NRC Initial Licensed Operator Written Examination

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Agenda

- Written Question Examples Exercise
- Recurring Issues On The Written Exam
- Written Exam Validation
- Questions and Answers

Purpose

- NRC Region I and MANTG representatives communicate on issues of importance related to written exam question quality and exam validation.

Success Criteria

- Participants and NRC obtain a new perspective and/or confirm past acceptable practices on the breakout session's topic with respect to the exam standards using practical examples and discussion.
- Address questions as they occur or identify questions for further development or formal response by NRC staff.

Question Examples Exercise

Question 1 (SRO)

K/A 036 G2.2.28;Equip Control; Knowledge of new and spent fuel management procedures

Given the following:

- Unit 2 is in a refueling shutdown
- As the refueling SRO you are on the refueling bridge in containment directing fuel movement operations
- The spent fuel assembly in the mast has just been pulled from the core
- SPENT FUEL PIT LEVEL 6" (SFG 2-2) has actuated
- The control room operator informs you that the alarm has been verified as a low level in the Spent Fuel Pit

What is the proper location for storing the assembly currently in the mast?

A. Leave it in the mast.

B. Place it in the containment upender in the vertical position.

C. Place it in the Rod Cluster Assembly Change Fixture

D. Place it in any accessible core location.

Question 1 ES-401-9 Review

- Correct answer “D”,
- Distractors “A”, “B”, “C” not credible with decreasing fuel pit level
- Revised the question with more credible distractors

Question 1 as Modified

- Given the following:

- ●Unit 2 is in a refueling shutdown
- ●As the refueling SRO you are on the refueling bridge in containment directing fuel movement operations
- ●The spent fuel assembly in the mast has just been pulled from the core
- ●SPENT FUEL PIT LEVEL 6" (SFG 2-2) has actuated
- ●The control room operator informs you that the alarm has been verified as a low level in the Spent Fuel Pit

- What is the proper location for storing the assembly currently in the mast?

- A. Place it in any safe location on the Refueling Cavity floor.
- B. Place it in the containment upender, in the horizontal position.
- C. Place it in any vacant location in the Spent Fuel Pool.
- D. Place it in the RCC Change fixture.

- Correct answer “B”

- Explanation: All other locations would either be difficult to recover and/or could be uncovered as the fuel pool continues to drain.

Question 2 (SRO)

K/A GEN 2.4.40; Knowledge of the SRO's responsibilities in E- Plan implementation

An "ALERT" has been declared at Unit 3.

At what point will the Shift Manager become the Manager of Control Room Operations?

A. Upon relief by the on-call DESO.

B. Upon relief by the ADTS.

C. Upon declaration of a SITE AREA EMERGENCY.

D. Upon declaration of a GENERAL EMERGENCY.

Question 2 ES 401-9 Review

- Correct Answer “A”
- Distractors “C” and “D” implausible with SM still in control room
- Question too simplistic. LOD = 1

Question 2 as Modified

- An "ALERT" has been declared and the Shift Manager has assumed the role of Control Room-Director of Station Emergency Organization (CR DESO)
- Which of the following tasks CAN the CR-DESO delegate to the Station Duty Officer?

- A. Notify the NRC of a 50.54(x) invocation.
- B. Authorize off-site notifications.
- C. Approve the station evacuation.
- D. Issue KI tablets to the control room staff.

- Answer: "A"
- Explanation: Per applicable procedures only NRC notification of 50.54(x) can be delegated.

Question 3

K/A K2.01; Knowledge of electrical power supplies to the following: Major DC Loads

An electrical transient has occurred resulting in the following:

- VITAL MG SET DC LOSS/DC RUN (8-P-8)
- BUS 8 MCC TROUBLE (8-J-8)
- Bus 8 voltage- 480 V
- Bus 9 voltage- 480 V

- FWLC and FRVs remain in automatic

What is the DC electrical power supply for the Vital AC MG?

A. DC-1 is currently supplying power to Vital AC
B. DC-3 is currently supplying power to Vital AC.
C. DC-1 is the normal power supply but DC power is unavailable to the Vital AC MG
D. DC-3 is the normal power supply but DC power is unavailable to the Vital AC MG

Question 3 ES 401-9 Review

- Correct Answer “B”
- Distractors C and D are not credible.
- The stem asks what DC supply is available and the distractors state no power is available.

