NRC EXAM

Facility: **Catawba Nuclear Station** Date of Examination: **June 2017**

Examination Level: RO ☒ SRO ☐ Operating Test Number: **2017301**

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R,D	**Perform Manual Shutdown Margin Calculation** G 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. 3.9/4.2
Conduct of Operations	R,D,P	**Calculate FWST Makeup** G 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. 4.3/4.4
Equipment Control	R,D	**Determine Isolation Boundary** G 2.2.41 Ability to obtain and interpret station electrical and mechanical drawings. 3.5/3.9
Radiation Control	R,M	**Calculate Total RL Discharge Flow** G 2.3.11 Ability to control radiation releases. 3.8/4.3
Emergency Procedures/Plan		

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

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

Admin JPMs

JPM A.1-1 – Perform Manual Shutdown Margin Calculation (Common RO & SRO) – Bank JPM RB-125
This JPM is time critical with a completion time requirement of 1 hour (to comply with requirement of T.S. 3.1.4).

K/A Generic 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR 41.10 / 43.5 / 45.12) RO 3.9 SRO 4.2

Initial conditions are that the computer program used to calculate shutdown margin is inoperable and that during performance of the RCCA Bank Repositioning Periodic Test, that Shutdown Bank E would not move. Control Rods H4 and K14 have been determined to be immovable and untrippable. Tech Specs require that a shutdown margin calculation be performed within 1 hour. Applicants are given values for current power level, core life, control rod positions, and current boron concentration and are instructed to perform a manual shutdown margin calculation per OP/0/A/6100/006 (Reactivity Balance Calculations) Enclosure 4.3 (Shutdown Margin – Untrippable / Misaligned RCCA(s) – Modes 1 & 2). Applicant will determine that current calculated shutdown margin is 1263 pcm. Applicant determines that required shutdown margin of 1300 pcm for the current mode does not exist.

JPM A.1-2S – Calculate boric acid and water addition to FWST. (RO ONLY) – Bank JPM 2016 NRC Exam JPM A.1-2R

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.

JPM A.2 – Use Flow Diagrams, Electrical Prints and Load Lists to Determine Leak Isolation Boundary (Common RO & SRO) – Bank JPM 2012 NRC Exam A.2

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 the 1B Condensate Booster Pump has been shut down in accordance with OP/1/A/6250/001 and is to be tagged out for removal and replacement of 1CM-327 (1B Condensate Booster Pump Suction Header Relief Valve). The applicant is provided CM flow diagrams CN 1590-1.5 and CN 1590-1.7, Load List for 1MXB, and Electrical Drawings CN 1702-1.1 through CN 1702-1.4, and are directed to determine all mechanical isolations, electrical isolations, and to identify applicable vent or drain path for use for the development of a tagout.

JPM A.3 – Calculate Total RL Discharge Flow (RO ONLY) – Bank JPM WL-001 Modified (Changed some values which changed the final answer)

K/A Generic 2.3.11 Ability to control radiation releases. (CFR 41.11 / 43.4 / 45.10) RO 3.8 SRO 4.3

Initial conditions are that the RL discharge header flow instrumentation is inoperable. Applicants are given plant conditions and directed to calculate and record the total RL discharge flow per PT/0/A/4250/011 (RL Temperature and Discharge Flow Determination). Applicant will calculate Total RL Discharge Flow to be 48,608 gpm (48,608 to 50,179 gpm acceptable).

NRC EXAM

Facility: **Catawba Nuclear Station** Date of Examination: **June 2017**

Examination Level: RO ☐ SRO ☒ Operating Test Number: **2017301**

Administrative Topic (See Note)	Type Code*	Describe activity to be performed
Conduct of Operations	R,D	**Perform Manual Shutdown Margin Calculation** G 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. 3.9/4.2
Conduct of Operations	R,D,P	**Calculate FWST Makeup and Tech Spec Actions** G 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. 4.3/4.4
Equipment Control	R,D	**Determine Isolation Boundary** G 2.2.41 Ability to obtain and interpret station electrical and mechanical drawings. 3.5/3.9
Radiation Control	R,M	**Calculate Total RL Discharge Flow** G 2.3.11 Ability to control radiation releases. 3.8/4.3
Emergency Procedures/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. 2.7/4.5

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

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

Admin JPMs

JPM A.1-1 – Perform Manual Shutdown Margin Calculation (Common RO & SRO) – Bank JPM RB-125
This JPM is time critical with a completion time requirement of 1 hour (to comply with requirement of T.S. 3.1.4).

K/A Generic 2.1.25 Ability to interpret reference materials, such as graphs, curves, tables, etc. (CFR 41.10 / 43.5 / 45.12) RO 3.9 SRO 4.2

Initial conditions are that the computer program used to calculate shutdown margin is inoperable and that during performance of the RCCA Bank Repositioning Periodic Test, that Shutdown Bank E would not move. Control Rods H4 and K14 have been determined to be immovable and untrippable. Tech Specs require that a shutdown margin calculation be performed within 1 hour. Applicants are given values for current power level, core life, control rod positions, and current boron concentration and are instructed to perform a manual shutdown margin calculation per OP/0/A/6100/006 (Reactivity Balance Calculations) Enclosure 4.3 (Shutdown Margin – Untrippable / Misaligned RCCA(s) – Modes 1 & 2). Applicant will determine that current calculated shutdown margin is 1263 pcm. Applicant determines that required shutdown margin of 1300 pcm for the current mode does not exist.

JPM A.1-2S – Calculate boric acid and water addition to FWST and determine applicable Tech Spec actions. (SRO ONLY) – Bank JPM 2016 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.2 – Use Flow Diagrams, Electrical Prints and Load Lists to Determine Leak Isolation Boundary (Common RO & SRO) – Bank JPM 2012 NRC Exam A.2

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 the 1B Condensate Booster Pump has been shut down in accordance with OP/1/A/6250/001 and is to be tagged out for removal and replacement of 1CM-327 (1B Condensate Booster Pump Suction Header Relief Valve). The applicant is provided CM flow diagrams CN 1590-1.5 and CN 1590-1.7, Load List for 1MXB, and Electrical Drawings CN 1702-1.1 through CN 1702-1.4, and are directed to determine all mechanical isolations, electrical isolations, and to identify applicable vent or drain path for use for the development of a tagout.

Admin JPMs

JPM A.3 – Calculate Total RL Discharge Flow (SRO ONLY) – Bank JPM WL-001 Modified (Changed some values which changed the final answer and added LWR to be approved for SRO ONLY)

K/A Generic 2.3.11 Ability to control radiation releases. (CFR 41.11 / 43.4 / 45.10) RO 3.8 SRO 4.3

Initial conditions are that the RL discharge header flow instrumentation is inoperable and an LWR package has been delivered to the control room for approval. Applicants are given plant conditions and directed to calculate and record the total RL discharge flow per PT/0/A/4250/011 (RL Temperature and Discharge Flow Determination) and determine whether sufficient dilution flow exists to approve the LWR. Applicant will calculate Total RL Discharge Flow to be 48,608 gpm (48,608 to 50,179 gpm acceptable). Applicant will determine that sufficient dilution flow does exist for the LWR approval.

JPM A.4 – Classify an Event and Fill Out the Emergency Notification Form (SRO ONLY) – NEW JPM
This JPM is time critical (≤ 15 minutes) from the point that the emergency classification is made.

K/A Generic 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 that both Units are at 100% power. A tornado strikes the switchyard causing a Loss of Offsite power to Unit 2. A lighting pole from the switchyard has punctured the FWST on Unit 1 and water is spilling out of it into the missile shield around it. Applicants are given a copy of RP/0/A/5000/001 (Emergency Classification) and the NEI Rev 6 EAL Wallcharts and are directed to classify the event and to fill out the Emergency Notification Form per RP/0/A/5000/006 A (Notifications to the States and Counties From the Control Room). This event is classified as an Alert (SA9.1).

NRC EXAM

Facility: **Catawba Nuclear Station** Date of Examination: **June 2017**

Exam Level: RO ☒ SRO-I ☐ SRO-U ☐ Operating Test Number: **2017301**

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

System / JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System 004 A2.14 (3.8/3.9)	A,D,S	1
b. Perform E-0 Actions To Ensure Complete Containment Isolation 013 A4.01 (4.5/4.8)	A,EN,N,S	2
c. Establish NC System Bleed and Feed WE05EA1.1 (4.1/4.0)	A,D,L,S	4P
d. Realign CA Suction Source 054AA1.01 (4.5/4.4)	A,D,L,S	4S
e. Operate Containment Cooling Fans 022 A4.01 (3.6/3.6)	D,P,S	5
f. Reset Radiation Monitor Trip Setpoints 073 A4.02 (3.7/3.7)	D,P,S	7
g. Isolate Cold Leg Accumulators During Shutdown LOCA 006 A1.13 (3.5/3.7)	A,D,L,P,S	3
h. Restore Normal Power To 1ETA From The Control Room 064 A4.07 (3.4/3.4)	D,S	6
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Place 2A Hydrogen Analyzer In Service 028 A1.01 (3.4/3.8)	D,E,L,R	5
j. Align Seal Injection to the Unit 1 NC Pumps 076 A2.01 (3.5/3.7)	E,N	4S
k. Align Swing Inverter 1EIE to 1ERPA 062 A2.01 (3.4/3.9)	D,E	6

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

*Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3 **(5/5/3)**
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4 **(9/8/3)**
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1 **(3/3/2)**
(EN)gineered safety feature	- / - / ≥ 1 **(1/1/1)**
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1 **(4/4/2)**
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1 **(2/2/2)**
(P)revious 2 exams	≤ 3 ≤ 3 / ≤ 2 **(3/3/0)**
(R)CA	≥ 1 / ≥ 1 / ≥ 1 **(1/1/1)**
(S)imulator	

Simulator JPMs

JPM a – Emergency Borate the Reactor Coolant System – Bank JPM - Alternate Path

K/A 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 a valid reactor trip signal has been received and the reactor will not trip from the control room. A Red Path on the Subcriticality CSF is in effect. The OATC is inserting control rods manually. The CRS directs the applicant to initiate emergency boration, per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicant ensures that an NV pump is in service and then depresses the OPEN pushbutton on 1NV-236B (Boric Acid To NV Pumps Suct). 1NV-236B fails to open beginning the **ALTERNATE PATH**. After ensuring that both boric acid transfer pumps are in service and still no emergency boration flow exists, the applicant will open the NV pump suction isolations from the FWST and isolate the NV pump suction from the VCT, ensure proper system lineup to the NC system, and verify NC system pressure is < 2335 psig.

