PREPARATION OF OPERATING TESTS 7/03

Course: License Examiner Techniques
Lesson Title: Preparation of Operating Tests

I. SPECIAL INSTRUCTIONS AND TRAINING AIDS

A. Special Instructions

1. None

B. Training Aids Needed

1. Transparencies

   a. Objectives: Preparation of Operating Tests
      Pros and Cons
   b. Operating Test Content (10 CFR 55.45)
   c. Operating Test Overview
   d. Scenario Development Process
   e. Form ES-301-5, Transient / Event Checklist
   f. Form ES-301-6, Competencies Checklist
   g. Form ES-303-4, Competency Grading Worksheet
   h. Scenario Sources and References
   i. General Scenario Guidelines
   j. Example - Completed Scenario Events (Form ES-D-1)
   k. Example - Completed Operator Actions (Form ES-D-2)
   l. Building a JPM
   m. EDG JPM (example; all pages)
   n. Walk-through Development - Category B
   o. Walk-through System Coverage Requirements
   p. Alternative Path JPMs
   q. Form ES-301-2, Individual Walk-through Test Outline
   r. Form ES-C-2, JPM Quality Assurance Checklist
   s. Walk-through Development - Category A
   t. Form ES-301-1, Administrative Topics Outline
   u. Quantitative Scenario Attributes
   v. Critical Task Criteria
   w. Form ES-201-2, Examination Outline QA Checklist
   x. Form ES-301-4, Simulator Scenario QA Checklist
   y. Form ES-C-1, JPM Worksheet
   z. Form ES-301-3, Operating Test QA Checklist

2. Handouts

   a. Transparencies
   b. Simulator Examination Exercise Instructions
   c. Walk-through Examination Exercise Instructions

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II. REFERENCES

A. Operator Licensing Examination Standards for Power Reactors, NUREG-1021, ES-301, Rev. 8, Supplement 1 [WITH DRAFT REVISION 9 NOTES]
B. PWR and BWR K/A Catalogs, NUREGS-1122 and 1123
C. BWR and PWR Off-Normal Event Descriptions, NUREG-1291

III. OBJECTIVES

A. Terminal

1. Use the facility and NRC reference material to construct a simulator scenario set that complies with the requirements of the Examination Standards to produce a valid and reliable basis for assessing the applicant's competence.

2. Use the facility and NRC reference material to construct Job Performance Measures (JPMs) that comply with the requirements of the Examination Standards to produce a valid and reliable basis for assessing the applicant's competence.

B. Enabling

1. Determine the minimum required scenario set events for different mixes of applicants in compliance with the Examination Standards.

2. Understand the eight competencies to be observed and evaluated during a simulator exam in accordance with the Examination Standards.

3. Understand the steps involved in scenario development including the purpose of the following forms:

a. Form ES-D-1, Scenario Outline

b. Form ES-201-2, Examination Outline QA Checklist

c. Form ES-D-2, Operator Actions

d. Form ES-301-5, Transient / Event Checklist

e. Form ES-301-6, Competencies Checklist

f. Form ES-301-4, Simulator Scenario QA Checklist

4. Understand the elements of a JPM required by the ES.

5. Understand the JPM / question requirements for initial license exams.

6. Understand the steps involved in walk-through exam development, including the use of the following forms:

   a. Form ES-C-1, JPM Worksheet

   b. Form ES-C-2, JPM Quality Checklist

   c. Form ES-301-1, Administrative Topics Outline

   d. Form ES-301-2, Control Room Systems and Facility Walk-through Test Outline

   e. Form ES-201-2, Examination Outline QA Checklist

   f. Form ES-301-3, Operating Test QA Checklist

7. Understand how the program objectives (validity, reliability, and efficiency) are achieved.

BEFORE BEGINNING THE FIRST LESSON, DISCUSS THE COURSE AGENDA WITH THE STUDENTS SO THEY UNDERSTAND THE SEQUENCE OF EVENTS. USE THE COURSE AGENDA VIEWGRAPH.

IV. PRESENTATION

A. Introduction

1. Review the learning objectives with class **(SLIDE-A)**

2. Operating Test Background

   a. Why administer an operating test (advantages) ? **(SLIDE)**

      Best way to measure operators' ability to actually perform licensed duties; direct observation rather than inference yields greater inherent validity

      Ideal for measuring performance-based skills such as communications, crew interactions, supervisory ability

      Allows follow-up questioning to clarify understanding

   b. But it does have disadvantages...