Question 3 as Modified

- An electrical transient has occurred resulting in the following:
- ● VITAL MG SET DC LOSS/DC RUN (8-P-8)
- ● BUS 8 MCC TROUBLE (8-J-8)
- ● Bus 8 voltage- 480 V
- ● Bus 9 voltage- 480 V
- ● FWLC and FRVs remain in automatic
- What DC electrical power supply, if any, is available for the Vital AC MG?
- A. DC-1 is currently supplying power to Vital AC
- B. DC-3 is currently supplying power to Vital AC.
- C. DC-1 is the normal power supply but DC power is unavailable to the Vital AC MG
- D. DC-3 is the normal power supply but DC power is unavailable to the Vital AC MG
- Answer "B"

Question 4 (SRO)

- **K/A 295009 AA2.02: Ability to determine and/or interpret the following as it relates to Low Reactor Water Level: Steam flow/Feed flow mismatch**

- Unit 3 was operating at full power when a failure in the Digital Feedwater Control System resulted in the following:

- ● Feedwater Control automatically shifted to single element control
- ● The Feedwater Control system is making NO additional adjustments to the feedwater pump speeds.

- The RO reports that actual Steam Flow is stable and higher than Feed Flow

- With no automatic response by the Feedwater Level Control System, interpret these conditions to predict the plant response, then identify the required procedural response.

- Based on these conditions, Reactor Level will begin to:

- A. Lower, direct a power reduction using GP-9, Fast Power Reduction

- B. Lower, direct restoring 3-element control using SO-6C.1.D-3, FW Auto Control

- C. Rise, direct taking manual control of the Master Level Controller in accordance with SO 6C.1.D-3 FW Auto Control

- D. Rise, direct a manual scram before level exceeds +35 inches in accordance with OT-110, Reactor High Level.

Question 4 ES 401-9 Review

- Correct Answer: “A”
- “C” and “D” Implausible distractors. Level will not rise with steam flow > feed flow

Question 4 as Modified

- Unit 3 was operating at full power when a failure in the Digital feedwater Control System resulted in the following:
- Feedwater Control automatically shifted to single element control
- The Feedwater Control system is making NO additional adjustments to the feedwater pump speeds.
- The RO reports that actual Steam Flow is stable and higher than Feed Flow
- With no automatic response by the Feedwater Level Control System, identify the required procedural response.
- A. Direct a power reduction using GP-3, Normal Plant Shutdown
- B. Direct restoring 3-element control using SO-6C.1.D-3, FW Auto Control
- C. Direct taking manual control of the Master Level Controller in accordance with SO 6C.1.D-3 FW Auto Control
- D. Direct a manual scram before level exceeds +35 inches in accordance with OT-110, Reactor High Level.
- Answer: "C"

Question 5

K/A: 295023 AA2.04; Ability to determine and/or interpret the following as they apply to REFUELING ACCIDENTS: Occurrence of fuel handling accident.

- Select the correct answer:
- During refueling operation a bundle being transferred from the Reactor vessel to the spent fuel pool is inadvertently dropped 1 foot on top of the spent fuel racks.
- The action(s) required in response to this event is:

- A. Lift the bundle, place the bundle in its proper location and then halt refueling.
- B. Halt refueling. Notify SM and Ops Supt for permission to re-commence fuel move.
- C. Evacuate the refuel floor only, notify SM and Ops Supt.
- D. Evacuate the refuel floor and Drywell. Notify SM and Ops Supt.

