

01/2008	OPERATOR LICENSING REPORT ON INTERACTION (ROI)		Interaction No.:	
			ROI-17-09	
Subject:	NUREG 1021, ES-401 Tier 1 written exam test items			
Type of Action:	Waiver:	Policy Interpretation: X	Request for HQ Action:	
From:	Eugene F. Guthrie, Region II OL Branch Chief, OB2	Date:	07/28/15	
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To:	Nancy L. Salgado, Branch Chief NRR IOLB	Proposed Due Date:	06/01/17	
Info.:	ADAMS Accession No.: ML17165A579			

Issue/Purpose:

The purpose of this ROI is to gain agency alignment (policy interpretation) on writing and/or assessing Tier 1 written test items in accordance with ES-401-9, Written Examination Review Worksheet; this ROI presents three differing viewpoints for how Tier 1 test items are required to be written and/or assessed.

Background:

Section 1.10, Emergency and Abnormal Evolutions, of the PWR K/A Catalog (NUREG-1122, Rev. 2, Supplement 1), and BWR K/A Catalog (NUREG-1123, Rev. 2, Supplement 1) contain the following definitions:

- **Emergency Evolution:** An emergency plant evolution is any condition, event or symptom which leads to entry into the Emergency Operating Procedures (EOPs). (BWR and PWR Catalogs)
- **Abnormal Evolution:** An abnormal plant evolution is any degraded condition, event, or symptom not directly leading to an EOP entry condition. (PWR Catalog NUREG-1122, page 1.10).
- **Abnormal Evolution:** An abnormal plant evolution is any degraded condition, event, or symptom not directly leading to an EOP entry condition, but, nonetheless, adversely affecting a safety function. (BWR Catalog NUREG-1123, Page 1-10)

Section 1.10.1 (BWR NUREG-1123, Rev 2, Supplement 1), Table 4, K/A Statements for Emergency and Abnormal Plant Evolutions, lists the following K/A stem statements:

**Table 4
Knowledge and Ability Stem Statements for
Emergency and Abnormal Plant Evolutions**

E/AK1	Knowledge of the operational applications of the following concepts as they apply to the (EMERGENCY OR ABNORMAL PLANT EVOLUTION): (CFR: 41.8 to 41.10)
E/AK2	Knowledge of the interrelations between (EMERGENCY OR ABNORMAL PLANT EVOLUTION) and the following: (CFR: 41.7 / 45.8)
E/AK3	Knowledge of the reasons for the following responses as they apply to (EMERGENCY OR ABNORMAL PLANT EVOLUTION): (CFR: 41.5 / 45.6)
E/AA1	Ability to operate and / or monitor the following as they apply to (EMERGENCY AND ABNORMAL PLANT EVOLUTION): (CFR: 41.7 / 45.6)
E/AA2	Ability to determine and interpret the following as they apply to (EMERGENCY AND ABNORMAL PLANT EVOLUTION): (CFR: 41.10 / 43.5 / 45.13)

The Summary of Changes for the PWR K/A Catalog (PWR NUREG-1122, Rev 2, Supplement 1) state the following with respect to the Rev 2 changes for NUREG-1122:

1.7 Revised knowledge and ability stem statements for emergency plant evolutions.

The knowledge and ability stem statements (categories) for emergency plant evolutions were revised for consistency with the BWR catalog. This involved revising all five (5) knowledge stem statements as shown below. The changes are underlined.

- EK1. Knowledge of the operational implications of the following concepts as they apply to the (EMERGENCY PLANT EVOLUTION):
(CFR 41.8 / 41.10 / 45.3)
- EK2. Knowledge of the interrelations between (EMERGENCY PLANT EVOLUTION) and the following:
(CFR 41.7 / 45.7)
- EK3. Knowledge of the reasons for the following responses as they apply to (EMERGENCY PLANT EVOLUTION):
(CFR 41.5 / 41.10 / 45.6 / 45.13)
- EA1. Ability to operate and / or monitor the following as they apply to (EMERGENCY PLANT EVOLUTION):
(CFR 41.7 / 45.6)
- EA2. Ability to determine and interpret the following as they apply to (EMERGENCY PLANT EVOLUTION):
(CFR 43.5 / 45.13)

NUREG-1021, Rev 10, ES-401, Section D.2 (page 6 of 50), and NUREG-1021, Rev 11, ES-401, Section D.2 (page 7 of 52), Select and Develop Questions, both state:

2. Select and Develop Questions

- a. Prepare the site-specific written operator licensing examination using a combination of existing, modified, and new questions that match the specific K/A statements in the previously approved examination outline (refer to Section D.1 and ES-201) and the criteria summarized below. Ensure that the questions selected for Tier 3 maintain their focus on plant-wide generic knowledge and abilities and do not become an extension of Tier 2, "Plant Systems."

