicate the correct answer is C. Correct page annotation of answer. Corrected 3. Plausibility of 548 F as a distractor. It only tests if the applicant remembers the temperature requirement. Recommend providing multiple channels and values for the applicant to evaluate. Example: 3 at 546F and Include one channel that is at 545F and all trending slowly down. Give the applicant the opportunity to evaluate if he needs to emergency borate based on the single channel at 545F or if multiple channels are needed. With 545 and trending down on one channel the answer would change to NC require Emergency Boration. A given temperature at, or below, 545 degrees does not automatically require boration (only evaluation). Revised with a temperature below 545, added the reference, and requirement for the applicant to evaluate. Enhancements provided. Question SAT
2	H	2		X										B M	E	APE008 AK2.02 1. Q=K/A, Q=RO 2. LOD marked as 2, but low. More like a 1.5. Basic GFES Question and with the plant conditions given at NOP, most applicants have done this conversion several times. 260F is often a known answer without using steam tables. Recommend making the question a Mode 3 question and lowering the given RCS Pressure. In the Initial Conditions. The distractor plausibility should all still work the same. This will increase LOD Revised question to change RCS pressure and PRT pressure. Changed question type to modified. Enhancements provided. Question SAT
3	H	3												B	S	EPE009 EK1.02 1. Q=K/A, Q=RO 2.
4	F	3												B	S	EPE011 2.4.21 1. Q=K/A, Q=RO 2
5	H	3												M	S	APE015/017 2.2.42 1. Q=K/A, Q=RO 2

6	H	3									X			B N	E	APE022 AK3.06 1. Q=K/A, Q=RO 2 Question does not meet Tier 1 applicability. Tier 2 (Systems) level knowledge only. The objective of Tier 1 questions is to test an applicant's knowledge of how to safely operate the plant during emergency and abnormal conditions. All Tier 1 questions must meet this objective. Satisfactory ways of meeting this objective include, but are not limited to, the following: (1) information contained in the site's procedures, including alarm response procedures, AOPs, EOPs, and their associated bases documents; (2) diagnosis that leads to selection of the procedures that should be used to respond to the evolution, (3) the progression of an event, and (4) assessment of the integrated plant response to emergency or abnormal situations crossing several plant systems and/or safety functions. Also a weak K/A tie. It implied that the thermal barrier hx is the back up for a loss of injection flow. But this is not testing the knowledge as it applies to loss of makeup. The second part of the question is directed towards a loss of CCS. There is nothing addressing a "Response" to a "Loss of Reactor Coolant Makeup." Recommend changing the second part to tie the question to an AP-008 foldout required Rx and RCP trip setpoint. This should clear up both issues. Difficult to tie to AP/08 since the thermal barrier hx will prevent significant rise in RCP parameters. Revised to reference Abnormal procedure entry, thermal barrier hx cooling effects, and procedure requirement. Changed question type to New. Question improvement overall and corrects original issues. There seems to be a plausibility issue with the second part of the question. I can think of no time at a PWR when Letdown would be restored prior to charging except maybe used for draindown during M5/M6. Maybe want to indicate the plant is in Mode 1 100% in the stem. Possible solution to provide the applicant with conditions to determine if normal letdown should be returned to service or if Excess Letdown is required. Or initial setting for 1NV-148 or 1NV-849 when initiating flow. Revised as suggested to ask initial setting of 1NV-148 Enhancements provided. Question SAT
7	F	3												B	S	APE025 AK2.01 1. Q=K/A, Q=RO 2
8	H	3												M	S	APE026 AA1.06 1. Q=K/A, Q=RO 2

Refer to Section D of ES-401 and Appendix B for additional information regarding each of the following concepts:

