



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV

611 RYAN PLAZA DRIVE, SUITE 400  
ARLINGTON, TEXAS 76011 8064

May 15, 1998

James M. Levine, Senior Vice  
President, Nuclear  
Arizona Public Service Company  
P.O. Box 53999  
Phoenix, Arizona 85072-3999

SUBJECT: REGION IV EXAMINATION WRITING WORKSHOP

Dear Mr. Levine:

Region IV and Office of Nuclear Reactor Regulation staffs will conduct an Examination Writing Workshop in the Region IV Training Conference Room, starting at noon on Wednesday, July 22 through noon on Friday, July 24, 1998. The workshop is designed to follow up on our May 1997 workshop. It will convey examination test item review techniques for operator licensing examinations, provide skill-building exercises in the presented techniques, and discuss potential changes in the final version of NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," Revision 8.

You and members of your operations and training staffs are invited to attend this workshop. Our goal for the workshop is to provide a learning experience for your staff, to provide opportunities to review examination materials, and to provide an opportunity to interact with regional and headquarters operator licensing staffs. The subject audience for this workshop is those members of your staff who will prepare and review your operator licensing examination submittals.

The location for this conference will be the Region IV Training Conference Room at the Region IV office, located at 611 Ryan Plaza Drive, Suite 400, Arlington, Texas, 76011. Please notify Ms. Laura Hurley of my staff at (817)860-8253 with the names and positions of your staff who plan to attend the workshop.

Some background information is enclosed, which supports our discussions of the fundamentals of examination question development. We request that all attendees at the workshop familiarize themselves with this material prior to the beginning of the workshop. However, we will allow for some time to provide an overview and answer questions on the material.

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A draft agenda is enclosed. We look forward to meeting with your staff in July. If you have any questions, any comments on the agenda, or need additional information, please contact me at (817)860-8159.

Sincerely,



John L. Pellet, Chief  
Operations Branch  
Division of Reactor Safety

Enclosures: As stated

Docket Nos.: 50-528; 50-529; 50-530  
License Nos.: NPF-41; NPF-51; NPF-74

cc w/enclosures:

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## ATTACHMENT 1

### REGION IV EXAMINATION WORKSHOP DRAFT AGENDA

Wednesday	12:00 - 12:15 pm	Introductory remarks	Ellis Merschoff Arthur Howell John Pellet
Wednesday	12:15 - 2:00 pm	Discussion of measurement concepts including: validity, levels of knowledge, level of difficulty, and sampling.	Dr. George Usova
Wednesday	2:00 - 2:15 pm	Break	
Wednesday	2:15 - 3:00 pm	What is a "direct lookup" question and how to identify one during a review.	Dr. George Usova
Wednesday	3:00 - 3:15 pm	Break	
Wednesday	3:15 - 4:15 pm	Discussion of proposed Revision 8 security and reviewer restriction changes.	John Pellet
Wednesday	4:15 - 4:45 pm	Question and answers from the day.	John Pellet
Wednesday	4:45 - 5:00 pm	Day 1 closing remarks	John Pellet
Thursday	8:00 - 8:15 am	Day 2 Opening Remarks	John Pellet
Thursday	8:15 - 9:00 am	Discussion of "scrutable" examination sampling methodology.	John Pellet
Thursday	9:00 - 9:30 am	The difference between a "correct" answer and a legally defensible, objectively demonstrable answer.	John Pellet
Thursday	9:30 - 10:00 am	One review methodology for the operating test tasks and questions.	John Pellet
Thursday	10:00 - 10:15 am	Break	
Thursday	10:15 - 11:30 am	Group review of potential test items.	
Thursday	11:30 - 12:30 pm	Lunch	
Thursday	12:30 - 1:30 pm	Workshop discussion of tasks and questions.	John Pellet



Thursday	1:30 - 2:00 pm	One review methodology for written test questions.	John Pellet
Thursday	2:00 - 2:15 pm	Break	
Thursday	2:15 - 4:00 pm	Group review of proposed test items.	
Thursday	4:00 - 4:45 pm	Workshop discussion of written test items.	John Pellet
Thursday	4:45 - 5:00 pm	Day 2 Closing Remarks	John Pellet
Friday	8:00 - 8:30 am	Opening Remarks and questions and answers from Day2.	John Pellet
Friday	8:30 - 10:00 am	Proposed changes in final issue of Revision 8 to NUREG-1021. <ul style="list-style-type: none"> <li>• Applications and eligibility</li> <li>• Test development</li> <li>• Test administration</li> <li>• Post exam process</li> </ul>	John Pellet
Friday	10:00 - 10:15 am	Break	
Friday	10:15 - 10:30 am	Examination scheduling	John Pellet
Friday	10:30 - 11:15 am	Questions and Answers	John Pellet
Friday	11:15 - 11:30 am	Closing Remarks	Ellis Merschoff Arthur Howell John Pellet



## ATTACHMENT 2

### THE NRC WRITTEN EXAMINATION: PRINCIPLES AND PRACTICES.

Dr. George M. Usova  
USNRC  
Training and Assessment Specialist  
301-415-1064

#### SESSION OBJECTIVE:

To review validity concepts affecting the NRC  
written examination for the purpose of:

*instructing facility personnel toward the construction of more valid and consistent NRC license  
examinations*

#### COVERAGE

- 3 Levels of Validity
- 3 Levels of Knowledge
- Discrimination, Sampling, and Cut Scores
- Psychometrics

#### VALIDITY

A valid test is one which tests what it intends to test.