      It is very labor intensive; generally plan to spend one full day per

operating test

Subject to observation and evaluation errors which may impact reliability (we will discuss some later)

Subject to inconsistencies among examiners

By their very nature, more subjective than written exam

Vulnerable to appeals

Procedures and forms have improved consistency by minimizing subjectivity (e.g., rating factors, behavioral anchors, prescripting)

3. Operating test overview

10 CFR 55.45(a) specifies content; requires applicant to demonstrate an <u>understanding of and ability to perform</u> representative sample of 13 items **(SLIDE-B)**

Item 1 applies to cold plants

a. 10 CFR 55.45(b) requires plant walk-through and simulation facility **(SLIDE-C)**

b. Three Categories established by NUREG-1021

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1. A - Administrative Topics (covers 55.45(a) items 9-12)

2. B - 1. Control Room Systems
2. Facility Walk-through
(cover items 3, 4, 7, 8, 9)

3. C - Integrated Plant Operations (dynamic simulator test) (covers items 1-8, 11-13)

c. Prepared IAW ES-301 and Appendices C and D - we will discuss the simulator test today and the walk-through tomorrow

d. Administered in accordance with ES-302 - the topic for discussion on Wednesday afternoon

e. Graded in a accordance with ES-303 - which will be discussed Thursday afternoon

B. Dynamic Simulator Test Preparation **(SLIDE-D)**

Accomplished IAW the General guidelines in Section D.1 of ES-301, the more specific instructions in Section D.4, and the detailed, generic simulator testing concepts in Appendix D.

1. Development process

a. Identify scenario objectives

"Terminal" objective is to evaluate the applicants' knowledge of integrated plant operations, their ability to diagnose abnormal plant conditions, their ability to work as a team, and their ability to mitigate plant transients by using the AOPs and EOPs.

Accomplished with two or more scenarios grouped into sets that enable the examiner to evaluate all competencies and rating factors applicable to the license level of the applicants taking the test (refer to and discuss Form ES-303-4 and the competency descriptions beginning on p. 18 of Appendix D **(SLIDE-G)**

Each scenario should also have a specific objective (i.e., to test a particular aspect of the EOPS) or "theme"

b. Identify initial conditions

Should allow the scenario to commence realistically.

Should represent a typical plant status, with various components, instruments, and annunciators out of service and with maintenance or surveillance activities in progress. Be careful not to inadvertently put them into a shutdown LCO and then ask them to increase power.

All, some, or even none of these initial conditions may affect events later in the scenario.

Minimize predictability: use a variety of different ICs to maintain integrity (e.g., high/low power, shutdown, BOL/EOL, etc.)

Special, non-standard IC's may add to setup time and can lead to confusion (e.g., unexplained xenon effects if power was changed); snapshots may be useful if security is maintained

c. Select events

1. What are the different types of events that make up a scenario? (refer to Appendix D, p 9-11) **(SLIDE-E)**

- normal evolutions, including reactivity manipulations (must produce clearly observable plant response under normal or controlled upset conditions per ES-301, D.4.d)
- *instrument failures (nuclear, control, or process)
- *component failures

  * both should normally be completed before the major transient is initiated otherwise they may get lost in the fray and be difficult to count as a separate event
- major plant transient (significant effect on plant safety and leads to one or more protective system actuations, such as a reactor trip or an ESF actuation; should normally require E-plan activation)

2. How many (events / scenarios) do you need?

R9D Scenario set must meet <u>minimum</u> event requirements per Form ES-301-5

NOTE that Supplement 1 changes the form to give examiners more flexibility in sampling instrument and component failures (4 total instead of 2 each), but both should be included whenever practical

R9D One of the normal evolutions for each RO and SRO-I must be reactivity manipulation in the primary RO position

Depends on the number and mix of applicants (RO / SRO-I / SRO-U)

SRO-U not required to manipulate controls

SRO-I must be evaluated on RO skills

To control level of difficulty, each scenario should fall within the target band specified in ES-301 for each of the following quantitative attributes discussed on pages 9-14 of Appendix D: **SLIDE-U**

Total malfunctions - must involve significant system response and operator action to count; post-EOP included

Malfunctions after EOP entry - must influence choice of mitigation strategy

Abnormal events - should not always be a precursor to the major transient; some should require TS interpretations

Major transients - as defined earlier

EOPs used - should only reflect those EOPs requiring substantive actions; primary trip/scram response procedure does not count

EOP contingencies used - have clear safety significance; should require substantive actions

Critical tasks - distributed so that each operator is required to respond **SLIDE-V**

To be valid, a CT must have (refer to p. 14 of Appendix D):

Safety significance - will missing the task have direct adverse consequences or significantly degrade the plant's mitigative capability; examples in Append. D

An external stimulus/cue - that prompts an operator to perform the task (verbal direction or reports, procedural steps, or indications)

Measurable performance indicators - positive, objective, verifiable actions; should be agreed to by NRC and facility; examples in Append. D