NUREG-1021, Rev 10, Form ES-401-1 (BWR Written Exam Outline) and Form ES-401-2 (PWR Written Exam Outline) Tier 1 Group 1 and Tier 1 Group 2 Headers are "Emergency and Abnormal Plant Evolutions." For example:

ES-401	3	Form ES-401-2
ES-401	PWR Examination Outline Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO/SRO)	Form ES-401-2

Consider the following Tier 1 Emergency/Abnormal Evolution K/A statement and the associated test item:

K/A:
040AK2.01
Steam Line Rupture
Knowledge of the interrelations between the Steam Line Rupture and the following:
Valves

Unit 2 is currently heating up following a refueling outage

- RCS Tavg = 520°F
- A Steam line break occurs on the "B" SG just downstream of the steam flow venturi
- The Main Steam Trip Valves receive an automatic close signal

Which ONE of the choices below completes the following statement?

The signal that caused the Main Steam Trip Valves to close is _____.

- A. High Steam flow coincident with Lo-Lo Tavg
- B. High Steam Line Differential Pressure
- C. High Steam flow coincident with Lo Steam Pressure
- D. Intermediate Hi-Hi Containment pressure

In this test item, the fault inside containment causes pressure to rise to 17.8 psia, which auto-isolates the Main Steam Trip Valves. The test item could also be linked with the following Tier 2 (Plant Systems) knowledge and abilities statements:

039, Main and Reheat Steam System (MRSS)

K4.08: Knowledge of MRSS design feature(s) and/or interlock(s) which provide for the following: Interlocks on MSIV and bypass valves

A3.02: Ability to monitor automatic operation of the MRSS, including: Isolation of the MRSS

On the other hand, the intent of the Tier 1 Emergency/Abnormal Evolution topic may be more appropriately tested in a different version of the original test item that tests the overall mitigative strategy of the Steam Line Rupture procedure (E-2) in the second portion of this question.

K/A:

040AK2.01

Steam Line Rupture

Knowledge of the interrelations between the Steam Line Rupture and the following:
Valves

10. Unit 2 is currently heating up following a refueling outage

- RCS Tavg = 520°F
- A Steam line break occurs on the B SG one foot downstream of the steam flow venturi.

Which of the following completes both statements?

The signal that should auto-close the Main Steam Trip Valves (MSTVs) is ___(1)___.

In accordance with 2-E-2, Faulted Steam Generator Isolation, if the MSTVs can not be manually closed then the crew is required to close ___(2)___ SG Non-Return Valve(s).

- A. (1) High Steam flow coincident with Lo-Lo Tavg
(2) only the faulted
- B. (1) High Steam flow coincident with Lo-Lo Tavg
(2) all
- C. (1) Intermediate Hi-Hi Containment pressure
(2) only the faulted
- D. (1) Intermediate Hi-Hi Containment pressure
(2) all

Consider another Tier 1 K/A example.

K/A:
022AA2.02
Loss of Reactor Coolant Makeup
Ability to determine and interpret the following as they apply to the Loss of Reactor
Coolant Makeup:
Charging pump problems

Unit 1 is at 100%

- The "C" charging pump is running powered from the 1J emergency bus (15J7)
- The "A" charging pump (1-CH-P-1A) is in AUTO
- The "B" charging pump (1-CH-P-1B) is in AUTO

The "C" charging pump trips due to an electrical fault in the motor

Which ONE of the choices below completes the following statements?

___(1)___ charging pump(s) will automatically start

AND

The crew ___(2)___ have to restore letdown.

- A. (1) Only B
(2) will
- B. (1) Both A and B
(2) will
- C. (1) Only B
(2) will not
- D. (1) Both A and B
(2) will not

In this test item, both charging pumps receive an auto-start signal and letdown auto-isolates when all charging pump breakers are open at the same time. This test item could also be linked with the Tier 2 (Plant Systems) knowledge and abilities statements:

004, Chemical Volume & Control System (CVCS)

A3.11: Ability to monitor automatic operation of the CVCS, including: Charging/Letdown

K6.04: Knowledge of the effect of a loss or malfunction on the following components: Pumps

*K4.14: Knowledge of CVCS design feature(s) and/or interlock(s) which provide for the following:
Control interlocks on letdown system*