Question 5 ES-401-9 Review

- Correct Answer: “D”
- 2 correct answers - B could also be correct

Question 5 As Modified

- Select the correct answer:
- During refueling operation a bundle being transferred from the Reactor vessel to the spent fuel pool is inadvertently dropped 1 foot on top of the spent fuel racks.
- The action(s) required in response to this event is:
- A. Lift the bundle, place the bundle in its proper location and refueling may continue.
- B. Lift the bundle, place the bundle in its proper location and refueling and obtain Refuel Supervisor permission to continue refueling.
- C. Evacuate the refuel floor only. Notify SM and Ops Supt.
- D. Evacuate the refuel floor and Drywell. Notify SM and Ops Supt.
- Answer: "D"

Question 6 (SRO)

K/A: 2.4.29; Knowledge of the Emergency Plan

- WHICH ONE of the following is the least severe Emergency Action Level (EAL) where the refueling crew will be required to evacuate to an offsite assembly area?
- A. Unusual Event.
- B. Alert.
- C. Site Area Emergency.
- D. General Emergency.

Question 6 ES 401-9 Review

- Correct Answer: “B”
- LOD=1; too basic; GET level not discriminatory at LSRO level.
- In the context of the whole exam, too many LOD=1, therefore this was reworked.

Question 6 as Modified

- Unit 2 Plant Conditions are as follows:
- Opcon 5
- Core Alterations are in progress

- The Main Control Room has informed you of the following issue:

- 30 minutes ago the site received a credible threat against the station from a disgruntled employee
- The threat claimed that an explosive device was packed in a tool box with equipment intended for delivery to the Refuel Floor and was set to detonate within the hour
- Security has located the device in a Reactor Enclosure equipment staging area

- WHICH ONE of the following Emergency Action Levels should be implemented?

- A. Unusual Event.

- B. Alert.

- C. Site Area Emergency.

- D. General Emergency.

- Answer: "C"

Question 7(SRO)

K/A: G2.1.32; Ability to explain and apply system limits and precautions, 295014 - Inadvertent Reactivity Addition

- The plant is MODE 5 with the following:

- Core reload is in progress per N2-FHP-13.3
- A new fuel bundle is being inserted near the center of the core
- SRM levels begin rising with a constant period
- Refuel Floor radiation levels are normal

- Which of the following action is required?

- A. Remove the new fuel bundle to an edge cell, stop fuel moves and inject SLS if available.

- B. Complete inserting the fuel bundle into the core, stop fuel moves and notify Reactor Engineer.

- C. Suspend Core Alts, insert all control rods in cells containing fuel and inject SLS if available.

- D. Immediately stop inserting the fuel bundle, evacuate the refuel floor and notify SM.

Question 7 ES 401-9 Review

- Correct Answer: C
- K/A mismatch; “explain” part of K/A not addressed.
- “B” is implausible for any SRO applicant. “D” may also be an acceptable answer.

Question 7 as Modified

- The plant is in MODE 5 with core reload in progress per N2-FHP-13.3, Core Shuffle, with the following:

- 0800 Annunciator 875111, SPENT FUEL POOL LEVEL HIGH/LOW alarms.
- 0800 Spent Fuel Pool (SFP) level is 352 ft 9 inches and steady
- 0802 2SFC*AOV33A and B, SFP NORMAL MAKEUP are open and SFP level begins to rise
- 0815 An irradiated fuel bundle is being lowered into the core
- 0816 A malfunction of the Refuel Bridge causes the grapple and fuel bundle to rapidly lower the last 4 inches into the core.
- 0817 Annunciator 603209, SRM SHORT PERIOD, alarms and clears 5 seconds later
- 0818 SRM count rates are rising steadily

- Which of the following actions is required to be taken and what is the reason for that action?

- A. Declare an Unusual Event because excessive SFP leakage is occurring

- B. Evacuate the Refuel Floor because an irradiated fuel bundle has been dropped.

- C. Initiate boron injection to the core because an inadvertent criticallity event is occurring.

- D. Remove the bundle within 1 hour because Shutdown Margin is not within LCO limits.

- Answer: “C”

Question 8 (LSRO)

K/A:292002 K1.14; Evaluate change in Shutdown Margin due to changes in plant parameter status.

- A reactor has been shutdown for one week from long-term power operation and shutdown cooling is in service. Upon a loss of cooling water to the shutdown cooling heat exchangers which one of the following coefficients of reactivity will act first to change core reactivity? (Assume continued forced circulation through the core)

- A. Moderator temperature coefficient
- B. Fuel temperature coefficient
- C. Void coefficient
- D. Pressure coefficient

Question 8 ES-401-9 Review

- Correct Answer: “A”

- K/A mismatch. The question is about reactivity coefficients; not Shutdown Margin (though they are related).