Performance feedback - regarding the effect of the operator's action or inaction

Some of the criteria do not apply to the initial exam (i.e., simulator and EOP run time)

Keep operator rotation in mind during planning

Operator should be actively involved by performing significant verifiable actions to get credit for the event; events after the major transient that do not alter the mitigation strategy may not count

Running simulator exams back-to-back cuts development by 50%; necessitates security measures; discuss schedule with chief examiner

No scenarios may be repeated from one day to the next

Facility-prepared exams may not repeat any scenarios from the operators' audit exams; similar events are acceptable if the mitigation actions are significantly different; every applicant must be tested using at least one new or significantly modified scenario

3. Where to look? **(SLIDE-H)**

PWR / BWR K/A Catalogs (NUREGs-1122 / 1123)

BWR / PWR Off-Normal Events Description (NUREG-1291)

Facility scenarios are good for ideas, but should not be used intact. Designed for training and not for evaluation.

Exams must have one new or significantly modified scenario (i.e., one or more conditions or events significantly changed to alter the mitigation strategy) for each applicant, and the other bank scenarios must be changed as necessary to prevent immediate recognition based on the IC or other cues

May not always have the required K/A importance factor of 2.5 (or lower if justified by a recent LER)

Both the BWROG and the WOG have prepared Simulator Scenario Development Guidelines that include templates designed to ensure thorough coverage of all the EPGs during facility requalification examinations.

They have NOT been officially endorsed by the NRC, nor do they over-ride anything in the

Examination Standards. But they can provide useful background when developing the EOP/major transient portion of a scenario.

Requalification scenarios may not cover the required events and transients.

Regional scenario banks from previous examinations at the same or similar facilities.

Actual events (LERs), but these are often difficult to simulate depending on the machine's capabilities

Evaluate the DASs for the facility to determine if they are suitable for testing, on a sampling basis, during the simulator test. The plant's PRA/IPE should be used to identify risk-important operator actions that are relied upon or result in specific events being driven to low risk contribution.

NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," provides perspectives gained by reviewing 75 individual plant examination (IPE) submittals pertaining to 108 nuclear power plant units. Chapter 13, "Operational Perspectives," is of particular interest because it identifies a number of important human actions that should be considered for evaluation on BWR and PWR licensing and requalification examinations.

Facility procedures, Tech Specs, training material, and simulator manual

4. General guidelines **(SLIDE-I)**

The following guidelines incorporate instructions from ES-301 and the qualitative attributes on pages 5-8 of Appendix D.

Integrate the exam Categories (including the written) to achieve broad, balanced coverage. Refer to the sample plan (sky scraper) or exam outline. Try to avoid duplication or over-emphasis of certain topics at the expense of others.

Cover a wide range of systems, procedures, and plant conditions (major, ECCS, and I&C; normal, abnormal, and

emergency; low power, full power, and shutdown if within simulator capability) within each scenario set and among crews.

Increased emphasis on risks associated with shutdown and low power operations.

Some inter-Category overlap is unavoidable, but watch out for double jeopardy.

Sequence the events to attain the stated objectives and build to a final major transient.

The sequence of events has a major effect on determining the complexity of the scenario.

Plan logical and gradual deterioration in plant status (i.e., scenario should have a theme) without being predictable

Avoid series of unrelated events; make use of event precursors where appropriate (e.g., small leak that propagates over time or a pump failure preceded by a high vibration condition) so you can observe the crew respond to the worsening condition (i.e., scenario should have a "theme")

Having one failure cause or exacerbate another can be used to evaluate the interactions of systems/components

> But be careful not to have one failure fully mask the symptoms of another

If an event may result in a premature plant trip, then try to put it near the end so you don't waste the rest of the scenario

It is often useful to have key components or instruments fail after entering the EOPs so the crew is compelled to alter its mitigation strategy

Normal evolutions and surveillances can be used as a backdrop or lead in for malfunctions

Some evolutions (e.g., startups) take a very long time to complete and are generally not performed

Surveillances can be used to evaluate panel dexterity but they have drawbacks as well

They can make the scenario drag so consider time versus benefit

They may require setup time and local operation time

They can key the operators to future events

Make them show their stuff

What gets put in the scenarios must enable you to differentiate a competent operator from one who is not; it must enable the examiners to evaluate every applicant on every rating factor / competency

Use events that have a success path, provide an opportunity for the applicants to perform, and provide you with something to evaluate

Events must be included that will allow an unsatisfactory evaluation in a particular rating factor if an operator performs poorly

Some very severe events require very little operator action

Remember that these are individual license examinations; get everyone involved so weak applicant is not "carried" by the rest of the crew

Initiate concurrent failures at separate board locations if each event can be handled by individual operator with minimal assistance

Good test of SRO's ability to set priorities

Maintain realism and credibility

It is unlikely to have multiple pipe failures in a scenario unless there is a connective precursor such as a seismic event

Keep the severity of the events and the simulator's capabilities in mind; be careful not to exceed the license's configuration management system

Do NOT alter the simulator model to obtain a desired effect; however, overrides and remote functions may be used with caution to simulate plant degradation that is not modeled or for which there is not a standard malfunction.