JPM b – Perform E-0 Actions To Ensure A Complete Containment Isolation – NEW JPM - Alternate Path

K/A 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 (Justification for the Safety Function 2 (Inventory Control) designation is that the WL penetration that is left un-isolated during this JPM is from the Containment Sump. As long as this penetration remains un-isolated, a constant discharge of water from the containment sump will be in progress. On a Large Break LOCA this water in the containment sump will eventually be the water used for core cooling following transfer to Cold Leg Recirculation. Removing inventory from the containment sump may lead to the eventual inability to properly cool the core and ultimately lead to core damage).

Initial conditions are that the applicant assumes the OATC role with the BOP out of the control room and the CRS performing an IPTE brief on Unit 2. Once the applicant has the watch, a Large Break LOCA will occur on Unit 1. The OATC will verify that all immediate actions are met. The examiner will provide a cue to applicant that the CRS directs them to continue performance of E-0 beginning at step 6. The applicant will announce that a safety injection has occurred and will verify that all Feedwater Isolation status lights are lit. The applicant will then determine that a Phase A Containment Isolation has not occurred and will manually initiate both trains. This begins the **ALTERNATE PATH**. The applicant will determine from the monitor light panel that Phase A Containment Isolation valves 1WL-825A and 1WL-827B (both on the containment floor and equipment sump discharge penetration) have not closed as expected. The applicant will then manually close these valves to end the JPM.

JPM c – Initiate RCS Bleed and Feed following loss of Secondary Heat Sink – Bank JPM – Alternate Path

K/A WE05 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 are that a Reactor Trip has occurred due to a loss of both main feed pumps. The Auxiliary Feedwater Pumps will not function. EP/1/A/5000/FR-H.1 has been entered and Bleed and Feed initiation criteria has been met. The applicant is directed to initiate Bleed and Feed in accordance with FR-H.1. Applicant will stop all NC pumps and manually initiate both trains of safety injection (Only 'A' train will initiate & NV pump cold leg injection valves fail to open). This begins the **ALTERNATE PATH**. When NV S/I flow cannot be verified, the applicant will start 1B NV pump and 1B NI pump and manually aligns the cold leg injection flowpath from the NV pumps. The applicant will then establish a bleed path from the NC system by opening 2 Pressurizer PORVs to finish the JPM.

Simulator JPMs

JPM d - Realign CA Suction Source – Bank JPM - Alternate Path

K/A 054 AA1.01 – Ability to operate and/or monitor the following as they apply to the Loss of Main Feedwater(MFW): AFW controls, including the use of alternate AFW sources. (CFR: 41.7 / 45.5 / 45.6) RO 4.5 SRO 4.4

Initial conditions are that the crew is performing actions in EP/1/A/5000/ES-0.1 (Reactor Trip Response) following a reactor trip when alarm 1AD-8, B/1 (UST LO LEVEL) is received. The crew has transitioned to AP/1/A/5500/006 (Loss of S/G Feedwater) Case II (Loss of Normal CA Supply). The CRS directs the applicant to perform the actions of AP-06 Case II beginning at step 7. The applicant will attempt to manually close 1CA-4 (CA Pmps Suct From UST) but is unsuccessful and will dispatch an operator to locally close 1CS-19 (CA Pumps Supply From Upper Surge Tank). Applicant will throttle CA flow to < 600 gpm to conserve UST inventory. Applicant will then attempt to break condenser vacuum from the control room, but is unsuccessful and dispatches operators to locally open the vacuum breaker valves. Operators are unable to locally open the vacuum breaker valves to begin the **ALTERNATE PATH**. Applicant will then align RN (Nuclear Service Water) to supply the running CA pumps to complete the JPM.

JPM e – Operate Containment Cooling System Fans – Bank JPM (2016 NRC Exam)

K/A 022 A4.01 Ability to manually operate and/or monitor in the control room: CCS fans. (CFR 41.7 / 45.5 to 45.8) RO 3.6 SRO 3.6

Initial conditions are that a secondary steam leak is occurring. The CRS directs the applicant to perform step 9 of AP/1/A/5500/028 (Secondary Steam Leak). The applicant will determine, based on conditions specified in the procedure, that the leak is occurring inside containment. The applicant will then start one additional Lower Containment Ventilation Unit, three additional Upper Containment Ventilation Units, and place all eight operating ventilation units in “MAX” cooling mode.

JPM f – Reset Radiation Monitor Trip Setpoints – Bank JPM (2015 NRC Exam)

K/A 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 Unit 1 is at 100% power. Following a discussion with RP concerning a premature gaseous release termination, the CRS directs the applicant to reset EMF 50L setpoints per OP/0/A/6500/080 (EMF RP86A Output Modules) Enclosure 4.2 (EMF RP86A Trip Setpoint Adjustment). The new setpoints will have a Trip 1 value of 6300 cpm and a Trip 2 value of 9000 cpm. The OAC program EMFLIB is not available. The applicants will input the new values one at a time per procedure and perform a verification of proper setpoints per the procedure. The applicants will then fill out the appropriate setpoint log entries to finish the JPM.

Simulator JPMs

JPM g – Isolate Cold Leg Accumulators Following a Shutdown LOCA – Bank JPM - Alternate Path (2016 NRC Exam)

K/A 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 are Unit 1 is in Mode 4 when pressurizer level and pressure begin to decrease uncontrollably. The CRS enters AP/1/A/5500/027 (Shutdown LOCA) to address the LOCA. The CRS directs the applicant to isolate the Unit 1 Cold Leg Accumulators by performing Enclosure 14 (Isolating Cold Leg Accumulators) of AP/27. The applicant will attempt to close all Cold Leg Accumulator discharge isolation valves, but only 1A and 1D will isolate. The applicant will transition to the RNO to begin the **ALTERNATE PATH**. Applicant will isolate the Nitrogen supply to the 1B and 1C Cold Leg Accumulators and then make the valve alignment to vent these accumulators to containment. This JPM is written to terminate at this time since all critical steps have been completed. Complete depressurization of these accumulators would take ~ 30 minutes.

JPM h – Restore Normal Power to 1ETA From the Control Room - Bank JPM

K/A 064 A4.07 Ability to manually operate and/or monitor in the control room: Transfer ED/G (with load) to grid. (CFR 41.7 / 45.5 to 45.8) RO 3.4 SRO 3.4

Initial conditions are that Unit 1 is recovering from a blackout per AP/1/A/5500/007 (Loss of Normal Power) Case I. Power has been aligned to 1ATC (normal offsite power source for 1ETA). CRS directs the applicant to parallel 1A D/G to 1ETA's normal power source (1ATC) and to shutdown 1A D/G per OP/1/A/6350/002 (Diesel Generator Operation) Enclosure 4.17 (Shutdown of D/G 1A After an Automatic Start). Applicant adjusts 1A D/G voltage to be 50-200 volts higher than line volts, increases D/G 1A speed, closes the ETA normal feeder breaker from 1ATC, and stabilizes 1A D/G with a positive load and a lagging power factor. Applicant will then decrease 1A D/G load to 200 KW prior to opening the 1A D/G breaker to 1ETA. Applicant will then depress the 1A D/G 'OFF' pushbutton to complete the JPM.

Plant JPMs

JPM i – Place the 2A Hydrogen Analyzer in Service – Bank JPM (RCA entry required)

K/A 028 A1.01 Ability to predict and/or monitor changes in parameter (to prevent exceeding design limits) associated with operating the HRPS controls including: Hydrogen concentration. (CFR 41.5 / 45.5) RO 3.4 SRO 3.8

Initial conditions are that a Large Break LOCA has occurred on Unit 2 and 2B Hydrogen Analyzer is tagged out for maintenance. The CRS directs the applicant to place the 2A Containment Hydrogen Analyzer in service to position "1" for sampling Upper Containment per OP/2/A/6450/010 (Containment Hydrogen Control Systems) Enclosure 4.9 (Operation of the Containment Hydrogen Analyzers Following a LOCA). Applicant will select the desired sample location, insert key and turn key-switch to open containment isolation valves, verify the analyzer is in standby, and energize the hydrogen analyzer.

JPM j – Align Seal Injection to the Unit 1 NC Pumps – NEW JPM

K/A 076 A2.01 Ability to (a) predict the impacts of the following malfunction or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of SWS (CFR 41.5 / 43.5 /45.3 / 45.13) RO 3.5 SRO 3.7

Initial conditions are that a loss of RN has occurred on Unit 1 and AP/0/A/5500/020 (Loss of Nuclear Service Water) has been entered. Alternate power has been aligned to 1EMXS per AP-20 Enclosure 4 (Align Alternate Power Supply To 1EMXS or 2EMXS). The CRS directs the applicant to place standby makeup pump #1 in service to provide seal injection to the Unit 1 NC pumps per the local copy of AP-20 Enclosure 6 (Align Seal Injection to the Unit 1 NC Pumps). Applicant will verify power to 1EMXS, open 1NV-865A (Stdby M/U Pump Suct Frm Xfer Tube) and 1NV-872A (Stdby M/U Pmp Filt Otlt), close 1NV-89A (NC Pmps Seal Ret Cont Isol), verify 1NV-877 (Stdby M/U To NC Pump Seal Inj) is open, and start Standby Makeup Pump #1 by depressing the "ON" pushbutton.