On the other hand, the intent of the Tier 1 Emergency/Abnormal Evolution topic may be more appropriately tested by testing the overall mitigative strategy of the Abnormal Operating Procedure (AP-49):

K/A:

022AA2.02

Loss of Reactor Coolant Makeup

Ability to determine and interpret the following as they apply to the Loss of Reactor

Coolant Makeup:

Charging pump problems

. Unit 1 is at 100% with the A charging pump running

- The B charging pump is available with its control switch in AUTO-AFTER-STOP
- The C charging pump is available with its control switch in AFTER-STOP

The following indications are noted:

- Charging flow is erratic
- Charging discharge header pressure is erratic
- The A charging pump motor amps are erratic
- The A charging pump trips
- The B charging pump automatically starts
- The same erratic indications are noted on the charging header and the B charging pump trips after 30 seconds

Which of the following choices describes the required actions in accordance with 1-AP-49, Loss of Normal Charging?

- A. Go to 1-AP-48, Charging Pump Cross-Connect
- B. Perform 1-AP-49 Attachment 2, Venting Charging Pumps
- C. Immediately start the C charging pump
- D. Close discharge MOVs on the previously running charging pumps and then start the C charging pump

THREE different viewpoints (licensees and/or examiners) associated with writing and/or evaluating Tier 1 written exam test items are:

VIEWPOINT #1:

The CFR item listed under the K/A statement must also be tested for Tier 1 test items, based on the following NUREG-1021 guidance: ES-401, Section D.1.b (page 4 of 50 in Rev 10; page 5 of 52 in Rev 11)

Examination authors and reviewers should ask themselves the following questions to help determine whether or not any K/A statement is appropriate for testing:

- (Fourth bullet)
 - Is it possible to prepare a question at the correct license level related to the subject K/A? A question at the RO level should test one (or more) of the 14 items listed under 10 CFR 55.41(b) that the K/A is linked to, or test at a RO level as determined from the facility's learning objectives. A question at the SRO-only level should test one (or more) of the seven items listed under 10 CFR 55.43(b) that the K/A is linked to, or test at a level that is unique to the SRO job position as determined from the facility's learning objectives.

The 13 items listed in 10 CFR 55.45 (a) are:

- (1) Fundamentals of reactor theory, including fission process, neutron multiplication, source effects, control rod effects, criticality indications, reactivity coefficients, and poison effects.
- (2) General design features of the core, including core structure, fuel elements, control rods, core instrumentation, and coolant flow.
- (3) Mechanical components and design features of reactor primary system.
- (4) Secondary coolant and auxiliary systems that affect the facility.
- (5) Facility operating characteristics during steady state and transient conditions, including coolant chemistry, causes and effects of temperature, pressure and reactivity changes, effects of load changes, and operating limitations and reasons for these operating characteristics.
- (6) Design, components, and function of reactivity control mechanisms and instrumentation.
- (7) Design, components, and function of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.
- (8) Components, capacity, and functions of emergency systems.
- (9) Shielding, isolation, and containment design features, including access limitations.
- (10) Administrative, normal, abnormal, and emergency operating procedures for the facility.
- (11) Purpose and operation of radiation monitoring systems, including alarms and survey equipment.
- (12) Radiological safety principles and procedures.
- (13) Procedures and equipment available for handling and disposal of radioactive materials and effluents.
- (14) Principles of heat transfer, thermodynamics and fluid mechanics.

When a Tier 1 K/A statement has CFR ITEM 7 listed, for example, this means that the Tier 1 test item must be written to test the design, component, and function of control and safety systems such as an automatic feature or valve interlock, etc. The only time the Tier 1 test item is required to test the following items is ONLY if CFR ITEM 10 is listed with the Tier 1 K/A statement:

- an immediate operator action,
- an important subsequent manual operator action,
- a long-range action or overall mitigative strategy, or
- a procedure requirement

The reason why Tier 2 Plant Systems K/A statements include the A2 K/A statements (“*Ability to predict the impacts and ...use procedures to correct, control, or mitigate*”) is because this “makes-up-for” Tier 1 test items that don’t test the items listed above associated with the emergency/abnormal evolution.