1. Enter the level of knowledge (LOK) of each question as either (F)undamental or (H)igher cognitive level.
2. Enter the level of difficulty (LOD) of each question a 1 (easy) to 5 (difficult); questions with a difficulty between 2 and 4 are acceptable.
3. Check the appropriate box if a psychometric flaw is identified:
   - "Stem Focus": The stem lacks sufficient focus to elicit the correct answer (e.g., unclear intent, more information is needed, or too much needless information).
   - "Cues": The stem or distractors contain cues (e.g., clues, specific determiners, phrasing, length).
   - "T/F": The answer choices are a collection of unrelated true/false statements.
   - "Cred. Dist.": The distractors are not credible; single implausible distractors should be repaired, and more than one is unacceptable.
   - "Partial": One or more distractors are partially correct (e.g., if the applicant can make unstated assumptions that are not contradicted by the stem).
4. Check the appropriate box if a job content flaw is identified:
   - "Job Link": The question is not linked to the job requirements (i.e., the question has a valid K/A but, as written, is not operational in content).
   - "Minutia": The question requires the recall of knowledge that is too specific for the closed-reference test mode (i.e., it is not required to be known from memory).
   - "#/Units": The question contains data with an unrealistic level of accuracy or inconsistent units (e.g., panel meter in percent with question in gallons).
   - "Backward": The question requires reverse logic or application compared to the job requirements.
5. Check questions that are sampled for conformance with the approved K/A and those K/As that are designated "SRO-only." (K/A and license-level mismatches are unacceptable.)
6. Enter question's source: (B)ank, (M)odified, or (N)ew. Verify that (M)odified questions meet the criteria of Form ES-401, Section D.2.f.
7. Based on the reviewer's judgment, is the question, as written, (U)nsatisfactory (requiring repair or replacement), in need of (E)ditorial enhancement, or (S)atisfactory?
8. At a minimum, explain any "U" status ratings (e.g., how the Appendix B psychometric attributes are not being met).

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
9	H	3												B	S	EPE029 EA1.11 1. Q=K/A, Q=RO 2
10	H	3												B	U	APE040 AA2.02 1. Q=K/A, Q=RO 2. Recommend adding words to describe the leak location for increased clarity in the stem. This should be obvious by the reference, but an applicant may contend that the leak being internal to the MSR was not obvious based on the reference. (Also, I have never seen this type of representation of MSR in a print, so it could just be that I am not familiar, and it took a second to understand it. If it is expected that the applicants are familiar with the symbol associated with MSR, this may not be necessary. We can discuss.) Agreed. Revised stem of question to better describe leak location. The MSR diagram is not from an official document. However, it came from a ppt used for presentation of the MSR lesson. The applicants are familiar with this representation. The ppt was not included with the reference set provided with the submittal but we can email it to you if preferred. Enhancements provided. Question SAT 9/19/21: Licensee determined that the original question, as written had the incorrect answer. It was determined that valve 2 HM-1 would close based on a turbine trip. The original answer required a reactor trip as the correct answer. Since the steam leak could be isolated by the turbine trip, the turbine trip became the correct answer. The licensee is updating the key as well as the 401-5 for question 10 as a part of their post exam submittal. Question analyzed as Unsat due to incorrect answer provided during exam submittal.
11	H	3												B	S	APE054 AK1.01 1. Q=K/A, Q=RO 2.
12	H	2												M	S	APE056 2.1.30 1. Q=K/A, Q=RO 2
13	H	3												B	S	APE062 AA2.01 1. Q=K/A, Q=RO 2
14	F	2												N	S	APE065 AK3.04 1. Q=K/A, Q=RO 2