In *training* examinations, this means it tests the specific skills and knowledge defined and taught  
in the objectives.

In *licensing* examinations, this means it tests the specific skills and knowledge that *should* have  
been defined and taught in the objectives.

#### 3 LEVELS OF VALIDITY

- Content
- Operational
- Discriminant



## CONTENT VALIDITY

Essentially addresses K/A coverage and sampling plan coverage

## OPERATIONAL VALIDITY

Addresses two questions:

1. Is the question, as stated, important to be known as a part of the operator's job?
2. Does the question, as expressed, require the candidate to perform a job related mental or physical operation?

## DISCRIMINANT VALIDITY

Addresses making a distinction of measurement along a continuum of candidate performance.

- The cut score is the exam performance level that the test yields for making a pass-fail decision.
- Since the cut score is 80 percent, the exam must be written at a level of difficulty that *intends* to discriminate at the 80 percent level.
- The test item, its stem and distractor, interplay are such that, *by intent and design*, at least 80 percent of the candidates taking the test should answer the item correctly.

## VALIDITY SUMMARY

1. The exam (item) must be content valid, which encompasses job safety significance and sampling.
2. The exam (item) should be operationally oriented: a conceivable mental or psychomotor performance of the job. As such the item should be written at the comprehension or analysis level vice simple fundamental knowledge; this means items that measure problem solving, prediction, and analysis--central to job performance.
3. The exam (item) must discriminate at a moderate level of difficulty as set by the cut score. This means that the stem and distractor interplay are such that at least 80 percent of the candidates taking the test should answer the item correctly.

### 3 LEVELS OF KNOWLEDGE

#### Bloom's Taxonomy

- Analysis, Application, Synthesis
- Comprehension
- Fundamental (simple memory)

#### LEVEL OF KNOWLEDGE

- Bloom's Taxonomy is the reference benchmark NRC uses to classify the levels of knowledge of test items.
- Bloom's Taxonomy is a classification scheme that permits the classification of items by the level (depth) of mental thought and performance required to answer the items.
- Bloom's Taxonomy conceptually can be applied to written, scenarios, or JPM items.

#### LEVELS DEFINED

##### LEVEL 1

Fundamental Knowledge testing is defined as a simple mental process that tests the recall or recognition of discrete information bits with concrete referents; examples include knowledge of terminology, definitions, set points, or other specific facts.

##### LEVEL 2

Comprehension testing involves the mental process of understanding the material through relating it to its own parts or to some other material; examples can include rephrasing information in different words, describing or recognizing relationships, showing similarities and differences among parts or wholes, recognizing how systems interact, including consequences or implications.

##### LEVEL 3

Analysis, synthesis, and application testing is a more reactive and product-oriented testing which involves the multi-part mental process of assembling, sorting, or integrating the parts (information bits and their relationships) so that the whole, and the sum of its parts can be used to: predict an event or outcome, solve a problem, or create something new, i.e., mentally using the knowledge and its meaning to solve problems.



## DETERMINANTS OF DISCRIMINATION

- Level of examination knowledge
- Level of examination difficulty
- Passing score
- Item bank use

## NATURE OF EXAMINATIONS AND TESTS

- Tests are samples of performance
- Infer overall performance based upon sample
- Sample must be broad-based to make confident inference
- Sample must not be fully predictable otherwise inferences cannot be made on untested areas
- Items must intend to discriminate otherwise test has little or no value

## PSYCHOMETRICS

Items may have one or more of the following psychometric errors:

1. Low level of knowledge (fundamental knowledge)
2. Low operational validity (not clearly job operational)
3. Low discriminatory validity (too easy or too hard)
4. Implausible distractors
5. Confusing language or ambiguous questions
6. Confusing or inappropriate negatives in the question
7. Collection of true/false statements
8. Backward logic

### LOW LEVEL OF KNOWLEDGE

Which one of the following is powered from 4160 VAC bus 1A?

- a. RHR pump A\*
- b. RHR pump B
- c. RHR pump C
- d. RHR pump D

LOW LEVEL OF KNOWLEDGE

Select the full core display indication of a drifting control rod.