JPM k – Align Swing Inverter 1EIE to 1ERPA – Bank JPM

K/A 062 A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the ac distribution system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Types of loads that, if de-energized, would degrade or hinder plant operation. (CFR 41.5 / 43.5 / 45.3 / 45.13) RO 3.4 SRO 3.9

Initial conditions are that vital AC Panelboard 1ERPA is being powered from regulated power (1VRD). The CRS directs the applicant to align Swing Inverter 1EIE to supply 1ERPA per OP/1/A/6350/008 (125 VDC/120 VAC Vital Instrument and Control Power System) Enclosure 4.37 (Placing in Service and Removing From Service 1EIE). Applicant will close breakers from 125 VDC distribution center, pre-charge 1EIE, and close 1EIE input breaker. Applicant will then align sync switch on 1EIE and close the 1EIE output breaker. Once applicant verifies 1EIE is in sync with the alternate source, they will align the manual bypass switch to provide power to 1ERPA from 1EIE.

NRC EXAM

Facility: **Catawba Nuclear Station** Date of Examination: **June 2017**

Exam Level: RO ☐ SRO-I ☒ SRO-U ☐ Operating Test Number: **2017301**

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

System / JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System 004 A2.14 (3.8/3.9)	A,D,S	1
b. Perform E-0 Actions To Ensure Complete Containment Isolation 013 A4.01 (4.5/4.8)	A,EN,N,S	2
c. Establish NC System Bleed and Feed WE05EA1.1 (4.1/4.0)	A,D,L,S	4P
d. Realign CA Suction Source 054AA1.01 (4.5/4.4)	A,D,L,S	4S
e. Operate Containment Cooling Fans 022 A4.01 (3.6/3.6)	D,P,S	5
f. Reset Radiation Monitor Trip Setpoints 073 A4.02 (3.7/3.7)	D,P,S	7
g. Isolate Cold Leg Accumulators During Shutdown LOCA 006 A1.13 (3.5/3.7)	A,D,L,P,S	3
In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Place 2A Hydrogen Analyzer In Service 028 A1.01 (3.4/3.8)	D,E,L,R	5
j. Align Seal Injection to the Unit 1 NC Pumps 076 A2.01 (3.5/3.7)	E,N	4S
k. Align Swing Inverter 1EIE to 1ERPA 062 A2.01 (3.4/3.9)	D,E	6

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

*Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3 **(5/5/3)**
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4 **(9/8/3)**
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1 **(3/3/2)**
(EN)gineered safety feature	- / - / ≥ 1 **(1/1/1)**
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1 **(4/4/2)**
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1 **(2/2/2)**
(P)revious 2 exams	≤ 3 ≤ 3 / ≤ 2 **(3/3/0)**
(R)CA	≥ 1 / ≥ 1 / ≥ 1 **(1/1/1)**
(S)imulator	

Simulator JPMs

JPM a – Emergency Borate the Reactor Coolant System – Bank JPM - Alternate Path

K/A 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 a valid reactor trip signal has been received and the reactor will not trip from the control room. A Red Path on the Subcriticality CSF is in effect. The OATC is inserting control rods manually. The CRS directs the applicant to initiate emergency boration, per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicant ensures that an NV pump is in service and then depresses the OPEN pushbutton on 1NV-236B (Boric Acid To NV Pumps Suct). 1NV-236B fails to open beginning the **ALTERNATE PATH**. After ensuring that both boric acid transfer pumps are in service and still no emergency boration flow exists, the applicant will open the NV pump suction isolations from the FWST and isolate the NV pump suction from the VCT, ensure proper system lineup to the NC system, and verify NC system pressure is < 2335 psig.

JPM b – Perform E-0 Actions To Ensure A Complete Containment Isolation – NEW JPM - Alternate Path

K/A 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 (Justification for the Safety Function 2 (Inventory Control) designation is that the WL penetration that is left un-isolated during this JPM is from the Containment Sump. As long as this penetration remains un-isolated, a constant discharge of water from the containment sump will be in progress. On a Large Break LOCA this water in the containment sump will eventually be the water used for core cooling following transfer to Cold Leg Recirculation. Removing inventory from the containment sump may lead to the eventual inability to properly cool the core and ultimately lead to core damage).

Initial conditions are that the applicant assumes the OATC role with the BOP out of the control room and the CRS performing an IPTE brief on Unit 2. Once the applicant has the watch, a Large Break LOCA will occur on Unit 1. The OATC will verify that all immediate actions are met. The examiner will provide a cue to applicant that the CRS directs them to continue performance of E-0 beginning at step 6. The applicant will announce that a safety injection has occurred and will verify that all Feedwater Isolation status lights are lit. The applicant will then determine that a Phase A Containment Isolation has not occurred and will manually initiate both trains. This begins the **ALTERNATE PATH**. The applicant will determine from the monitor light panel that Phase A Containment Isolation valves 1WL-825A and 1WL-827B (both on the containment floor and equipment sump discharge penetration) have not closed as expected. The applicant will then manually close these valves to end the JPM.

JPM c – Establish RCS Bleed and Feed following loss of Secondary Heat Sink – Bank JPM – Alternate Path

K/A WE05 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 are that a Reactor Trip has occurred due to a loss of both main feed pumps. The Auxiliary Feedwater Pumps will not function. EP/1/A/5000/FR-H.1 has been entered and Bleed and Feed initiation criteria has been met. The applicant is directed to initiate Bleed and Feed in accordance with FR-H.1. Applicant will stop all NC pumps and manually initiate both trains of safety injection (Only 'A' train will initiate & NV pump cold leg injection valves fail to open). This begins the **ALTERNATE PATH**. When NV S/I flow cannot be verified, the applicant will start 1B NV pump and 1B NI pump and manually aligns the cold leg injection flowpath from the NV pumps. The applicant will then establish a bleed path from the NC system by opening 2 Pressurizer PORVs to finish the JPM.

Simulator JPMs

JPM d - Realign CA Suction Source – Bank JPM - Alternate Path

K/A 054 AA1.01 – Ability to operate and/or monitor the following as they apply to the Loss of Main Feedwater(MFW): AFW controls, including the use of alternate AFW sources. (CFR: 41.7 / 45.5 / 45.6) RO 4.5 SRO 4.4

Initial conditions are that the crew is performing actions in EP/1/A/5000/ES-0.1 (Reactor Trip Response) following a reactor trip when alarm 1AD-8, B/1 (UST LO LEVEL) is received. The crew has transitioned to AP/1/A/5500/006 (Loss of S/G Feedwater) Case II (Loss of Normal CA Supply). The CRS directs the applicant to perform the actions of AP-06 Case II beginning at step 7. The applicant will attempt to manually close 1CA-4 (CA Pmps Suct From UST) but is unsuccessful and will dispatch an operator to locally close 1CS-19 (CA Pumps Supply From Upper Surge Tank). Applicant will throttle CA flow to < 600 gpm to conserve UST inventory. Applicant will then attempt to break condenser vacuum from the control room, but is unsuccessful and dispatches operators to locally open the vacuum breaker valves. Operators are unable to locally open the vacuum breaker valves to begin the **ALTERNATE PATH**. Applicant will then align RN (Nuclear Service Water) to supply the running CA pumps to complete the JPM.

JPM e – Operate Containment Cooling System Fans – Bank JPM (2016 NRC Exam)

K/A 022 A4.01 Ability to manually operate and/or monitor in the control room: CCS fans. (CFR 41.7 / 45.5 to 45.8) RO 3.6 SRO 3.6

Initial conditions are that a secondary steam leak is occurring. The CRS directs the applicant to perform step 9 of AP/1/A/5500/028 (Secondary Steam Leak). The applicant will determine, based on conditions specified in the procedure, that the leak is occurring inside containment. The applicant will then start one additional Lower Containment Ventilation Unit, three additional Upper Containment Ventilation Units, and place all eight operating ventilation units in “MAX” cooling mode.

JPM f – Reset Radiation Monitor Trip Setpoints – Bank JPM (2015 NRC Exam)

K/A 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 Unit 1 is at 100% power. Following a discussion with RP concerning a premature gaseous release termination, the CRS directs the applicant to reset EMF 50L setpoints per OP/0/A/6500/080 (EMF RP86A Output Modules) Enclosure 4.2 (EMF RP86A Trip Setpoint Adjustment). The new setpoints will have a Trip 1 value of 6300 cpm and a Trip 2 value of 9000 cpm. The OAC program EMFLIB is not available. The applicants will input the new values one at a time per procedure and perform a verification of proper setpoints per the procedure. The applicants will then fill out the appropriate setpoint log entries to finish the JPM.

JPM g – Isolate Cold Leg Accumulators Following a Shutdown LOCA – Bank JPM - Alternate Path (2016 NRC Exam)

K/A 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 are Unit 1 is in Mode 4 when pressurizer level and pressure begin to decrease uncontrollably. The CRS enters AP/1/A/5500/027 (Shutdown LOCA) to address the LOCA. The CRS directs the applicant to isolate the Unit 1 Cold Leg Accumulators by performing Enclosure 14 (Isolating Cold Leg Accumulators) of AP/27. The applicant will attempt to close all Cold Leg Accumulator discharge isolation valves, but only 1A and 1D will isolate. The applicant will transition to the RNO to begin the **ALTERNATE PATH**. Applicant will isolate the Nitrogen supply to the 1B and 1C Cold Leg Accumulators and then make the valve alignment to vent these accumulators to containment. This JPM is written to terminate at this time since all critical steps have been completed. Complete depressurization of these accumulators would take ~ 30 minutes.