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
15	F	3												B	S	APE077 AA1.03 1. Q=K/A, Q=RO 2.
16	H	3												M N	E	WE04 EA2.2 1. Q=K/A, Q=RO 2. When did the requirement to verify PZR Level and RVLMS change and go into the procedure? Was the class trained on the original version and retrained on the change? If the applicants were only ever trained on the current revision, this becomes an invalid distractor. Also, there can be an inequitable issue where SRO(I) and RO's would never consider the old procedural step and the SRO(U) would consider it. Recommend providing parameters for evaluation after isolation of B ND header. NC Pressure is slowly lowering with RVLIS is going up. The leak is/is not isolated. Agree with plausibility comment. Revised as suggested with a slight difference to account for possible unforeseen situation in which NC pressure does not respond per the procedure note. Revised to ask most reliable diagnostic indication. Enhancements made. 3. If OMP 1-7 contains guidance to allow operators to isolate a known leak, is isolating the B ND Header first, truly an incorrect answer? Can this procedure be used in concurrence with EOPs? To use guidance of OMP 1-7, it must be a known leak. A known leak is one that is confirmed by local verification or redundant control room indications. The scenario outlined in this question does not meet that criteria. No concern or enhancement required. Changed question type to New. Enhancements provided. Question SAT
17	F	3												B	S	WE05 EK2.2 1. Q=K/A, Q=RO 2
18	F	2												B	S	WE11 EK3.4 1. Q=K/A, Q=RO 2.
19	H	3				X								N	E	APE036 AK1.03 1. Q=K/A, Q=RO 2. The supporting documentation provided 19 is for the Pre-Submittal version of Q19.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
																3. Plausibility of part 1 distractor is questionable. How long ago was the setpoint on the SDM Alarm changed? Was this recent? May be plausible if applicants were trained on this new change. Agree the setpoint change is no longer relevant. Changed part one distractor from four to three which is the approximate setpoint of another shutdown monitor (High flux at shutdown alarm). This alarm is set .5 decade above background which represents approximately 3 times background (0.5 decade = 3.16 times) Enhancements provided. Question SAT
20	F	3												N	S	APE037 AA1.07 1. Q=K/A, Q=RO 2.
21	H	3												M N	U	APE051 AK3.01 1. Q=K/A, Q=RO 2. Not written as Tier 1 question. Systems knowledge only is required to answer correctly. Recommend rewrite to addressing requirements of AP-023. Example: Mode 2, loss of vacuum and crew enters AP-023. Vacuum trending to 16.9 inches. A reactor trip (is/is NOT) required and Steam Bypass (is/is NOT) available. Revised question as suggested except recommended mode. Alternate guidance in AP/06 does not contain trip criteria less than 5% (i.e. trip Rx upon loss of all feed only if >5%). Although question states "IAW AP/23" listed Mode 1 to prevent confusion. Changed question type to New and Cognitive level to High. Enhancements provided. Question SAT
22	H	3												B	S	APE059 AA2.03 1. Q=K/A, Q=RO 2.
23	F	3				X								M	E	WE14 EK3.2 1. Q=K/A, Q=RO 2. Plausibility of distractor. The way the question is written it implies that all fans remain in slow speed and the choice is to start the C in HIGH or LOW. If all other fans are in LOW, why would you ever have one fan in HIGH? Recommend making the question "All LCVU will be started in (LOW/HIGH) speed and… (This may not be applicable if it is normal to have LCVUs in different speeds. Not what I have seen.) 3. Is there ever a condition that would require 4 LCVU's running in slow and still be in NORM?

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
																Revised question 1, as suggested, to include all LCVUs. 4 LCVUs are not operated in the slow/norm configuration. However, there is guidance to operate Upper Containment Vent Units this way (see attached procedure). Changed question type to modified bank. Enhancements provided. Question SAT
24	H	3										X		N	E	EPE074 EK2.09 1. Q=K/A, Q=RO 2. Question misses the mark on K/A. It does not address controller or positioners. I recommend shifting the second part of the question to address the correct operation of the SG PORVS to establish Max Cooldown. Revised question as suggested. Also changed part 1 question to beef up (controller ??) knowledge Changed question type to new. Enhancements provided. Question SAT
25	H	3												N	S	WE02 EA1.3 1. Q=K/A, Q=RO 2. Looks like supporting documentation is describing a previous revision of the question that addressed Secondary Heat Sink vice NC Pressure. Updated support documentation attached.
26	H	3												B	S	WE15 EA2.2 1. Q=K/A, Q=RO 2.
27	H	3												M	S	WE03 2.1.20 1. Q=K/A, Q=RO 2. Second part of D answer cut off of page my the lower margin. Have confirmed it will fit on applicant's copy once "NOT APPROVED" banner is removed.
28	F	3												M	S	SYS003 A3.01 1. Q=K/A, Q=RO