Question 8 as Modified

- A nuclear reactor has been shutdown for one week from long-term power operation and shutdown cooling is in service. Upon loss of cooling water to the shutdown cooling heat exchangers, which one of the following coefficients of reactivity will act first to change core reactivity and determine the effect on Shutdown Margin? (Assume continued forced circulation through the core)

Coefficient to Act First	Effect on Shutdown Margin
A. Moderator temperature coefficient	Decrease
B. Fuel temperature coefficient	Increase
C. Fuel temperature coefficient	Decrease
D. Moderator Temperature coefficient	Increase

- Answer "D"

Question 9 (SRO)

- A drywell entry must be made in order to inspect for increased unidentified leakage. A plant shutdown is in progress. The following conditions exist:

- •Reactor Power is 90% and decreasing
- •Purging of the drywell with air is in progress in accordance with Procedure 312.9, "Primary Containment Control".
- •The Chemistry Department indicated that the Stack Gas Activity should **NOT** exceed 900 CPS, based on their sample
- •DRYWELL VENT-PURGE INTERLOCK BYPASS switch is in the BYPASS position (Panel 12XR)
- •Venting is via the Reactor Building Ventilation System
- •Stack gas activity is at 1100 CPS and slowly increasing

- Your direction to the operator(s) controlling the purge in accordance with Procedure 312.9 is that they are required to:

- A. Decrease the purge flow until stack gas activity decreases below 900 CPM

- B. Confirm stack release rate with RAGEMS and then decrease purge flow rate.

- C. Secure the primary containment purge by closing V-28-17 and V-28-18.

- D. Shift the purge to go through the Standby Gas Treatment System

Question 9 Review & Resolution

- CORRECT ANSWER: C
- Procedure 312.9, "Primary Containment Control", Revision 30 is the System Operating Procedure. Prior to exam administration, during the exam review phase and based on discussions between the exam developer and the licensee, it was agreed that references should be provided for the applicants to use in answering this question. It was agreed that sections 7.1 and 7.2 of Procedure 312.9 should be adequate, considering the training given on the System Operating Procedure. However, the correct answer to the question was actually contained in step 7.3.2.6, which was not included in the reference provided to the applicants. This step specifies to "Close Torus vent valves V-28-17 and V-28-18".
- Upon reviewing the results of the exam, it was clear that the applicants used the provided reference material for the question and determined that answer "D" was supported by step 7.2.4. Step 7.2.4 specifies "...potential exists for airborne activity to be higher than normal, consideration should be given to vent through the Standby Gas Treatment System".
- The SRO candidates would not be expected to know step 7.3.2.6 from memory and this section of the procedure was not provided as part of the reference. In summary, this question is deleted from the SRO exam, since the question is flawed (i.e., too difficult - level of difficulty LOD=5) without the reference as handout. It is an example of procedure application and not just direct look-up.
- The error should have been caught by the NRC reviewer or the licensee. It was deleted from the exam.

Question 10

K/A: 215004 – Source Range Monitor, K6.02 – Knowledge of the effect that a loss or malfunction of the following will have on the SRM system: D.C. Power

- Phase II core shuffle is in progress
- 1. The next step (step 226) requires movement of the fuel assembly at core location 13-34 to core location 37-16
- 2. Before starting step 226, 24 VDC- Bus 11 is deenergized
- Which one of the following statements is correct reason for NOT performing STEP 226?

- A. The fuel assembly would be MOVED TO a core quadrant with an inoperable SRM.
- B. The fuel assembly would be REMOVED FROM a core quadrant with an inoperable SRM.
- C. NO SRM is operable in a core quadrant adjacent to the location where the fuel assembly would be MOVED TO.
- D. NO SRM is operable in a core quadrant adjacent to the location where the fuel assembly would be REMOVED FROM.