VIEWPOINT #2

The 10 CFR 55.41 (a) item listed with a Tier 1 K/A statement does NOT mean that the test item must be written to test that specific CFR 55.41 item; a Tier 1 test item can be written to test ANY of the fourteen 10 CFR 55.41 (a) test items. Furthermore, as long as the stem of the question contains a situation where the crew entered an Emergency Operating Procedure or off-normal annunciator procedure or Abnormal Operating Procedure, then the test item is acceptable if it solely tests a Tier 2 Plant Systems

aspect, such as:

- valve interlock
- automatic system response
- power supply arrangement
- component design
- failure mode

As long as the stem [emphasis added] of the question deals with an emergency/abnormal “evolution” then the answer choices don’t necessarily have to test required operator actions listed in emergency/abnormal/off-normal annunciator procedures. The reason why Tier 2 Plant Systems K/A statements include the A2 K/A statements (“*Ability to predict the impacts and ...use procedures to correct, control, or mitigate*”) is because this “makes up for” Tier 1 test items that don’t test operator actions associated with the emergency/abnormal evolution.

VIEWPOINT #3

The 10 CFR 55.41 (a) item listed with a Tier 1 K/A statement does NOT mean that the test item must be written to test the specific CFR item. A Tier 1 test item should, whenever possible, be written to test 10 CFR 55.41 (a) Item #10 as it pertains to abnormal and emergency operating procedures:

(10) Administrative, normal, abnormal, and emergency operating procedures for the facility.

Test items where the stem of the question deals with an emergency/abnormal “evolution”, or off-normal situation, are inappropriate Tier 1 test items, and are K/A mismatches, if the test item can be answered solely [emphasis added] with the Tier 2 (Plant Systems) knowledges or abilities such as:

- valve interlock logic
- automatic system response
- power supply arrangement
- component design, or
- equipment failure modes.

Tier 1 test items should, whenever possible, test a knowledge or ability associated with the off-normal annunciator, Abnormal Operating, or Emergency Operating Procedure. For example:

- an immediate operator action,
- an important subsequent manual operator action,
- a long-range action or overall mitigative strategy, or
- a procedure requirement.

The fact that Tier 2 Plant Systems K/A statements include the A2 K/A statements (“*Ability to predict the impacts and ...use procedures to correct, control, or mitigate*”) does not mean that Tier 1 test items are allowed to become an extension of Tier 2.

Tier 1 test items where the stem contains an abnormal/emergency evolution, but where the test item can be answered solely with the Tier 2 (Plant Systems) knowledges or abilities listed above, become, in a sense, “window dressing”; these test items should be evaluated as K/A mismatches (unacceptable) in accordance with Form ES-401-9, Written Exam Review Worksheet.

Recommended Action/Resolution

The three tiers for the site-specific written exam are:

- Tier 1: Emergency/Abnormal Evolutions (or Procedures)
- Tier 2: Plant Systems
- Tier 3: Plant-wide Generic Administrative Requirements

When writing and/or assessing Tier 1 written test items for the current versions of the K/A catalogs,

Region II recommends viewpoint #3 because the 10 CFR 55.41 (a) requirement for “a representative selection of questions on the knowledge, skills, and abilities needed to perform licensed operator duties” may be in jeopardy when the written exam “systematic” sample is inappropriately skewed toward Tier 2 (Plant Systems) test items.

Note: It is likely this same issue may still exist when the new versions of the K/A catalogs are issued.

Final Action/Resolution:

The Region’s recommended resolutions (“viewpoints”), that would implement requirements for Tier 1 test item content beyond what is required by NUREG-1021 as discussed below, are not approved.

Viewpoint #1: “The CFR item listed under the K/A statement **must** [emphasis added] also be tested for Tier 1 test items, based on the following NUREG-1021 guidance: ES-401, Section D.1.b (page 4 of 50 in Rev 10; page 5 of 52 in Rev 11).”

Resolution: The Region cites as the justification for this proposal guidance from ES-401, D.1.b which states “A question at the RO level **should** [emphasis added] test one (or more) of the 14 items listed under 10 CFR 55.41(b) **that the K/A is linked** to ...” However, the guidance also states “or test at a level as determined from the facility’s learning objectives.” While the guidance encourages question content consistent with both the K/A and its listed 10 CFR 55.41, 43, and/or 45 referenced item(s), it does not require or limit the question content as proposed by the Region’s viewpoint, i.e., it would be incorrect to conclude that the question content “must” test “the CFR item listed under the K/A statement.”

Viewpoint #2: “... a Tier 1 test item can be written to test ANY of the fourteen 10 CFR 55.41 (a) test items. Furthermore, as long as the stem of the question contains a situation where the crew entered an Emergency Operating Procedure or off-normal annunciator procedure or Abnormal Operating Procedure, then the test item is acceptable if it solely tests a Tier 2 Plant Systems aspect ...”