Don't violate the laws of thermodynamics and physics; it may provide negative training

Try to select events having safety significance and procedural support at the facility

Basing events and scenarios on actual operating experiences, risk-dominant accident sequences, and risk-important operator actions (based on the facility's PRA and IPE) improve credibility

Timing

Resist the temptation to flood the applicants with too many "malfunctions per minute"

Slower scenarios can be used for evaluating SRO supervisory / resource management skills

If SROs are being evaluated the scenarios shall contain failures that challenge TS

> Ensure you give enough time to determine the LCO; few LCOs have action requirements that must be accomplished during the scenario time frame (follow up with questions as necessary)

Plan for contact time of about 45 - 50 minutes per scenario, with 2 - 3 scenarios per set.

Time could actually run 1.5 - 2 hours because applicants will take time to do all actions correctly.

Don't force the scenario and impose artificial time constraints.

It is better to initiate events on the basis of plant parameters or operator actions rather than a rigid, planned time sequence.

Time compression may be used to expedite the scenario, but ensure that the applicants are given sufficient time to

execute the expected actions. The applicants should be informed that time compression may/will be used during the scenario and debriefed after the scenario to ensure that there was no negative training. Be judicious.

The crew expects something to occur; extending the time between events may cause undue stress.

Level of Difficulty

Scenarios that are either too easy (everyone passes) or too difficult (everyone fails) will not effectively discriminate between competent and incompetent applicants.

The scenario's level of difficulty is generally, but not always, proportional to the value of its quantitative attributes. Two scenarios with identical attributes could vary significantly in LOD.

The most significant contributors to level of difficulty are analysis or problem-solving malfunctions and the number of operator actions required for event mitigation. Scenarios deficient in these areas may not provide an adequate basis to evaluate the rating factors.

In the spring of 1994, a panel of examiners concluded that although the level of difficulty did vary across the regions, the variations did not significantly affect the consistency of the examination process.

If a scenario's quantitative attributes fall outside the target bands, which were derived from the LOD study, it may be indicative of a problem and should be evaluated to ensure the scenarios are appropriate

We will be taking a closer look at this subject during a class exercise on Friday

d. Identify endpoints

Plan ahead regarding the restoration of failed equipment; what operator actions, if any, will return the component or system to service

Determine the expected final plant condition or procedural step when the scenario should be stopped; should be clearly recognizable

Sometimes it is actually easier to identify the desired endpoint for a scenario (e.g., a particular EOP) and then work backwards to develop the entry conditions, lead-up malfunctions / ICs. The BWROG scenario templates use this technique.

e. Complete Form ES-D-1's, Scenario Outlines **(SLIDE-J)**

1. Include simulator operator instructions that are accurate and easy to follow; this is particularly important with variable malfunctions (specify rates, as required)

2. Check the following shift turnover instructions with the instructor:

   current active procedures;
   power history;
   out-of-service equipment (known and unknown);
   maintenance or special activities; and
   expected plant operations

3. If the facility licensee is preparing the exam, it shall submit the outlines to the NRC for review and comment at this point (nominally 75 days before the exam date unless other arrangements are made with the licensee)

f. Complete Form ES-D-2's, Operator Actions **(SLIDE-K)**

1. Enter a brief description of the event (i.e., when and how it is to be initiated, symptoms and plant effects)

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2. Prerecord all <u>significant</u> anticipated operator actions and communications (every action not required) for each position on the crew

   Critical tasks must be flagged as such

   Include those with "evaluation power"; why you picked the event in the first place

   Keep in mind the 6/8 (RO/SRO) competencies that will have to be evaluated after the test is administered

   Use prior experience (including other examiners) and best judgment regarding which position will complete the action (make sure to make

adjustments as necessary during the validation process)

Attempt to list in chronological order for ease of reference; use an asterisk to denote continuing actions

Most examiners find it easier to follow if all the expected actions for a watch position are listed together

Best obtained from ARPs, Off-normals, EOPs

Reference procedures whenever possible; attach a copy if desired

Identify the event terminus or point at which it is acceptable to move on to the next event or terminate the scenario

Be specific (e.g., include control ranges, setpoints and calculation results)

3. Functions as a checklist during exam administration and minimizes the need to take notes during the exam

4. Leave spaces for recording unpredicted correct or incorrect actions or remarks

g. Author checks for adequacy of coverage (Q/A)