Plant JPMs

JPM i – Place the 2A Hydrogen Analyzer in Service – Bank JPM (RCA entry required)

K/A 028 A1.01 Ability to predict and/or monitor changes in parameter (to prevent exceeding design limits) associated with operating the HRPS controls including: Hydrogen concentration. (CFR 41.5 / 45.5) RO 3.4 SRO 3.8

Initial conditions are that a Large Break LOCA has occurred on Unit 2 and 2B Hydrogen Analyzer is tagged out for maintenance. The CRS directs the applicant to place the 2A Containment Hydrogen Analyzer in service to position "1" for sampling Upper Containment per OP/2/A/6450/010 (Containment Hydrogen Control Systems) Enclosure 4.9 (Operation of the Containment Hydrogen Analyzers Following a LOCA). Applicant will select the desired sample location, insert key and turn key-switch to open containment isolation valves, verify the analyzer is in standby, and energize the hydrogen analyzer.

JPM j – Align Seal Injection to the Unit 1 NC Pumps – NEW JPM

K/A 076 A2.01 Ability to (a) predict the impacts of the following malfunction or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of SWS (CFR 41.5 / 43.5 /45.3 / 45.13) RO 3.5 SRO 3.7

Initial conditions are that a loss of RN has occurred on Unit 1 and AP/0/A/5500/020 (Loss of Nuclear Service Water) has been entered. Alternate power has been aligned to 1EMXS per AP-20 Enclosure 4 (Align Alternate Power Supply To 1EMXS or 2EMXS). The CRS directs the applicant to place standby makeup pump #1 in service to provide seal injection to the Unit 1 NC pumps per the local copy of AP-20 Enclosure 6 (Align Seal Injection to the Unit 1 NC Pumps). Applicant will verify power to 1EMXS, open 1NV-865A (Stdby M/U Pump Suct Frm Xfer Tube) and 1NV-872A (Stdby M/U Pmp Filt Otlt), close 1NV-89A (NC Pmps Seal Ret Cont Isol), verify 1NV-877 (Stdby M/U To NC Pump Seal Inj) is open, and start Standby Makeup Pump #1 by depressing the "ON" pushbutton.

JPM k – Align Swing Inverter 1EIE to 1ERPA – Bank JPM

K/A 062 A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the ac distribution system; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Types of loads that, if de-energized, would degrade or hinder plant operation. (CFR 41.5 / 43.5 / 45.3 / 45.13) RO 3.4 SRO 3.9

Initial conditions are that vital AC Panelboard 1ERPA is being powered from regulated power (1VRD). The CRS directs the applicant to align Swing Inverter 1EIE to supply 1ERPA per OP/1/A/6350/008 (125 VDC/120 VAC Vital Instrument and Control Power System) Enclosure 4.37 (Placing in Service and Removing From Service 1EIE). Applicant will close breakers from 125 VDC distribution center, pre-charge 1EIE, and close 1EIE input breaker. Applicant will then align sync switch on 1EIE and close the 1EIE output breaker. Once applicant verifies 1EIE is in sync with the alternate source, they will align the manual bypass switch to provide power to 1ERPA from 1EIE.

NRC EXAM

Facility: **Catawba Nuclear Station** Date of Examination: **June 2017**

Exam Level: RO ☐ SRO-I ☐ SRO-U ☒ Operating Test Number: **2017301**

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

System / JPM Title	Type Code*	Safety Function
a. Emergency Borate the Reactor Coolant System 004 A2.14 (3.8/3.9)	A,D,S	1
b. Perform E-0 Actions To Ensure Complete Containment Isolation 013 A4.01 (4.5/4.8)	A,EN,N,S	2
c. Establish NC System Bleed and Feed WE05EA1.1 (4.1/4.0)	A,D,L,S	4P

In-Plant Systems@ (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

i. Place 2A Hydrogen Analyzer In Service 028 A1.01 (3.4/3.8)	D,E,L,R	5
j. Align Seal Injection to the Unit 1 NC Pumps 076 A2.01 (3.5/3.7)	E,N	4S

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

*Type Codes	Criteria for RO / SRO-I / SRO-U
(A)lternate path	4-6 / 4-6 / 2-3 **(5/5/3)**
(C)ontrol room	
(D)irect from bank	≤ 9 / ≤ 8 / ≤ 4 **(9/8/3)**
(E)mergency or abnormal in-plant	≥ 1 / ≥ 1 / ≥ 1 **(3/3/2)**
(EN)gineered safety feature	- / - / ≥ 1 **(1/1/1)**
(L)ow-Power / Shutdown	≥ 1 / ≥ 1 / ≥ 1 **(4/4/2)**
(N)ew or (M)odified from bank including 1(A)	≥ 2 / ≥ 2 / ≥ 1 **(2/2/2)**
(P)revious 2 exams	≤ 3 ≤ 3 / ≤ 2 **(3/3/0)**
(R)CA	≥ 1 / ≥ 1 / ≥ 1 **(1/1/1)**
(S)imulator	

Simulator JPMs

JPM a – Emergency Borate the Reactor Coolant System – Bank JPM - Alternate Path

K/A 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 a valid reactor trip signal has been received and the reactor will not trip from the control room. A Red Path on the Subcriticality CSF is in effect. The OATC is inserting control rods manually. The CRS directs the applicant to initiate emergency boration, per EP/1/A/5000/FR-S.1 (Nuclear Power Generation/ATWS) step 4. The applicant ensures that an NV pump is in service and then depresses the OPEN pushbutton on 1NV-236B (Boric Acid To NV Pumps Suct). 1NV-236B fails to open beginning the **ALTERNATE PATH**. After ensuring that both boric acid transfer pumps are in service and still no emergency boration flow exists, the applicant will open the NV pump suction isolations from the FWST and isolate the NV pump suction from the VCT, ensure proper system lineup to the NC system, and verify NC system pressure is < 2335 psig.

JPM b – Perform E-0 Actions To Ensure A Complete Containment Isolation – NEW JPM - Alternate Path

K/A 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 (Justification for the Safety Function 2 (Inventory Control) designation is that the WL penetration that is left un-isolated during this JPM is from the Containment Sump. As long as this penetration remains un-isolated, a constant discharge of water from the containment sump will be in progress. On a Large Break LOCA this water in the containment sump will eventually be the water used for core cooling following transfer to Cold Leg Recirculation. Removing inventory from the containment sump may lead to the eventual inability to properly cool the core and ultimately lead to core damage).

Initial conditions are that the applicant assumes the OATC role with the BOP out of the control room and the CRS performing an IPTE brief on Unit 2. Once the applicant has the watch, a Large Break LOCA will occur on Unit 1. The OATC will verify that all immediate actions are met. The examiner will provide a cue to applicant that the CRS directs them to continue performance of E-0 beginning at step 6. The applicant will announce that a safety injection has occurred and will verify that all Feedwater Isolation status lights are lit. The applicant will then determine that a Phase A Containment Isolation has not occurred and will manually initiate both trains. This begins the **ALTERNATE PATH**. The applicant will determine from the monitor light panel that Phase A Containment Isolation valves 1WL-825A and 1WL-827B (both on the containment floor and equipment sump discharge penetration) have not closed as expected. The applicant will then manually close these valves to end the JPM.

JPM c – Establish RCS Bleed and Feed following loss of Secondary Heat Sink – Bank JPM – Alternate Path

K/A WE05 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 are that a Reactor Trip has occurred due to a loss of both main feed pumps. The Auxiliary Feedwater Pumps will not function. EP/1/A/5000/FR-H.1 has been entered and Bleed and Feed initiation criteria has been met. The applicant is directed to initiate Bleed and Feed in accordance with FR-H.1. Applicant will stop all NC pumps and manually initiate both trains of safety injection (Only 'A' train will initiate & NV pump cold leg injection valves fail to open). This begins the **ALTERNATE PATH**. When NV S/I flow cannot be verified, the applicant will start 1B NV pump and 1B NI pump and manually aligns the cold leg injection flowpath from the NV pumps. The applicant will then establish a bleed path from the NC system by opening 2 Pressurizer PORVs to finish the JPM.

Plant JPMs

JPM i – Place the 2A Hydrogen Analyzer in Service – Bank JPM (RCA entry required)

K/A 028 A1.01 Ability to predict and/or monitor changes in parameter (to prevent exceeding design limits) associated with operating the HRPS controls including: Hydrogen concentration.
(CFR 41.5 / 45.5) RO 3.4 SRO 3.8

Initial conditions are that a Large Break LOCA has occurred on Unit 2 and 2B Hydrogen Analyzer is tagged out for maintenance. The CRS directs the applicant to place the 2A Containment Hydrogen Analyzer in service to position "1" for sampling Upper Containment per OP/2/A/6450/010 (Containment Hydrogen Control Systems) Enclosure 4.9 (Operation of the Containment Hydrogen Analyzers Following a LOCA). Applicant will select the desired sample location, insert key and turn key-switch to open containment isolation valves, verify the analyzer is in standby, and energize the hydrogen analyzer.

JPM j – Align Seal Injection to the Unit 1 NC Pumps – NEW JPM

K/A 076 A2.01 Ability to (a) predict the impacts of the following malfunction or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of SWS (CFR 41.5 / 43.5 /45.3 / 45.13) RO 3.5 SRO 3.7

Initial conditions are that a loss of RN has occurred on Unit 1 and AP/0/A/5500/020 (Loss of Nuclear Service Water) has been entered. Alternate power has been aligned to 1EMXS per AP-20 Enclosure 4 (Align Alternate Power Supply To 1EMXS or 2EMXS). The CRS directs the applicant to place standby makeup pump #1 in service to provide seal injection to the Unit 1 NC pumps per the local copy of AP-20 Enclosure 6 (Align Seal Injection to the Unit 1 NC Pumps). Applicant will verify power to 1EMXS, open 1NV-865A (Stdby M/U Pump Suct Frm Xfer Tube) and 1NV-872A (Stdby M/U Pmp Filt Otlt), close 1NV-89A (NC Pmps Seal Ret Cont Isol), verify 1NV-877 (Stdby M/U To NC Pump Seal Inj) is open, and start Standby Makeup Pump #1 by depressing the "ON" pushbutton.