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
																2. Listed as Comprehensive but justification was based of original question prior to modification. Question appears to be fundamental as both parts are answered from memory. Changed cognitive level to fundamental.
29	F	3												N	S	SYS004 K2.06 1. Q=K/A, Q=RO 2.
30	H	3												M	S	SYS005 K6.03 1. Q=K/A, Q=RO 2.
31	H	3												B	S	SYS006 A1.15 1. Q=K/A, Q=RO 2.
32	H	3												N	S	SYS007 K3.01 1. Q=K/A, Q=RO 2.
33	H	3												B	S	SYS007 K4.01 1. Q=K/A, Q=RO 2.
34	H	3												B	S	SYS008 K4.02 1. Q=K/A, Q=RO 2.
35	F	3												N	S	SYS010 K2.01 1. Q=K/A, Q=RO 2.
36	H	3												B	S	SYS010 K6.01 1. Q=K/A, Q=RO 2.
37	F	3				X								N	E	SYS012 A4.04 1. Q=K/A, Q=RO 2. There is no supporting documentation that discusses the trip setpoint shift to IR at 25% power. Updated distractor analysis and development references to list the associated trips and interlocks. 3. Is there ever a time when you could manually block the Intermediate Range? This brings in to question some operational validity in the distractor. Makes SR obvious answer for part 1. Yes, IR trip is blocked once Rx power reaches Permissive 10 (vs Permissive 6). Additionally, P-10 logic feeds both the SR and IR trip logic.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
																Enhancements not required. Question SAT
38	H	3												N	S	SYS013 K1.13 1. Q=K/A, Q=RO 2.
39	F	2												B	S	SYS022 A4.04 1. Q=K/A, Q=RO 2.
40	F	3												B	S	SYS025 A1.03 1. Q=K/A, Q=RO 2.
41	H	2												M	S	SYS025 K5.01 1. Q=K/A, Q=RO 2.
42	H	3												B	S	SYS026 A2.07 1. Q=K/A, Q=RO 2.
43	H	3												N	S	SYS026 K3.02 1. Q=K/A, Q=RO 2.
44	H	3												M	S	SYS039 A1.06 1. Q=K/A, Q=RO 2.
45	F	3	X											N	E	SYS039 A2.03 1. Q=K/A, Q=RO 2. Does being on Hold for 3 hrs have any relevance on the question or help validate distractors? If no, remove from the stem. Information removed from the stem. Enhancements provided. Question SAT
46	F	3												B	S	SYS059 K4.08 1. Q=K/A, Q=RO 2.
47	F	2												M	S	SYS061 K5.02 1. Q=K/A, Q=RO 2.
48	H	3												B	S	SYS062 K2.01 1. Q=K/A, Q=RO 2.
49	F	3												B	S	SYS063 A3.01 1. Q=K/A, Q=RO 2.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
50	F	2												N	S	SYS064 A2.15 1. Q=K/A, Q=RO 2.
51	H	3												M	S	SYS073 2.1.25 1. Q=K/A, Q=RO 2.
52	H	3												B	E	SYS076 K1.19 1. Q=K/A, Q=RO 2 Written to Tier 1 level. Needs to be more basic, systems-oriented knowledge being asked and less Emergency Procedure implementation. Recommend for Part 1; The NS Heat Exchanger will be aligned when Containment Pressure is greater than (1PSIG/3PSIG) Modified as suggested. New version states ILT 21 CNS SRO NRC Examination at the top. Suspect only typo Enhancements provided. Question SAT
53	F	2				X								B	E	SYS078 K3.03 1. Q=K/A, Q=RO 2. The first part question is not plausible. Barring any design difference between A and B train, it is not reasonable to think that because one train of RHR is effected by a loss of Instrument Air that the other train would not be effected in the same way and therefore not be able to be placed in service. Throttle 1NI-173 is an obvious correct answer. Possible correction could be to state that 1NI-173A is throttled (OPEN/CLOSED) to maintain temperature. This will test if the understanding of the failure mode for the bypass valve. Revised as suggested. Enhancements provided. Question SAT
54	H	3												M	S	SYS103 A3.01 1. Q=K/A, Q=RO 2.
55	H	3												B	S	SYS103 2.4.50 1. Q=K/A, Q=RO 2.
56	F	3												N	S	SYS001 K2.02 1. Q=K/A, Q=RO 2.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
57	F	3												N	S	SYS011 K4.07 1. Q=K/A, Q=RO 2.
58	H	3												B	S	SYS015 K1.02 1. Q=K/A, Q=RO 2.
59	F	2												B	S	SYS016 2.2.39 1. Q=K/A, Q=RO 2
60	F	3	X											B	E	SYS028 K5.03 1. Q=K/A, Q=RO 2. There needs to be some indication in the stem of the question that core melt is in progress and temperatures have reached the point where the Zirc-water reaction is taking place. DBA LOCA does not ensure core damage. Without this it can be argued that there was no indication of core damage in the stem and therefore there could be two correct answers. Revised question to state core melt in progress and zirc-water reaction taking place. Enhancements provided. Question SAT
61	H	3												B	S	SYS045 A2.12 1. Q=K/A, Q=RO 2.
62	F	2												N	S	SYS055 K3.01 1. Q=K/A, Q=RO 2.
63	F	2												B	S	072 A1.01 1. Q=K/A, Q=RO 2.
64	F	2	X											M	E	SYS075 A4.01 1. Q=K/A, Q=RO 2. Written to Tier 1. By asking the procedural step requirement, this question is more at the Tier 1 Level. Asking more directly, “Which valve has automatic action associated with Emergency Low Pit Level?” This is more systems base knowledge. 3. Fundamental knowledge. Direct Memory action to remember associated interlocks. Revised question, as suggested, to be more directed toward system knowledge. Changed Cognitive level to fundamental. Enhancements provided. Question SAT