1. Review the examination outline that is normally due about 75 days (unless other arrangements have been made) before the exam date IAW Form ES-201-2, Outline QA Checklist **(SLIDE-W)**

Review events against Form ES-301-5 **(SLIDE-E)**

2. Review final scenarios which are due 45 days (unless other arrangements have been made) before the exam by using Form ES-301-4 **(SLIDE-X)**

3. Review competencies against Form 301-6 **(SLIDE-F)**

h. Submit to Region for review

Outline should be received by responsible Region 75 days before start of exam, unless other arrangements have been made (refer to time line Form ES-201-1)

The complete exams are due 45 days before the exam date

The CE will ensure that the outlines and the scenarios are reviewed using the QA sheet (the reviewer will initial the items and the CE must concur) and, after supervisory concurrence, relay consolidated comments to the author. Final exam comments are often reviewed with the facility during a preparatory trip to the site.

There is no limit to the changes that the NRC can direct if they are necessary to make the exam conform with NRC standards for quality and difficulty.

Supervisor should not sign the QA form authorizing the exam to be given until the region is satisfied with the quality and LOD of the exam.

i. Validate ("Dry run") the scenarios

All scenarios should be dry run by/with facility simulator instructor to ensure they will run

It is not absolutely necessary to run every event if time is a factor; focus on those having variable / questionable outcomes

This is often done during prep week, but other arrangements are possible.

Ensure facility representatives have signed security agreements

2. Simulator Exam Review

a. Review the learning objectives **(SLIDE-A)**

b. Review the use of the following forms

1. Form ES-D-1 - Scenario Outline
2. Form ES-D-2 - Operator Actions
3. Form 5 - Transient Checklist
4. Form 6 - Competency Checklist
5. Form ES-201-2, Outline QA
6. Form ES-301-4, Scenario QA

D. Simulator Examination Exercise Instructions

1. Don Jackson is the Chief Examiner and the others are members of his exam team.

2. Develop a complete simulator operating test consisting of two scenarios that conform with the ES requirements and guidelines. Fill out the required forms.

3. Prepare the required actions for each event on both scenarios based on the reference materials available in the simulator (e.g., procedures, Off-Normal Events Descriptions, malfunction descriptions, TS, etc.).

4. Ensure adequate competence and transient / event coverage and conduct a QA check of the expected actions.

5. Give the scenarios to me no later than Wednesday morning so I can review them before the afternoon validation session.

D. Walk-through Examination (Categories A & B) Preparation

Accomplished IAW the General guidelines in Section D.1 of ES-301, the more specific instructions in Sections D.2 and D.3, and the detailed guidelines in Appendix C.

1. Anatomy of a JPM

a. What they are and why we use them

A "Job Performance Measure" is an evaluation tool based on tasks contained in the facility's Job Task Analysis or the NRC's Knowledge and Abilities Catalogs that requires the applicant to correctly perform a task applicable to the license level of the examination (Appendix F).

By observing the operator PERFORM JPMs and answer associated questions which probe the individual's knowledge of the task / system we can assess his / her systems-related knowledge. The methodology is much more performance-based than the traditional oral walk-through. Refer to 10 CFR 55.45(a) - demonstrate understanding of and ability to perform sample of 13 items.

JPMs are the primary building blocks from which the walk-through portion (Categories A and B) of the operating test is constructed. So before we get into the details of constructing each test category, we will focus on the anatomy of a JPM.

b. Building a JPM (per Appendix C) **(SLIDES-L, M, AND Y)**

JPMs can be constructed using Form ES-C-1 or an equivalent and by marking up the relevant section of the applicable facility procedure.

1. Specify initial conditions and an initiating cue

System and plant conditions that will permit the task to be performed realistically

e.g., reactor critical at 1% power, ready to start up main feed pump; include the equipment failure for alternate path tasks (more on these later)

The initiating cue provides the stimulus for the operator to begin the task performance; it should contain sufficient detail for the operator to perform the task without coaching

e.g., the SS has directed you to start and load the A EDG to XXX kw IAW with SOP-XXX

Per Sup 1, all the required operator actions preceding the start point of the JPM should be completed unless the action is purposely omitted as part of an alternate path JPM (more on them later)

It should clearly specify the desired endpoint for the task (be careful not to reveal the nature of alternate path JPMs)

These items may be duplicated on a separate sheet of paper that can be handed to the operator - useful in high noise areas

2. Identify references and tools

The procedures that require task performance and the procedures that provide guidance, directions, or standards for task performance

e.g., GOP-XXX, Reactor Plant Startup; SOP-XXX, Main Feed System Operation

Make sure the procedures are current

Also identify any special tools required to complete the task and, for the examiner's benefit, where they can be found

e.g., stop watch, wrench, fuse puller, spool piece

3. Develop performance criteria

Every JPM should have meaningful performance requirements that will provide a legitimate basis for evaluating the operator's ability to safely operate the system/plant (repeated subdivision may result in meaningless tasks). However, be careful not to turn the task into a "mini-scenario" that exceeds the performance expectations for an individual operator.