FINAL

ES-401, Rev. 10 **PWR Examination Outline** **Form ES-401-2**

Facility: CATAWBA Date of Exam: JUNE 2017

Tier	Group	RO K/A Category Points											SRO-Only Points		
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G * / Total	A2	G*	Total
1. Emergency & Abnormal Plant Evolutions	1	3	3	3	N/A			3	3	N/A		3 / 18	3	3	6
	2	1	1	2				2	2			1 / 9	2	2	4
	Tier Totals	4	4	5				5	5			4 / 27	5	5	10
2. Plant Systems	1	3	2	3	2	2	3	3	2	3	3	2 / 28	3	2	5
	2	1	1	1	1	1	1	1	1	1	1	0 / 10	2	1	3
	Tier Totals	4	3	4	3	3	4	4	3	4	4	2 / 38	5	3	8
3. Generic Knowledge and Abilities Categories		1			2			3			4	10	1	2	3	4	7
		3			2			2			3		1	2	2	2	

1. Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A 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 associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems that are not included on the outline should be added. Refer to 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 KAs.
8. On the following pages, enter the K/A numbers, a brief description of each topic, the topics importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note # 1 does not apply). Use duplicate pages for RO and SRO-only exams.
9. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43..

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
007EK1.05	Reactor Trip - Stabilization - Recovery / 1	3.3	3.8	☑											Decay power as a function of time
008AK2.03	Pressurizer Vapor Space Accident / 3	2.5	2.4		✔										Controllers and positioners
009EK1.02	Small Break LOCA / 3	3.5	4.2	✔											Use of steam tables
011EG2.1.25	Large Break LOCA / 3	3.9	4.2											✔	Ability to interpret reference materials such as graphs, monographs and tables which contain performance data.
015AG2.1.20	RCP Malfunctions / 4	4.6	4.6											✔	Ability to execute procedure steps.
022AK3.01	Loss of Rx Coolant Makeup / 2	2.7	3.1			✔									Adjustment of RCP seal backpressure regulator valve to obtain normal flow
025AK2.02	Loss of RHR System / 4	3.2	3.2		✔										LPI or Decay Heat Removal/RHR pumps
026AA1.06	Loss of Component Cooling Water / 8	2.9	2.9							✔					Control of flow rates to components cooled by the CCWS
029EA1.09	ATWS / 1	4	3.6							✔					Manual rod control
040AA2.01	Steam Line Rupture - Excessive Heat Transfer / 4	4.2	4.7								✔				Occurrence and location of a steam line rupture from pressure and flow indications
054AK1.02	Loss of Main Feedwater / 4	3.6	4.2	✔											Effects of feedwater introduction on dry S/G

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
056AG2.2.44	Loss of Off-site Power / 6	4.2	4.4											✔	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
062AA2.01	Loss of Nuclear Svc Water / 4	2.9	3.5								✔				Location of a leak in the SWS
065AK3.04	Loss of Instrument Air / 8	3	3.2			✔									Cross-over to backup air supplies
077AA1.05	Generator Voltage and Electric Grid Disturbances / 6	3.9	4.0							✔					Engineered Safety Features
WE04EA2.2	LOCA Outside Containment / 3	3.6	4.2								✔				Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.
WE05EK2.1	Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4	3.7	3.9		✔										Components and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes and automatic and manual features.
WE11EK3.4	Loss of Emergency Coolant Recirc. / 4	3.6	3.8			✔									RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
036AA1.02	Fuel Handling Accident / 8	3.1	3.5							☑					ARM system
037AA2.06	Steam Generator Tube Leak / 3	4.3	4.5								☑				S/G tube failure
059AK1.02	Accidental Liquid RadWaste Rel. / 9	2.6	3.2	✔											Biological effects on humans of various types of radiation, exposure levels that are acceptable for nuclear power plant personnel and the units used for radiation-intensity measurements and for radiation exposure levels
069AK2.03	Loss of CTMT Integrity / 5	2.8	2.9		✔										Personnel access hatch and emergency access hatch
WE01EA2.1	Rediagnosis / 3	3.2	4								✔				Facility conditions and selection of appropriate procedures during abnormal and emergency operations.
WE03EK3.4	LOCA Cooldown - Depress. / 4	3.5	3.9			☑									RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.
we06EG2.1.30	Degraded Core Cooling / 4	4.4	4.0											✔	Ability to locate and operate components, including local controls.
WE13EA1.2	Steam Generator Over-pressure / 4	3.0	3.2							✔					Operating behavior characteristics of the facility.
WE16EK3.4	High Containment Radiation / 9	3.0	3.2			✔									RO or SRO function within the control room team as appropriate to the assigned position, in such a way that procedures are adhered to and the limitations in the facilities license and amendments are not violated.

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
003A3.01	Reactor Coolant Pump	3.3	3.2									☑			Seal injection flow
004~~K2.04~~ 2.01	Chemical and Volume Control	2.6	2.7		✔										BWST tank heaters
005A2.02	Residual Heat Removal	3.5	3.7								✔				Pressure transient protection during cold shutdown
006K6.05	Emergency Core Cooling	3.0	3.5						✔						HPI/LPI cooling water
007A3.01	Pressurizer Relief/Quench Tank	2.7	2.9									✔			Components which discharge to the PRT
008A4.05	Component Cooling Water	2.7	2.5										✔		Normal CCW-header total flow rate and the flow rates to the components cooled by the CCWS
010A2.03	Pressurizer Pressure Control	4.1	4.2								✔				PORV failures
010A4.03	Pressurizer Pressure Control	4.0	3.8										✔		PORV and block valves
012K3.01	Reactor Protection	3.9	4.0			✔									CRDS
012K5.01	Reactor Protection	3.3	3.8					✔							DNB
013G2.4.1	Engineered Safety Features Actuation	4.6	4.8											✔	Knowledge of EOP entry conditions and immediate action steps.

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
013K6.01	Engineered Safety Features Actuation	2.7	3.1						☑						Sensors and detectors
022K1.04	Containment Cooling	2.9	2.9	✔											Chilled water
025A3.02	Ice Condenser	3.4	3.4									✔			Isolation valves
025K6.01	Ice Condenser	3.4	3.6						✔						Upper and lower doors of the ice condenser
026K4.04	Containment Spray	3.7	4.1				✔								Reduction of temperature and pressure in containment after a LOCA by condensing steam, to reduce radiological hazard and protect equipment from corrosion damage (spray)
039A1.09	Main and Reheat Steam	2.5	2.7							✔					Main steam line radiation monitors
039K3.06	Main and Reheat Steam	2.8	3.1			✔									SDS
059G2.4.35	Main Feedwater	3.8	4.0											✔	Knowledge of local auxiliary operator tasks during emergency and the resultant operational effects
061K5.01	Auxiliary/Emergency Feedwater	3.6	3.9					✔							Relationship between AFW flow and RCS heat transfer
062K1.04	AC Electrical Distribution	3.7	4.2	✔											Off-site power sources
063A4.01	DC Electrical Distribution	2.8	3.1										✔		Major breakers and control power fuses

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
064K4.02	Emergency Diesel Generator	3.9	4.2				✔								Trips for ED/G while operating (normal or emergency)
073K3.01	Process Radiation Monitoring	3.6	4.2			☑									Radioactive effluent releases
076A1.02	Service Water	2.6	2.6							✔					Reactor and turbine building closed cooling water temperatures.
078K2.01	Instrument Air	2.7	2.9		☑										Instrument air compressor
103A1.01	Containment	3.7	4.1							✔					Containment pressure, temperature and humidity
103K1.01	Containment	3.6	3.9	✔											CCS

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
002K3.03	Reactor Coolant	4.2	4.6			✔									Containment
014K5.01	Rod Position Indication	2.7	3.0					✔							Reasons for differences between RPIS and step counter
016K1.08	Non-nuclear Instrumentation	3.4	3.4	✔											PZR PCS
027K2.01	Containment Iodine Removal	3.1	3.4		✔										Fans
033A3.01	Spent Fuel Pool Cooling	2.5	2.7									✔			Temperature control valves
034K6.02	Fuel Handling Equipment	2.6	3.3						✔						Radiation monitoring systems
035A2.05	Steam Generator	3.2	3.4								✔				Unbalanced flows to the 5/Gs
071A1.06	Waste Gas Disposal	2.5	2.8							✔					Ventilation system
079K4.01	Station Air	2.9	3.2				✔								Cross-connect with IAS
086A4.01	Fire Protection	3.3	3.3										✔		Fire water pumps

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
G2.1.15	Conduct of operations	2.7	3.4											☑	Knowledge of administrative requirements for temporary management directives such as standing orders, night orders, Operations memos, etc.
G2.1.17	Conduct of operations	3.9	4.0											✔	Ability to make accurate, clear and concise verbal reports.
G2.1.28	Conduct of operations	4.1	4.1											✔	Knowledge of the purpose and function of major system components and controls.
G2.2.22	Equipment Control	4.0	4.7											✔	Knowledge of limiting conditions for operations and safety limits.
G2.2.44	Equipment Control	4.2	4.4											✔	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
G2.3.11	Radiation Control	3.8	4.3											✔	Ability to control radiation releases.
G2.3.12	Radiation Control	3.2	3.7											✔	Knowledge of radiological safety principles pertaining to licensed operator duties
~~G2.4.32~~ G2.4.6	Emergency Procedures/Plans	3.6	4.0											✔	Knowledge of operator response to loss of all annunciators.
G2.4.37	Emergency Procedures/Plans	3.0	4.1											✔	Knowledge of the lines of authority during implamentation of an emergency plan.
G2.4.9	Emergency Procedures/Plans	3.8	4.2											✔	Knowledge of low power / shutdown implications in accident (e.g. LOCA or loss of RHR) mitigation strategies.