- a. Red light\*
- b. White light
- c. Blue light
- d. Amber light

LOW LEVEL OF KNOWLEDGE

Concerning use of water as a fire extinguishing agent, SELECT the correct statement from the following:

- a. Primary agent for extinguishing Class A fires and also effective on Class B and C fires \*
- b. Primary agent for extinguishing Class B fires and also effective on Class A and C fires
- c. Primary agent for extinguishing Class A and B fires but not effective on Class C fires
- d. Primary agent for extinguishing Class B and C fires but not effective on Class A fires

LOW LEVEL OF KNOWLEDGE

The following plant conditions exist:

- o RCP 2A tripped after running for 50 minutes.
- o The RCP was restarted, but tripped within 15 seconds.

Which ONE of the following is the minimum required interval before the next attempt to start RCP 2A?

- a. 15 minutes
- b. 30 minutes\*
- c. 45 minutes
- d. 60 minutes

LOW OPERATIONAL VALIDITY

Under which one of the following conditions should the Shift Supervisor inform the shop steward?

- a. Initiation of a directed overtime request
- b. Discipline action on a supervisory personnel
- c. Medical injury of a contractor personnel
- d. Personnel error by a bargaining unit member\*



While this may be related to a SS's job, it has nothing to do with nuclear safety and should not be included in an NRC examination.

LOW DISCRIMINATORY VALIDITY

Which one of the following reactor water levels will initiate the RHR pumps?

- a. Level 1 only\*
- b. Level 1 and 2 only
- c. Level 1 and 2 and 3 only
- d. Level 6 only

This information should be known by 100% of all operators at all times and is of low discriminatory validity.

LOW DISCRIMINATORY VALIDITY

The plant is recovering from a scram due to a spurious Group I isolation. The cause of the isolation has been repaired and preparations are being made to reopen the MSIVs. Reactor pressure is currently 825 psig and the main steam lines are being pressurized.

WHICH ONE (1) of the following represents the LOWEST main steam line pressure that will allow the MSIVs to be opened per procedure?

- a. 625 psig
- b. 675 psig\*
- c. 725 psig
- d. 775 psig

IMPLAUSIBLE DISTRACTORS

Which of the following will cause the RHR pumps to start during a design basis LOCA?

- a. Low drywell pressure
- b. High reactor water level
- c. High drywell pressure\*
- d. MSIVs in the NOT OPEN position

Distractors a, b, and d are implausible distractors considering minimal knowledge of the plant response to a LOCA.



### CONFUSING OR INAPPROPRIATE NEGATIVES IN THE QUESTION

Regarding temporary plant alterations (TPA), technical reviews are NOT required

- a. for a TPA NOT installed using an approved procedure.
- b. for TPAs installed on BOP systems but are required for safety related systems.
- c. for a TPA that has NOT been directed by the shift supervisor to be an emergency TPA.
- d. for all TPAs directed by the shift supervisor.

This question contains multiple problems: (1) While negative questions can be used, they should be used for good reason; in the above example, there appears to be no good basis for asking this question negatively. (2) Two of the distractors (a and c) also contain a negative, creating a double negative and readability confusions, a violation of good item writing practice.

This question would be more appropriately written as "Under which of the following conditions are technical reviews required?" This phrasing would eliminate the negative in the stem.

### COLLECTIONS OF TRUE/FALSE STATEMENTS

Which of the following are true?

- a. High drywell pressure will auto start the emergency diesel generators.\*
- b. Low reactor water level will trip the main turbine.
- c. High reactor pressure will initiate RCIC.
- d. High reactor power with the mode switch in startup will NOT close the MSIVs.

### COLLECTIONS OF TRUE/FALSE STATEMENTS

Which one of the following describes pump cavitation?

- a. Vapor bubbles are formed when the enthalpy difference between pump discharge and a pump suction exceeds the latent heat of vaporization.
- b. Vapor bubbles are formed in the eye of the pump and collapse as they enter higher pressure regions of the pump.\*
- c. Vapor bubbles are produced when the localized pressure exceeds the vapor pressure at the existing temperature.
- d. Vapor bubbles are discharged from the pump where they impinge on downstream piping and cause a water hammer.

Both examples represent an error of a collection of true/false statements, which typically only test simple rote memory; the candidate needs only to recall a definition or condition. The question elicits no comprehension or problem-solving; hence, the question lacks operational validity. This type of question allows a candidate to answer the question without the stem of the question.



### BACKWARD LOGIC

Which of the following parameters will simultaneously start HPCI, RCIC and SBGTS?

- a. High RPV water level
- b. High drywell pressure\*
- c. Low RPV water level
- d. Low drywell pressure

It is better to select a parameter and then request the expected system response because that is more operationally relevant.

### BACKWARD LOGIC

Backward logic is a question that asks the candidate for information normally received, and provides the candidate with information he/she normally has to supply. In an operational setting, operators are faced with conditions and required to know what procedure(s) to use. Instead the question asks them to do just the opposite.

### BACKWARD LOGIC - an everyday example

"If it takes 12.5 cubic feet of concrete to build a square loading pad 6 inches thick, what is the length of one side of the pad?"

This question gives the test takers information they should be asked to calculate, while it requires them to provide information they would be supplied in an actual work situation.