Each JPM must have a specific, predetermined outcome (control / indication nomenclature) against which task performance is measured; i.e., a task standard

e.g., EDG is running, paralleled with the bus and

carrying 1000 KW

Specific performance standards or check points should be used to evaluate the operator's progress toward successful completion of the task (i.e., steps in the procedure); include specific control and indication nomenclature whenever possible

Every procedural step need not be included, but all critical steps (i.e., those that if omitted or performed incorrectly would prevent the completion of the task standard) and their associated performance standards, must be identified

Note any important observations that the operator should make while performing the task

Also note any restrictions on the sequence of steps

4. Develop examiner cues

System response cues that will enable the examiner to provide the operator with specific feedback regarding the component, system, and plant response to the operator's manipulations, especially for those steps identified as critical

e.g., meter readings and switch positions, even if they are not specified in the procedural step; pump discharge pressure increased to XX psig; "yellow stickies", handouts, etc. can be used on a case-by-case basis (with exam team approval)

When a problem is detected, a cue should be provided (e.g., alarm X-X did not clear) to alert the operator that system or component response was not correct

To the extent possible try to anticipate incorrect actions that the operators might take

Particularly important for inplant (simulated) tasks that would not provide real time feedback and for alternate path tasks that require the operator to perform auxiliary procedures when equipment fails during use

May not be necessary for tasks performed in the simulator

Also include other cues and instructions that the operator

might need regarding completed steps or remote operations

5. Develop a time standard

   Estimate of approximate, average time for completion; ensure the time is reasonable because the examiner may use it as a basis for cutting off an applicant who is not making progress (more on this when we discuss test administration)

   Time-critical tasks will have absolute maximum time limit indicated (should be based on a regulatory requirement or commitment and verified with facility Operations Department)

   Should be validated; using facility JPMs leaves fewer questions concerning validation

6. Be prepared to ask follow-up questions

   10 CFR 55.45(a) requires the applicant to demonstrate an <u>understanding</u> of and the ability to perform the actions necessary to accomplish a representative sample from among 13 items listed in the rule. If the applicant correctly performs a JPM (including both critical and noncritical steps) and demonstrates familiarity with the equipment and procedures, the examiner should infer that the applicant's <u>understanding</u> of the system/task is adequate and refrain from asking follow-up questions. However, if the applicant fails to accomplish the task standard for the JPM, exhibits behavior that demonstrates a lack of familiarity with the equipment and procedures, or is unable to locate information, control board indications, or controls, the examiner should ask performance-based follow-up questions as necessary to clarify or confirm the applicant's understanding of the system as it relates to the task that was performed.

   The questions are not intended to explore general system knowledge (no "fishing expeditions")

   Should have an operational orientation at the analysis, synthesis, or application level; others should not permit the use of references

   May include a combination of open- and closed-reference

items. Open-reference items that require applicants to apply their knowledge of the plant to postulated normal, abnormal, and emergency situations are preferred. Closed-reference items may be used to evaluate the immediate actions of emergency and other procedures, certain automatic actions, operating characteristics, interlocks, and set points, as appropriate to the facility. Examiners should minimize the use of closed-reference questions that rely solely on memory.

Ability to discriminate between a competent and incompetent operator is more important than question difficulty

Form ES-602-1 is a checklist for evaluating the suitability of open reference questions; with the exception of items 9, 10, 11 and the K/A rating on item 7 they generally apply to the walk-through and can be used as a basis for revising or rejecting proposed questions

7. Check for quality

Form ES-C-2 can be used to verify that all the relevant criteria are satisfied

2. Walk-through development methodology

[It's generally easier to begin with Category B with the goal of integrating as many administrative topics as possible and then go back to Category A and pick up the topics that were missed.]

a. Category B **(SLIDE-N)**

1. Select the appropriate number of systems and/or evolutions from the safety function groupings (and E/APEs) in the applicable K/A Catalog (the appropriate safety group for each E/APE is listed on the written exam outline in ES-401)

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SYSTEM/EVOLUTION REQUIREMENTS (SLIDE-O)

License Level	SubCategory B.1	B.2	Total
RO / SRO(I)	7	3	10*
SRO(U)	2/3	3/2	5#

* Should cover at least 7 different safety functions, with each system/evolution in a subcategory from a different safety function and no more than one task per system in a subcategory. For PWRs the primary and secondary systems in SF 4 may be treated as separate safety functions.