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
009EG2.4.47	Small Break LOCA / 3	4.2	4.2											☑	Ability to diagnose and recognize trends in an accurate and timely manner utilizing the appropriate control room reference material.
022AG2.4.4	Loss of Rx Coolant Makeup / 2	4.5	4.7											✔	Ability to recognize abnormal indications for system operating parameters which are entry-level conditions for emergency and abnormal operating procedures.
027AG2.1.7	Pressurizer Pressure Control System Malfunction / 3	4.4	4.7											✔	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior and instrument interpretation.
057AA2.03	Loss of Vital AC Inst. Bus / 6	3.7	3.9								✔				RPS panel alarm annunciators and trip indicators
062AA2.05	Loss of Nuclear Svc Water / 4	2.4	2.5								✔				The normal values for SWS-header flow rate and the flow rates to the components cooled by the SWS
WE12EA2.2	Steam Line Rupture - Excessive Heat Transfer / 4	3.4	3.9								✔				Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.

ES-401, REV 10 **SRO T1G2 PWR EXAMINATION OUTLINE** **FORM ES-401-2**

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
033AG2.2.38	Loss of Intermediate Range NI / 7	3.6	4.5											☑	Knowledge of conditions and limitations in the facility license.
WE02EA2.2	SI Termination / 3	3.5	4.0								✔				Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.
we07EG~~2.2.3~~ 2.2.44	Saturated Core Cooling Core Cooling	3.8	3.9											✔	(multi-unit license) Knowledge of the design, procedural and operational differences between units.
WE15EA2.2	Containment Flooding / 5	2.9	3.3								✔				Adherence to appropriate procedures and operation within the limitations in the facility's license and amendments.

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
004G2.1.7	Chemical and Volume Control	4.4	4.7											✔	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior and instrument interpretation.
013A2.04	Engineered Safety Features Actuation	3.6	4.2								✔				Loss of instrument bus
059A2.05	Main Feedwater	3.1	3.4								✔				Rupture in MFW suction or discharge line
061G2.1.23	Auxiliary/Emergency Feedwater	4.3	4.4											✔	Ability to perform specific system and integrated plant procedures during all modes of plant operation.
~~078A2.01~~ 008A2.01	Instrument Air	2.4	2.9								✔				Air dryer and filter malfunctions

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
028A2.03	Hydrogen Recombiner and Purge Control	3.4	4.0								✔				The hydrogen air concentration in excess of limit flame propagation or detonation with resulting equipment damage in containment
055G2.2.37	Condenser Air Removal	3.6	4.6											✔	Ability to determine operability and/or availability of safety related equipment
~~079A2.01~~ 016 A2.01	Station Air	2.9	3.2								✔				Cross-connection with IAS

KA	NAME / SAFETY FUNCTION:	IR RO	IR SRO	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	TOPIC:
G2.1.7	Conduct of operations	4.4	4.7											✔	Ability to evaluate plant performance and make operational judgments based on operating characteristics, reactor behavior and instrument interpretation.
G2.2.11	Equipment Control	2.3	3.3											✔	Knowledge of the process for controlling temporary design changes.
G2.2.5	Equipment Control	2.2	3.2											✔	Knowledge of the process for making design or operating changes to the facility
G2.3.14	Radiation Control	3.4	3.8											✔	Knowledge of radiation or contamination hazards that may arise during normal, abnormal, or emergency conditions or activities
G2.3.6	Radiation Control	2.0	3.8											✔	Ability to aprove release permits
G2.4.26	Emergency Procedures/Plans	3.1	3.6											✔	Knowledge of facility protection requirements including fire brigade and portable fire fighting equipment usage.
G2.4.5	Emergency Procedures/Plans	3.7	4.3											✔	Knowledge of the organization of the operating procedures network for normal, abnormal and emergency evolutions.

Tier / Group	Randomly Selected KA	Reason for Rejection
2 / 1	SYS004 K2.04	Q(29) No tank heaters at CNS. Could not write a discriminating question. 004 K2.01
3 / 0	GEN2.4 2.4.32	Q(73) No meaningful procedure guidance in this area. Could not write a discriminating question. G 2.4.6
1 / 2	WE07 2.2.3	Q(84) No meaningful unit differences in this topic. Could not write a discriminating question. WE07 EG 2.2.44
2 / 1	SYS078 A2.01	Q(90) Unable to write discrimating question at the SRO level 008 A 2.01
2 / 2	SYS079 A2.01	Q(93) Unable to write discrimating question at SRO level 016 A 2.01

ES-401 **Written Examination Quality Checklist** **Form ES-401-6**

Facility: **Catawba Nuclear Station** Date of Exam: June 2017 Exam Level: RO X SRO X

Item Description				Initial a	Initial b*	Initial c#
1.	Questions and answers are technically accurate and applicable to the facility.			RM		MB
2.	a. NRC K/As are referenced for all questions. b. Facility learning objectives are referenced as available.			RM		MB
3.	SRO questions are appropriate in accordance with Section D.2.d of ES-401			RM		MB
4.	The sampling process was random and systematic (If more than 4 RO or 2 SRO questions were repeated from the last two NRC licensing exams, consult the NRR/NRO OL program office).			RM		MB
5.	Question duplication from the license 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		MB
6.	Bank use meets limits (no more than 75 percent from the bank, at least 10 percent new, and the rest new or modified); enter the actual RO / SRO-only question distribution(s) at right.	Bank 32% / 44%	Modified 21%/16%	New 47% / 40%	RM		MB
7.	Between 50 and 60 percent of the questions on the RO exam are written at the comprehension/ analysis level; the SRO exam may exceed 60 percent if the randomly selected K/As support the higher cognitive levels; enter the actual RO / SRO question distribution(s) at right.	Memory 45% / 28%	C/A 55% / 72%		RM		MB
8.	References/handouts provided do not give away answers or aid in the elimination of distractors.				RM		MB
9.	Question content conforms with 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		MB
10.	Question psychometric quality and format meet the guidelines in ES Appendix B.				RM		MB
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		MB

	Printed Name / Signature	Date
a. Author	Rusty Miller /	06/06/17
b. Facility Reviewer (*)	RP Jones /	06/06/17
c. NRC Chief Examiner (#)	Mark A. Bates /	06/08/17
d. NRC Regional Supervisor	Gerald J. McCoy /	6/19/2017

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

Q	1.	2.	3. Psychomeric Flaws					4. Job Content Flaws				5. Other		6.	7.	8. Explanation
	LOK (F/H)	LOD (1-5)	Stem Focus	Cues	T/F	Cred. Dist	Partial	Job-Link	Minutia	# / Units	Backward	Q – K/A	SRO Only	B, M, N	U, E, S	
RO																
1	H	3												B 15NRC	S	EPE007EK1.05 No comments.
2	H	2										X		N	E	APE008AK2.03 The title of the Tier 1 K/A Tables in NUREG-1021 contains the word “Evolution”. Operators perform evolutions by performing steps in procedures; therefore, the Tier 1 K/As, should test procedure knowledge for addressing the abnormal/emergency condition. This question can be answered by only applying “systems” knowledge, which appears to be more appropriate for a Tier 2 question. Disucuss options for testing procedure knowledge in one part of the question so that the K/A can be tested. Disucss. Region II has asked the NRR Program office for further guidance in the area of Tier 1 / Tier 2 K/A match evaluation. Preliminarily Region II has interpreted Tier 1 as testing procedure knowledge whenever possible. Otherwise, there essentially would be little if any difference between Tier 1 and Tier 2 and the original authors of the Tiers could have placed everything on one large tier and just segregated them into groups. Until we get closure on this issue, I will designate the question as an “E” vs. “U” and we should attempt to obtain a solution that squarely meets the K/A regardless of NUREG interpretation. Q replaced. Now sat.

3	H	2?				x						X		M	U	EPE009EK1.02 C(2) and D(2) may not be plausible. With a hot RCS and pressure in the RCS, why would an operator think that SGs were not needed for heat removal? Discuss possibilities to modify question. I.E. procedural actions to cooldown, etc. Discuss context of this K/A with comments on Q2. What evolution knowledge is being tested? Is there a way to use steam tables to make a procedural decision or that dictates a procedural action? Q replaced. Now sat.
4	H	2?	x			x								N	U	EPE011G2.1.25 The RCS is already broken with a LBLOCA – how is a RED path on Integrity plausible? Red Path purpose is to prevent breaking the RCS. Suggest testing whether P.1 (IS) / (IS NOT) required to be entered for the first part of the question, rather than RED vs. ORANGE. Not providing pressure may impact plausibility of a Red path. In order to evaluate a Red Path, an operator would need pressure to determine if all points were to the right of limit A. Q modified. Now sat.
5	F	2												B	S	APE015/017G2.1.20 Reasons exist for selecting any of the answer choices; however, the justification for reversing the setpoints for frame and shaft do not appear to be good justification. It would reason that the frame would see less vibration than the shaft, and the stem even provides a cue to this with the magnitude of the values given in the table. However, plausible reasons still exist based on alarms and procedural values. Discussed. Question appears to be more of a fundamental knowledge question, where if an operator recalls the trip setpoints, they will arrive at the correct answer. LOK changed.
6	H	2												N	S	APE022AK3.01 No comments.