Resolution: The Region’s proposal is partially correct in that it recognizes, as discussed in the Resolution to Viewpoint #1, that Tier 1 test items “can be written to test ANY” of the 10 CFR 55.41 and/or 55.43 items. However, the BWR and PWR K/A Catalogs state that “an emergency plant evolution is any condition, event or symptom which **leads to entry** [emphasis added] into Emergency Operating Procedures (EOPs)” and “an abnormal plant evolution is any degraded condition, event, or symptom not directly leading to an EOP entry condition.” Therefore, contrary to the viewpoint position, entry **into** an EOP or Abnormal Operating Procedure (AOP) is not required for Tier 1 test items.

Viewpoint #2: “The reason why Tier 2 Plant Systems K/A statements include the A2 K/A statements (“*Ability to predict the impacts and ...use procedures to correct, control, or mitigate*”) is because this ‘makes up for’ Tier 1 test items that don’t test operator actions associated with the emergency/abnormal evolution.”

Resolution: The viewpoint discussion provides no justification to support the assertion that the A2 K/A (b) statement regarding procedure use “‘makes up for’ Tier 1 test items that don’t test operator actions associated with the emergency/abnormal evolution.” However, even if correct, the A2 K/A (b) statement does not support the proposal that Tier 1 test items require entry into an EOP or AOP.

Viewpoint #3: “The 10 CFR 55.41 (a) item listed with a Tier 1 K/A statement does NOT mean that the test item must be written to test the specific CFR item. A Tier 1 test item should, whenever possible, be written to test 10 CFR 55.41 (a) Item #10 as it pertains to abnormal and emergency operating procedures.”

Resolution: The Region’s proposal is partially correct in that it recognizes the test item is not required to be written, as discussed in the Resolution to Viewpoint #1, to the 10 CFR item that the K/A is linked to. However, there is no justification provided to support the view that “a Tier 1 test item “should, whenever possible, be written to test 10 CFR 55.41 (a) Item #10.” This assertion is contrary to the justification provided by ES-401 D.1.b (see Viewpoint #1) which promotes testing the 10 CFR item linked by the K/A. Furthermore, while the Viewpoint #1 justification recognizes question testing as determined by the facility’s learning objectives in lieu of the linked 10 CFR 55.41 and 55.43 items, it does not support preferentially testing 10 CFR 55.41, Item #10, “Administrative, normal, abnormal, and emergency

operating procedures.”

Viewpoint #3: “Tier 1 test items where the stem contains an abnormal/emergency evolution, but where the test item can be answered solely with the Tier 2 (Plant Systems) knowledges or abilities listed above, become, in a sense, “window dressing”; these test items should be evaluated as K/A mismatches (unacceptable) in accordance with Form ES-401-9, Written Exam Review Worksheet.”

Resolution: Again, rating a question as an “unacceptable” K/A mismatch because it can be answered based on plant system knowledge as it relates to the referenced Emergency or Abnormal Plant Evolution, is not supported by and is contrary to the one ES-401 justification provided in support of Viewpoint #1. Moreover, testing plant system design features, interlocks, and system operation for conditions, events, or symptoms that lead to entry into EOPs or AOPs and match the Tier 1 K/A statement is not unacceptable simply because the EOPs or AOPs were not entered. Testing plant system design features, interlocks, and system operation will in many instances test 10 CFR 41.10 procedural knowledges and abilities albeit without entry into the procedure.

In summary, each of the viewpoints/proposals presented above would implement test item content requirements more restrictive than currently called for by NUREG-1021. This type of change would likely require a revision or supplement to NUREG-1021 and could result in test items previously assessed as satisfactory for conformance with the reference K/A per the existing NUREG-1021 guidance now being assessed as unacceptable due to their not requiring entry into EOPs or AOPs.

It should also be noted that the program office position regarding the procedural content of Tier 1 test items was presented in a program office assessment (ML17095A958) of the 2016 Brunswick initial examination. The assessment noted that several Tier 1 questions were categorized as deficient because the questions did not reference procedures and only required system knowledge to answer. The assessment concluded that there is nothing in NUREG-1021 that requires Tier 1 questions to reference a procedure and if a question meets its specific K/A, then it meets the intent of the Tier category it is within, even if it does not specifically test procedural knowledge for a Tier 1 question.

OGC review is not necessary since no changes to existing NUREG-1021 guidance or requirements result from the ROI resolution.

Distribution:	RI, RII, RIII, and RIV OLBCs and OLAs and HOIB BC		
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