\# Should cover at least 5 different systems and safety functions and one of the B.1 systems/evolutions must be an ESF.

Remember concept of exam integration / coverage

2. Select and develop a TASK (JPM) to perform from the list under the system name in the K/A Catalog or the site's JTA or one that applies to the selected E/APE; illustrate with the EDG example **(SLIDE-M)**

One JPM must be performed for each system/EAPE that is selected for evaluation in Subcategories B.1 and B.2

Tasks should have operational importance of 2.5 or greater and should have meaningful performance requirements (that won't leave you wondering if a failure is justified if the applicant misses a sufficient number of tasks)

The facility licensee's failure to train the applicants on a valid K/A is not an acceptable reason for avoiding that K/A

Be careful to differentiate RO / SRO level of knowledge or BOTH

Keep dual unit considerations in mind; if the simulator is modeled after one unit, focus some JPMs on the other

Try not to duplicate tasks that are performed during the dynamic simulator test

At least one JPM shall evaluate the applicant on low power or shutdown conditions.

At least one Category B.2 JPM must evaluate a local emergency or abnormal procedure and at least one JPM shall require entry into a radiologically controlled area (RCA); good opportunity to evaluate A.3 (more later)

R9D

Forty percent (2/5 or 4/10) of the JPMs shall require the applicant to execute alternate paths within the facility's operating procedures (which are discussed on page 6-7 of Appendix C). Operators are often challenged to perform auxiliary procedures when equipment fails or malfunctions during use.

Although most alternate path JPMs do involve some sort of system fault, the goal is to assess the applicant's response to a situation that is not as it should be or is somehow different from what the applicant might have expected based on the initiating cue for the task.

Should have five characteristics: **(SLIDE-P)**

1. A facility-endorsed success path

2. The required actions should be addressed by a procedure or policy

3. A logical and realistic sequence of actions (should not be expected to enter EOPs or contain a cascading sequence of malfunctions).

4. The operator should be able to perform the task without reliance on other control room operators. Simulator operator may acknowledge superfluous alarms and take outside actions.

5. It should be prevalidated and not come as a surprise to the simulator operator.

Plan the walk-through exam for direct contact time of approximately 15 - 30 minutes per JPM

Keep ease of administration in mind:

- Minimize the number of simulator setups; some of the JPM initial conditions provide realism but do not

prevent the task from being performed as planned
- Choose tasks that can be run in parallel

Use facility-developed JPMs (preferred) or develop your own as discussed earlier

No more than 80% of the tasks on the walk-through may be taken from the facility's banks without significant modification that alters the course of action; also, no more than 30% repeats from the last NRC exam and no JPMs may be repeated day-to-day

Fill in Form ES-301-2 **(SLIDE-Q)**

The new form includes codes for identifying the type of task

Copy applicable facility procedure; ensure it's current

Complete a JPM Worksheet (Form ES-C-1) for the task selected

Identify initial conditions, initiating cures, task standard, critical steps, performance standards, important observations, time standard (if applicable), references, and tools

Develop appropriate system response cues as required

3. Submit ES-301-2 for review so it is received by Chief Examiner (nominally) 75 days before the exam

The CE will ensure that the outline is reviewed IAW Form ES-201-2 **(SLIDE-W)**

The completed JPMs are due to the CE 45 days before exam

The CE will ensure they are reviewed IAW Form ES-301-3 **(SLIDE-Z)**

Examiner will review for content, scope, and duplication with other sections of the exam, and overlap with consecutive tests (CE will concur) and forward to the BC for approval to discuss/review with the licensee

There is no limit to the changes that the NRC may direct

b. Category A **(SLIDE-S)**

R9D

1. Each of the four administrative topics described in ES-301 must be evaluated for each applicant.

   Conduct of Operations
   Equipment Control
   Radiation Control
   Emergency Plan

2. Identify a selection of administrative subjects to be evaluated for each of the four topics (ES-301, p. 2 - 3) give examples).

   Then enter a brief description of the subject on Form ES-301-1. The number of subjects required for each topic corresponds with the number of blanks on the form.
   (SLIDE-T)

R9D

3. Determine the best method to evaluate each subject and briefly describe the method you plan to use on Form ES-301-1 (e.g., the title of any JPMs you plan to administer and a brief summary of the proposed questions). Either one of the following methods may be used:

   One Administrative JPM may be selected from the facility bank or developed (e.g., having the applicant perform a tagout could cover tagging, P&IDs, maintenance, TS operability, etc.) (this is the preferred method)

   OR

   Two prescripted questions of an administrative nature can be asked independently or added to the JPMs performed as part of the Category B evaluation

   Short answer format (2-3 sentences) is best; avoid direct look-up questions that allow the use of references; see the other guidelines on Attachment 1 of ES-301 (p. 4-5 of Appendix C in Interim Rev 8)

   Should have an operational orientation at the analysis, synthesis, or application level; others should not permit the use of references

Topic A.3 (Rad Con) is best covered during the conduct of JPMs associated with the local plant operations part of Category B

The applicant's license level should dictate the scope and depth of material covered under each administrative subject.