Question 10 ES-401-9 Review

- Correct Answer: B
- Question elicits a negative response and could be confusing to applicant. Question stem should be re-written
- Note: that backwards logic at the comprehensive level is acceptable

Question 10 as Modified

- A plant startup is in progress, with the following:
- All SRMs are reading about 700 cps
- SRM detectors are fully inserted
- IRMs are on Range 1

- THEN, a loss of power to 24 VDC Bus 11 occurs
- Which one of the following identifies the effect of the power loss on SRMs?
- A. SRM 11 and 12 are deenergized preventing trips from these SRMs
- B. SRM 11 and 12 are deenergized causing trips from these SRMs
- C. SRM 13 and 14 are deenergized preventing trips from these SRMs
- D. SRM 13 and 14 are deenergized causing trips from these SRMs

Answer: B

Question 11

K/A 005 A4.04; Ability to manually operate and/or monitor in the control room: Controls and indication for closed cooling water pumps

- Given the following conditions while in MODE 4:

  - RCS cooldown is in progress on RHS Train "B"
  - [2CCP*P21A], Component Cooling Pump is running
  - [2CCP*P21B], Component Cooling Pump is racked out
  - [2CCP*P21C], Component Cooling Pump is running

- The following annunciators alarm in the Control Room:
- - [A6-1H], PRI COMP COOLING WATER SYSTEM TROUBLE
- - [A6-1G], PRI COMP COOLING PUMP AUTO START/AUTO STOP

- The crew determines that the cause is a high CCP system demand, with NO other failures present.

- Assuming all equipment operates as required and NO operator action, which ONE of the following describes the CCP pump control indication on Benchboard-B?

- A. 2CCP*P21A green and bright white indication. 2CCP*21C red indication.

- B. 2CCP*P21A red indication. 2CCP*21C green and bright white indication.

- C. 2CCP*P21A green and bright white indication. 2CCP*21C green and bright white indication.

- D. 2CCP*P21A red indication. 2CCP*21C red indication.

Question 11 ES-401-9 Review

- Correct Answer: D
- Stem States No Other Failures, D Only Answer Indicating No Failure (Cues)
- “A” and “C” pumps already running

Question 11 as Modified

- Given the following conditions while in MODE 4:

- -RCS cooldown is in progress on RHS Train "B"
- -[2CCP*P21A], Component Cooling Pump is running
- -[2CCP*P21B], Component Cooling Pump is racked out
- -[2CCP*P21C], Component Cooling Pump is in standby connected to the 2DF bus.

- The following annunciators alarm in the Control Room:
- - [A6-1H}, PRI COMP COOLING WATER SYSTEM TROUBLE
- - [A6-1G], PRI COMP COOLING PUMP AUTO START/AUTO STOP

- The crew determines that the cause is a high CCP system demand, with NO other failures present.

- Assuming all equipment operates as required and NO operator action, which ONE of the following describes the CCP pump control indication on Benchboard-B?

- A. 2CCP*P21A bright white indication. 2CCP*21C red indication.

- B. 2CCP*P21A red indication. 2CCP*21C bright white indication.

- C. 2CCP*P21A bright white indication. 2CCP*21C bright white indication.

- D. 2CCP*P21A red indication. 2CCP*21C red indication.

Answer: D

Question 12

K/A: 061 A2.01 - As it pertains to the startup of MFW pump during AFW operation - The ability to predict the impacts of the following malfunctions on AFW and based on those predictions use procedures to correct, control, or mitigate the consequences of those malfunctions or operations.

- Initial Plant Conditions:
- - Reactor operating at 60% power.
- - FW-P-1A is the only avaible Main FW Pump.

- Event:
- -Reactor Trip due to FW-P-1A trip.

- Current plant conditions:
- - All 3 Emergency Feedwater Pumps are operating
- - EFW control valves EF-V-30A-D are controlling OTSG levels at setpoint.
- - RCS subcooling margin is 41 degrees f and steady
- - FW-P-1A has been restarted, and is in HAND maintaining 0.1 mlbm/hr to each OTSG

- Based upon these conditions identify the ONE selection below that describes the required disposition of EFW equipment.

- A. Return EFW systems to normal standby conditions.

- B. Stop all EFW pumps, and manually close EF-V-30A-D.

- C. Continue operating EFW as the preferred source of FW.