7	H	2				X								B	E/U	APE025AK2.02 B(1) and D(1) do not appear to be plausible with oscillating amps. I would suggest retaining the second part and replacing the cavitation/runout portion. Aspects of the cavitation vs runout is already being tested based on the actions that make sense to address this (reducing flow will help reduce cavitation). Q modified. Now sat.
8	H	2												N	S	APE026AA1.06 No comments.
9	H	2												B	S	EPE029EA1.09 No comments.
10	H	2												N	S	APE040AA2.01 No comments.
11	H	2?				X								B	E	APE054AK1.02 Enhance the first question statement by clarifying if the 100 gpm is the "total" feedwater flow or if it is 100 gpm to "each" SG. The ambiguity damages the plausibility of A(1) and C(1). The two halves of "C" do not fit with one another thereby rendering "C" to not be a credible distractor. If additional cooldown was actually the reason for the max feedwater flow limit, then feeding ALL generators vice just one would not make sense. The question could be fixed by testing whether "thermal stress to SG components" (IS) / (IS NOT) the reason for the max limit. Other options may be available too. Modifications made. Now sat.
12	H	2												M	E	APE056G2.2.44 Sequence (timing) of events seems to be important to the question in that voltage adjustments are meant to occur after volts indicated 3925 V; however, when bullets are all presented under Unit 2 conditions, no actual order is stated (only implied). Different points in time may need to be stated. The bullet states that voltage is adjusted, but it is not clear what voltage is adjusted (only implied). Modifications made. Now sat.

13	H	2												N	S	APE062AA2.01 No comments.
14	F	2										x		B	E	APE065AK3.04 See comment on Q2. No evolution knowledge is being tested for this Tier 1 K/A. No other issues with this Q. Q modified. Now sat.
15	F	2												N	S	APE077AA1.05 No comments.
16	F	1				X								B	U	WE04EA2.2 None of the answer choices are plausible when compared directly to "B" for RCS pressure rising. System pressure for the system that has the leak would obviously be the most universal and quickest responding indication that would provide the operator with the indication of leak isolation. Therefore, none of the distractors are plausible in the comparative sense to "B" and the LOD is unacceptably low. Consider testing which vales are closed or if they are closed in a prioritized fashion and/or if they are re-opened after evaluating RCS pressure response. This is just one idea, but it may provide more credible answer choices for the applicant to evaluate. Other ideas may be available too. Q replaced. Now sat.
17	F	2										X		N	E	WE05EK2.1 To better test the K/A, consider changing the first part to test whether the procedure directs just 34A or both 34A and 32B. Scripting the question this way will negate the ability to answer that part of the question by just using systems knowledge. Currently, the way the question is written, just knowing that 36B does no receive backup nitrogen is all that is needed (which is systems knowledge) to know that it cannot be the correct answer. If the question is modified as suggested, then the procedure knowledge would be necessary to answer the question. Q replaced. Now sat.

18	F	2												B 15 NRC	E	WE11EK3.4 Q wording may cause some problems. The question asks for a complete list, so if there is one reason that is not included in the question, then there is no correct answer. Consider the statement in the supporting reference that says that a cooldown is performed to lower the overall NC temp to reduce the need for heat removal….this alone may be an additional reason. Q needs to be revised to ensure a correct answer. Concerns addressed. Now sat.
19	H	2										X		B	E	APE036AA1.02 Modify the second part to AP/1/A/5500/025 (DOES)/(DOES NOT) direct VP to be manually secured. This will test the procedure content vs. simply testing whether or not an automatic function to secure purge is present. Q modified. Now sat.
20	H	2												M	S	APE037AA2.06 No comments.
21	F	2												B	S	APE059AK1.02 No comments.
22	F	2												B	S	APE069AK2.03 No comments.
23	F	2												N	E	WE01EA2.1 Would it help clarify to replace “this procedure” at the end of both question statements with “EP/1/A/5000/ES-0.0”? Discuss. It is only a suggestion to be implemented if you think it helps clarify, particularly when the second question statements starts with E-0. Revised. Now sat.
24	F	2												N	S	WE03EK3.4 No comments.
25	F	2												N	S	WE06G2.1.30 No comments.

26	H	2												M	E	WE13EA1.2 When H.2 is entered is there a possibility that the procedure steps performed prior to H.2 entry could have already reset MSLI? If this possibility exists, then there may not be enough information in the stem to solicit one and only one correct answer for the first part. With my comment on Q2 in mind, this question appears to be OK because an applicant would need to know if MSLI was previously reset prior to getting to H.2; therefore, procedure/evolution knowledge is being tested. Revised. Now sat.
27	H	2												N	E	WE16EK3.4 What information in the stem indicates > 25 R/Hr containment radiation? Does the stem need to clearly state that the Z.3 entry conditions for radiation have been met? Revised. Now sat.
28	H	2		x		X								N	U	SYS003A3.01 C(2)and D(2) are not plausible because of cues presented in the first part of the question. An applicant will know that 1NV-309 will automatically adjust when selected to AUTO. Therefore, why would an applicant think that seal injection would not automatically adjust when NC system pressure changes, which would have the same effect on seal injection as 1NV-294 repositioning? Q modified. Now sat.
29	F	2												B 15NRC	S	SYS004K2.01 No comments.
30	H	2												M	E	SYS005A2.02 Procedure knowledge in the form of Tech Specs are being tested in that operator knowledge of how many pumps are allowed to inject at low temp. Having this knowledge would allow for operators to mitigate pressure transients while still maintaining adequate inventory sources. Sat.

31	F	2												M	S	SYS006K6.05 No comments.
32	F	2												M	S	SYS007A3.01 No comments.
33	F	2												N	E	SYS008A4.05 The wording of the second question statement is awkward and has potential to cause confusion to the applicants. Exceeded a MIMIMUM value does not really fit with the question. What you are asking is the setpoint for the runout alarm. Why not just ask that: The setpoint for 1AD-9 F/7 is _____. Revised. Now sat.
34	H	2												N	E	SYS010A2.03 Does the stem contain enough information to inform the applicant that the PORV cannot be manually cycled? The valve failed to intermediate while in AUTO. Does the stem need to state that the PORV could not be manually closed? Otherwise, how does the applicant know that the PORV is stuck in the intermediate position. Maybe the word "stuck" just needs to be added to the second bullet? Discuss. Enhanced. Now sat.
35	H	2				x								B	U	SYS010A4.03 A subset issue appears to exist between the answers and distractors on the first part of the question. OVERRIDE will always close the block valve – correct me if I am wrong. Therefore, CLOSE is a subset of OVERRIDE. Therefore, CLOSE can never be plausible because OVERRIDE closes the block under all circumstances. The question may need to be modified to test what position the block valve is in after the operator places the switch to CLOSE. Discuss. Revised. Now sat.
36	H	2												N	S	SYS012K3.01 No comments.
37	H	2												B	S	SYS012K5.01 No comments.

38	H	2												N	S	SYS013G2.4.1 No comments.
39	H	2	x											N	E	SYS039K6.01 This question is arguably fundamental/memory level. It is possible for someone to answer this using lower cognitive thought. It is also possible for someone to answer this using higher level thought processes by mentally stepping through the sequence that leads them to the answer. Discussed – OK. Why would "D" not be correct? One channel is already satisfied, but isn't the logic still 2/3? You have simply satisfied the first channel. Revised. Now sat.
40	F	2												N	S	SYS022K1.04 No comments.
41	F	2												B	S	SYS025A3.02 No comments.
42	F	2												B	E	SYS025K6.01 Asking for a complete list of something does not appear to be a very precise way to ask a question. If anything exists that the question authors were not thinking of at the time the question was written, then there is no correct answer. Write the answer choices with precision even if it takes a few more words. To be precise in the answer choices you may need to state that, for instance, A) Action statement(s) of TS 3.6.13 is(are) required, but action statements of SLC 16.6-3 & TS 3.6.12 are not required to be performed…etc. Revised. Now sat.
43	F	2												N	S	SYS026K4.04 No comments.
44	H	2												N	S	SYS039A1.09 No comments.
45	H	2												N	S	SYS039K3.06 No comments.

46	H	2												N	S	SYS059G2.4.35 No comments.
47	F	2		x										B	U	SYS061K5.01 Distractors “C” and “D” do not appear to be plausible due to THREE SGs requiring minimum level. The easiest fix would be to change them to ONE as is used in “A” and “B”. Furthermore, to add credibility to the adverse values, modify the last bullet to state that containment pressure peaked at 3.2 psig and is now 2.1 psig. (Designated correct answer may be impacted) – [Q73, as written, will impact this suggestion.] Q modified. Now sat.
48	H	2												M	S	SYS062K1.04 Some applicants will answer question using lower cognitive thought because they simply know that Unit 1 will trip under these conditions. Discussed – OK.
49	H	2												B	S	SYS0634.01 No comments.
50	F	2												B	S	SYS064K4.02 No comments.
51	H	2												M	E	SYS073K3.01 Walk me through the SLC and application to this question just to ensure I am evaluating the Q correctly. The provided supporting reference is from training material, which is great, but I just need to ensure that the SLC itself adequately supports the Q. Discussed – OK.
52	H	2												B	E	SYS076A1.02 Can the second half of all the answer choices be deleted? It appears that there are four distinctly different choices with one and only one correct answer even without the second part of each answer choice. Evaluate and discuss appropriate changes, if any. Revised. Now sat.

53	F	2												N	S	SYS078K2.01 No comments.
54	H	2												N	E	SYS013A1.01 How is this operationally valid? It appears that the physics would not lend itself to linear parameter changes unless you have some type of control system that will automatically control the rates of change of pressure and temperature (likely not the case). It appears that you are attempting to contrive, somewhat artificially, a higher cog Q. Just ask the Q in a straightforward manner for Tech Spec pressure and temperature limits. Then change the LOK designation from H to F if warranted. Revised. Now sat.
55	H	2												M	S	SYS013K1.01 No comments.
56	H	2												N	S	SYS002K3.03 No comments.
57	H	2												N	E	SYS014K5.01 Are the actions performed in accordance with a procedure? If so, please show me the procedure steps that directed CB "B" movement. If not, then we need to discuss operational validity. Revised. Now sat.
58	H	2												N	E	SYS016K1.08 Evaluate the LOK of the question. Is this a higher cog question where the impact of two different instruments needs to be analyzed? If so designate as "H"/Comprehensive. Changed. Now sat.
59	F	2												B 16CNS	S	SYS027K2.01 No comments.