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
65	F	2												N	S	SYS086 K6.04 1. Q=K/A, Q=RO 2.
66	F	2												N	S	GEN2.1 2.1.15 1. Q=K/A, Q=RO 2.
67	F	2												N	S	GEN2.1 2.1.37 1. Q=K/A, Q=RO 2.
68	H	2												B	S	GEN2.2 2.2.1 1. Q=K/A, Q=RO 2.
69	F	3												B	S	GEN2.2 2.2.22 1. Q=K/A, Q=RO 2.
70	F	3		X										N	E	GEN2.2 2.2.43 1. Q=K/A, Q=RO 2. Subset issue. By asking how often an audit is performed, you give away the answer to the first part, even if the applicant doesn't recognize that all procedurally driven OAC alarms do not need to be in eSOMS. Recommend changing the alarm to be associated with a procedure and test the understanding in the opposite fashion. Revised question as suggested. Enhancements provided. Question SAT
71	H	3												B	S	GEN2.3 2.3.4 1. Q=K/A, Q=RO 2. Not sure I ever seen that "Emergency exposure limits are exclusive of current occupational exposure." I would be interested to see the basis document for this note or if it is driven by the fleet requirements. Question is SAT if this statement is true. Unable to locate basis document. Revised question to ask if the worker is required to be a volunteer. Enhancements provided. Question SAT
72	F	3												B	S	GEN2.3 2.3.5 1. Q=K/A, Q=RO 2.
73	F	2												M	S	GEN2.4 2.4.29 1. Q=K/A, Q=RO 2.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
74	F	2												B	S	GEN2.4 2.4.3 1. Q=K/A, Q=RO 2
75	H	3												B	S	GEN2.4 2.4.9 1. Q=K/A, Q=RO 2
															E	General Issue. NUREG-1021 ES-401 D.2.f requires a minimum of 10 new questions written at the comprehensive/analysis level. (8 for RO and 2 for SRO-only) There are only 7 new questions on the RO exam that are written to this level. Questions 6, 16, 21, and 24 are now new and written at the comprehensive/analysis level. Enhancements provided.
76	F	3											X	B	S	APE027 2.2.22 1. Q=K/A, Q=SRO 2
77	F	3											X	B	S	EPE038 EA2.17 1. Q=K/A, Q=SRO 2
78	H	3											X	N	S	EPE055 EA2.03 1. Q=K/A, Q=SRO 2. Answer B discussion still has info from the presubmittal. Removed
79	H	3											X	M	S	APE057 2.2.44 1. Q=K/A, Q=RO 2
80	H	3											X	N	S	APE058 2.4.41 1. Q=K/A, Q=SRO 2.
81	H	3		X									X	B	E	WE11 EA2.1 1. Q=K/A, Q=SRO 2. It is assumed that the transfer to ECA-1.1 was from ES-1.3 and the applicant will know the foldout step requirements of ES-1.3. But there are other ways to get to ECA-1.1. I am concerned that if the procedure was to be entered from another procedural point that the CSFST's may not have to be addressed at that time and it could create two correct answers. Recommend adding a bullet in the stem that the crew was performing ES-1.3 and transitioned to ES-1.3.