- D. Continue operating EFW as a back up to the only operating MFW pump.

Question 12 Review & Resolution

- Correct Answer: A
- Concern:
- The question as stated gave no indication that the reliability of FW-P-1A had been assessed. Although the assessment is not a condition specified in the reference supporting the proposed correct answer, CRS concurrence isa requirement before returning EFW to a standby condition. Some applicants (who were all tested at the SRO level) did not want to give concurrence until an assessment was performed.
- Resolution:
- CRS concurrence is required in the references supporting the proposed correct answer. Since the question stem provided no indication of an assessment an option to leave EFW in service is a valid strategy. Additionally, the EOPs do not establish a preference for MFW vs. EFW for the conditions listed.
- Therefore the question was deleted due to more than 2 possible correct answers.

Question 13 (SRO)

K/A: 209001 – Low pressure Core Spray, G2.1.31 –Ability to locate control room switches, controls and indications and to determine that they are reflecting the desired plant lineup. 10 CFR (55.43 (b)(2)

Given the following conditions:

- Core Spray Booster Pump NZ03A breaker is racked out for repairs
- MN BRKR 1D 86 LOCKOUT TRIP annunciator is received
- Two (2) minutes later, drywell pressure reaches 4 psig

What is the status of the EDGs and the Core Spray systems one minute after the above conditions occur?

A. EDG 1 idling, EDG 2 fast start, 1A &1D Mains on, 3D Booster on

B. EDG 1 & 2 idling, 1B & 1C Mains on, 3B & 3C Boosters on

C. EDG 1 idle, EDG fast start, 1A &1B Mains on, 3B Booster on

D. EDG 1 & 2 idling, 1A &1D Mains on, 3D Booster on

Question 13 ES-401-9 Review

- Correct Answer: D
- Only system knowledge is required to answer the question – Not SRO level question
- Does not meet 10 CFR 55.43(b)(2) requirements – Facility Operating Limitations in TS
- No condition analysis to select appropriate procedures, therefore the question would also not meet 10 CFR 55.43 (b)(5) requirements

Question 13 as Modified

Given the following conditions: (NOTE - EOPS without entry conditions provided to applicant)

- Core Spray Booster Pump NZ03A breaker is racked out for repairs
- MN BRKR 1D 86 LOCKOUT TRIP annunciator is received
- Two (2) minutes later, drywell pressure reaches 4 psig and is rising
- RPV Water Level is +55 inches TAF and lowering slowly

- Which of the following actions are required IAW the EOPs

A. Confirm NZ01A, NZ01D and NZ03D pumps are operating, then reduce pressure with Isolation Condensers and EMRVs.

B. Confirm NZ01B, NZ01C and NZ03C pumps are operating, then reduce pressure with Isolation Condensers and EMRVs.

C. Confirm NZ01A, NZ01D and NZ03D pumps are operating, maintain RPV pressure until water level reaches 0 in. TAF, then Emergency Depressurize.

D. Confirm NZ01B, NZ01C and NZ03C pumps are operating, maintain RPV pressure until water level reaches 0 in. TAF, then Emergency Depressurize.

Correct Answer: A

Recurring Themes On The Written Exam

- SRO Level of Knowledge per 10CFR55.43
- K/A Matching
- Backward Logic
- Credible Distractors
- LOD=1, Direct Lookups

Why is this happening?

- The Written Examination Is Required To Be Technically and Psychometrically Correct
- This is difficult due to the required skill sets involved
- Need To Carefully Choose Your Reviewers Based On Exam Taking/ Technical Skills, as Well As Working Knowledge of NUREG 1021 Written Exam Principles
- Management Oversight of Exam Development Process
- Funding/Resource Constraints

Exam Validation

- Time Validation Is Only A Small Subset of Technical Validation
- Use of INPO Bank – Helpful or Not
- Need To Confirm The Correct Answer Is Correct, and that the Distracters Are Absolutely Wrong Yet Plausible
- The Upfront Investment of Effort By The NRC, Licensee Training, and Operations Departments Pays Dividends On The Back End of the Examination Process
- Post Exam Comment Resolution Resource Intensive For All Involved

Questions?