60	F	2												N	E	SYS033A3.01 Be specific on which annunciator setpoint is exceeded. What is the standard alarm window nomenclature, name of the alarm, etc. (1AD-13, E/1, SPENT FUEL POOL TEMP HI) Revised. Now sat.
61	F	2												M	S	SYS034K6.02 No comments.
62	F	2												N	S	SYS035A2.05 No comments.
63	H	2												M	S	SYS071A1.06 No comments.
64	F	2												M	S	SYS079K4.01 No comments.
65	F	2												N	S	SYS086A4.01 No comments.
66	F	2												B	S	G2.1.15 No comments.
67	F	2				X								N	U	G2.1.17 Stating that containment P exceeds 3 psig may be a cue for other questions that depend on adverse numbers for plausibility, etc. Discuss. It may be better to use a different example. Three-way communications does not appear to be plausible for either a brief or an update. Recommend replacing that half of the question. Replaced Q. Now sat.
68	F	<2?				X								N	U	G2.1.28 Auto start for SSF EDG does not appear to be plausible. Recommend replacing first half, or maybe even entire Q is it is difficult to develop an acceptable first half paired with the existing second half. Revised. Now sat.

69	F	2												B	E	G2.2.22 Nothing technically wrong with the question. I would ask if this is information that you believe contains enough operational validity for a control room operator on which you want NRC to use in a licensing decision? I raise the Q because the operator cannot monitor anything that measures FCL Temp. They cannot make decisions while operating the plant that is related to FCL temp. It is important and certainly an item of interest for Reactor Engineers, Core Designers, and Safety Analysis Staff, so I will not instruct you to change the test item, but I do want to engage you on the material being tested. Q replaced. Now sat.
70	H	2				X								N	U	G2.2.44 There is no procedure requirement to place rods to manual. The supporting reference on states "should." When conditions like this exist but you still want to test the material, you need to test what the procedure actually states. I.E.: OMP 1-7 (DOES)/(DOES NOT) state that following a load rejection/turbine runback, control rods should be placed in MANUAL once steam dumps are closed. "B" is a subset of "C". In order to perform "C", an operator would first need to place rods to MANUAL. Therefore, "C" is not plausible. "B" is a subset of "D". Same reasoning as above. Therefore, "D" is not plausible. If there is a less severe rod insertion alarm (as many plants have) like just a LO (vs LO LO) that does not indicate violation of insertion limits, you could pair that with the revised first half to test whether the Tech Spec insertion limit (IS)/(IS NOT) met. Revised Q. Now sat.

71	F	2											X?	B	E	G2.3.11 Is this knowledge related to the RO position or the SRO position at Catawba. At most sites the administrative aspects of rad waste releases is the responsibility of the SRO. Discuss. Discussed – OK.
72	F	2												N	E	G2.3.12 I saw training material that stated that a "Yellow" flashing light would be used. I need to see the plant procedure stating the same thing. Q replaced. Now sat.
73	F?	2												B	E	G2.4.6 I made a suggestion on an earlier question (Q47) that involved having containment pressure peaking above 3 psig and subsequently lowering below 3 psig. Can Catawba containment go Adverse on Rad levels? If so, this Q could be slightly modified so that my suggestion for Q47 is not impacted. LOK may be more appropriately "H"/Comprehensive because they need to analyze containment P changes. Discuss. Q replaced. Now sat.
74	F	2				X								B	U	B(2) and C(2) are not plausible because they are subsets of Shift Manager. In other words, if the CRS can authorize it, the Shift Manager can also. Furthermore, most sites will allow all but just a handful of Shift Manager responsibilities to be delegated to other on-shift SROs. Typically, Emergency Classification, Temp Mod Approval, and Operability Determinations are some of the few things that a Shift Manager Cannot delegate. Q replaced. Now sat.

75	H	2												M	E	G2.4.9 Is site assembly knowledge being asked in the second half of the question knowledge that is required of the RO position at Catawba? Just double checking to ensure content validity for RO exam. I see that it is part of the alarm response guidance. Discussed. OK.
SRO																
76	H	2				X						x		N	U	EPE009G2.4.47 Plausibiity of "A" is not acceptable because it is based on linear extrapolation that may or may not be accurate because no controller exists to maintain a constant linear pressurizer level rise. Plausibility of "C" is not acceptable because inventory loss is well within high pressure makeup capacity. Therefore, needing cold leg recirc is not credible. KA Match: The definition of a LOCA typically is inventory loss that is not within charging capacity. This question may not meet the K/A due to the existence of a leak rather than a SBLOCA. A better set of conditions would be to provide parameters that will result in SI needing to be re-initiated after termination (Steam Space Small LOCA). Then ask them if they are required to go to ES-1.1. Plausibility for not going to ES-1.1 is that SI will need to be re-initiated. Maybe also provide a second set to test re-initiation. If memory serves me, I think the EOP bases would support going to SI Termination as long as adequate subcooling and other parameters are met. After termination is completed, then re-initiation criteria would apply and subsequently be invoked. A. Go to ES-1.1. Terminate SI, then re-initiate based on second set of conditions (or go to a ES1.2). B. Go to ES-1.1, Terminate SI, then do not re-initiate SI based on second set of conditions. C. Go to ES-1.2, Action 1 D. Go to ES-1.2, Action 2 Replaced Q. Now sat.

77	H	2												N	E	APE022G2.4.4 Is there enough info in the stem to ensure that the leak rate has been > 10 gpm for more than 15 minutes? I think the Note is likely enough to address the situation in that the criteria will be exceeded even if it has not yet. Discuss just to ensure stem is adequate. Really trying to verify that the Note applies to all three conditions separated by the "OR" and not just the last condition because the Note is only listed once following the last condition for leak outside containment. Revised. Now sat.
78	H	2												M	S	APE027G2.1.7 No comments.
79	H	2				X								N	E	APE057AA2.03 "C" is not plausible. If all Tech Spec actions have been completed, Tech Specs would not leave the plant in a condition where the reactor would not trip on a loss of a bus if, in fact, the reactor was required to be tripped. Therefore, the second part of the answer does not fit with the first part of the question thereby rendering it non-plausible. Discussed – OK.
80	F	2												N	S	APE062AA2.05 No comments.
81	F	2												B	S	WE12EA2.2 No comments.
82	H	2												M	S	APE033G2.2.38 No comments.
83	F	2												N	S	WE02EA2.2 No comments.

84	H	2												N	E	WE07G2.2.44 Do you require your SROs to know YELLOW path entry conditions from memory? Why is this important when YELLOW path procedures are never even required to be performed? We typically do not test YELLOW path criteria, especially from memory, because validity could be questioned in the post-exam environment because YELLOW path procedures are not required to be performed. If you have a learning objective for it, then maybe it is OK. Discuss. Discussed – OK.
85	H	2										x	x	B	U	WE15EA2.2 The procedure selection portion in the first half is RO knowledge due to orange path criteria being used to determine the answer. K/A Match at SRO Level: The second part of the question tests knowledge of the containment water source assumptions that are analyzed, but I do not believe knowing this will be a determining factor in whether the appropriate procedures will be implemented. Discuss. Discussed. Q was sat. OK
86	H	2				X						x		N	U	SYS004G2.1.7 K/A Match: Only generic Tech Spec Rules of Usage and Surv Proc requirements are being tested. No CVCS knowledge is needed to answer the question. With the provided reference, the distractors do not appear to be plausible. The applicant can review the provided reference and not only determine that the Alert range was entered, but also that the Required Action Vibration Rates were not violated – so they could know, just by looking at the reference, that no actions were required. Q replaced. Now sat.

87	H	2				X								M	E	SYS013A2.04 Typically we would not subject applicants to memorize greater than one hour action statements. Does Catawba have a learning objective that requires this from memory? Otherwise the reference should be provided, which may impact the plausibility of distractors. One possible solution would be to test the NOTE in Tech Specs for the LCO that allows separate condition entry for each function. There may be a question that could be developed that played off that knowledge. Discussed and documentation revised. Now sat.
88	H	2				X								B	U	SYS059A2.05 C(1) and D(1) are not plausible. The question tells them that the flow path is ruptured. One possibility may be to test whether they procedurally are allowed to initiate feed and bleed with the current conditions. It appears that the H.1 bleed and feed criteria are not yet met, but with the conditions provided, feed does not look like it will be available. Typically most plants would not allow feed and bleed to be performed pre-emptively because they want to exhaust all possible attempts at getting feed to a SG. The second part could remain pretty much as-is. SRO-only justification could be based on how quickly the steps are required to be performed and when the section of steps that essentially breach a fission product barrier are allowed to be performed. (testing the "when" aspect of procedure selection.) Q revised. Now sat.
89	H	2											x	B	S	SYS061G2.1.23 No comments.
90	H	2												N	S	SYS008A2.01 No comments.

91	H	2												N	E	SYS028A2.03 YELLOW path procedures are not required to be performed. Does Catawba have a learning objective that states that entry criteria for Z.4 are required memory items? General comment on your SRO justification. I have seen on this question, as well as others, that you partially justify SRO-only by stating "detailed knowledge of the associated procedure." "Detailed knowledge" of a procedure does not , on its own, make it SRO-only. The SRO-only guidance states that the detailed procedure knowledge is used to make a procedure selection. Discussed. Enhanced documentation. Q sat.
92	H	2												N	S	SYS055G2.2.37 No comments.
93	H	2												B 15CNS	S	SYS016A2.01 No comments.
94	H	2												B	S	G2.1.7 No comments.
95	H	2												B 15NRC	S	G2.2.11 No comments.
96	F	2												B	S	G2.2.5 No comments.
97	F	2												B	S	G2.3.14 No comments.
98	H	2												B	S	G2.3.6 No comments.
99	F	2												B	S	G2.4.26 No comments.
100	H	2				x								B	U	G2.4.5 B(2) and D(2) are not plausible. NEI 99-01 has nothing to do with implementation of Westinghouse EOPs. Q replaced. Now sat.