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
																Revised question to state that ECA-1.1 was entered from ES-1.3. Enhancements provided. Question SAT
82	H	4											X	B	S	APE005 2.2.12 1. Q=K/A, Q=SRO 2.
83	H	3				X							X	M	E	APE028 AA2.11 1. Q=K/A, Q=SRO 2. Plausibility concern with the first part of the question. It does not seem plausible that one would enter the TSAS for PZR Level based on a failed component or indication. That is basic level knowledge. Revised part 1 question to require knowledge of PZR setpoint calculation and TS determination based on provided info. Changed cognitive level to Comprehensive due to calculation. Enhancements provided. Question SAT
84	H	3											X	M	S	APE033 2.4.46 1. Q=K/A, Q=SRO 2.
85	H	3											X	N	S	APE067 AA2.15 1. Q=K/A, Q=SRO 2.
86	F	3											X	B	S	SYS004 2.2.22 1. Q=K/A, Q=SRO 2.
87	H	3											X	B	S	SYS013 A2.04 1. Q=K/A, Q=SRO 2
88	F	3											X	N	S	SYS059 A2.11 1. Q=K/A, Q=SRO 2
89	H	3				X							X	N	E	SYS061 2.4.30 1. Q=K/A, Q=SRO 2. Recommend adding conditions to make the applicant analyze the EALs for a different Alert Threshold (LOOP or similar). The first part could be considered direct lookup as a stand-alone question. Rewrote question to include LOOP and also listed only S/G levels (vs FR-H.1 entry) to require the applicant to determine loss of heat sink rather than list the condition. Also used S/G level unit difference as distractor for heat sink procedure entry. Enhancements provided. Question SAT

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
90	F	3											X	N	S	064 A2.06 1. Q=K/A, Q=SRO 2.
91	H	3											X	B	S	SYS002 A2.04 1. Q=K/A, Q=SRO 2.
92	H	3											X	M	S	SYS014 A2.03 1. Q=K/A, Q=SRO 2.
93	H	3											X	N	S	017 2.1.7 1. Q=K/A, Q=SRO 2
94	F	2											X	B	S	GEN2.1 2.1.1 1. Q=K/A, Q=SRO 2
95	H	3				X						X	X	N	U	GEN2.1 2.1.25 1. Q=K/A, Q=SRO 2 The first part distractor is .98 for Keff, yet all the examples given for plausibility are .99. Keff of .98 is not a value that correlates to anything of significance. The distractor should be .99 like the analysis describes. 3. The answer is a direct lookup from the reference provided. There is no critical though required other than knowing that the core has Zero EFPD. Because the answer is provided in the reference, there is never a need to analyses the graph to determine the correct answer. This misses the mark on the K/A. Replaced question 1. Q=K/A, Q=SRO 2. Enhancements provided. Question SAT
96	F	2					X						X	B	E	GEN2.2 2.1.13 1. Q=K/A, Q=SRO 2. The distractor analysis doesn't discuss Shift Supervisor as a plausible distractor. If the Shift Supervisor is qualified as a SM, can he approve Exceptional Clearances, or does this have to be approved by the on shift SM only? Extra wording may be required to differentiate. This is to avoid the argument and potential two correct answers. Revised part 2 question to ask if SM/Work Group supervisor permission is/is not required. Enhancements provided. Question SAT

Q	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. Other		6. Source (B/M/N)	7. Status (U/E/S)	8. Explanation
			Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	#/Units	Backward	Q – K/A	SRO Only			
97	F	2											X	B	S	GEN2.2 2.2.18 1. Q=K/A, Q=SRO 2.
98	H	3					X						X	B M	E	GEN2.3 2.3.11 1. Q=K/A, Q=SRO 2. Is there procedural guidance that supports the answer to part one that prohibits the CRS from using the guidance of OP/60? Although not a conservative decision to continue the release, no procedural step stating to stop the release when the recirc pump trips means that the distractor could be a correct answer. The correct answer as written needs a procedural step stating this is the correct action, then the question is OK. Could not locate specific procedural guidance. Replaced part 1 of this question to ask requirement for release. Changed question type to modified. Enhancements provided. Question SAT
99	H	3											X	B	S	GEN2.3 2.3.12 1. Q=K/A, Q=SRO 2.
100	H	3											X	B	S	GEN2.4 2.4.5 1. Q=K/A, Q=SRO 2.