Try to cover as many of the administrative topics as possible during Categories B and C of the operating test.

4. Sign Form ES-301-1 and forward it to the chief examiner

The test outlines are nominally due 75 days before exam date and the final JPMs/questions are due at 45 days

c. General guidelines

Be thoroughly familiar with how the task is performed and how it is to be evaluated

Complex JPMs should be validated to assist in time planning; particularly important if NRC-developed

Whenever possible use the simulator to provide optimum conditions for task performance and evaluation

All JPMs / questions must be prescripted to the maximum extent possible

Maximize efficiency by sharing in exam preparation

Have all examiners administer the same exam on same day (vary sequence to limit interference)

Prepare and administer one exam the entire week (each applicant gets same of JPMs on any day)

3. Walk-through Exam Review

a. Review Learning Objectives

b. Review the standard forms

1. Form ES-301-1, Admin. Topics Outline

2. Form ES-301-2 - Control Room Systems and Facility Walk-through Test Outline

3. Form ES-201-2, Examination outline QA checklist

4. Form ES-602-1 - Open Reference Test Item Checklist (Recommended)

5. Form ES-C-2 - JPM Quality Checklist

6. Form ES-C-1 - JPM Worksheet

7. Form ES-301-3 - Operating Test QA Checklist

c. Review program goals

1. Maximize examination validity and reliability (consistency)

To ensure consistency, develop and administer exams IAW ES (Per Sup. 1, Region must get approval to deviate from intent of ES or take initiatives that may undermine consistency.)

Maximize use of facility exam material within limits established in the ES

Minimum K/A importance of 2.5, unless lower number justified by recent events (LERs, system changes, etc)

Integrate the three segments of the examination to achieve broad, balanced coverage

Maximize use of higher order questions (not memory level)

Maximize use of the simulator to administer JPMs

2. Maximize efficiency in exam administration

Integrate Categories A, B and C to the extent possible

Maximize use of facility-developed material

Minimize simulator bottlenecking: minimize setup time; use parallel paths when possible (independent JPMs with common ICs can double-up)

All examiners administer same walk-through each day or administer one test incrementally during week; run back-to-back simulator tests

F. Walk-through Examination Exercise Instructions

1. Work as an examination team and select three tasks (each from a different safety function) that can be done on the simulator using the same initial condition. The designated chief examiner will be in charge.

2. Each student shall then prepare one complete JPM, including all applicable ES Forms.

3. If desired and time permits, the JPMs can be dry-run on Wednesday afternoon after the simulator scenarios have been validated.

4. All JPMs should be turned in by COB Wednesday so they can be reviewed and returned to you prior to administration on Thursday afternoon.

PREPARATION OF OPERATING TESTS OBJECTIVES

A. Terminal

1. Construct a simulator scenario set.

2. Construct a JPM.

B. Enabling

1. Describe required scenario set events.

2. Describe the eight competencies.

3. Describe scenario development steps and use of Standard Forms.

4. Describe the elements of a JPM.

5. Describe the minimum JPM / question requirements.

6. Describe walk-through development steps and use of Standard Forms.

7. Describe how exam validity, reliability, and efficiency are achieved.

PROS AND CONS

Pros

1. Direct observation rather than inference
2. Best for assessing performance-based skills
3. Can probe understanding

Cons

1. Labor intensive
2. Prone to observation and evaluation errors
3. Subject to inconsistency among examiners

OPERATING TEST CONTENT PER 10 CFR 55.45(a)

1. Perform pre-startup procedures

2. Manipulate console controls between shutdown and designated power level

3. Identify annunciators and signals and perform remedial actions

4. Identify instrument systems and significance of readings

5. Observe and safely control the facility

6. Perform control manipulations during normal, abnormal, and emergency situations

7. Safely operate the facility's heat removal systems

OPERATING TEST CONTENT
PER 10 CFR 55.45(a)

8. Safely operate the facility's auxiliary and emergency systems

9. Demonstrate or describe the use and function of the facility's radiation monitoring systems

10. Demonstrate knowledge of significant radiation hazards

11. Demonstrate knowledge of the emergency plan for the facility

12. Demonstrate the knowledge and ability to assume responsibility for safe operation of the facility

13. Demonstrate the ability to function within the control room team

OPERATING TEST OVERVIEW

1. 10 CFR 55.45(b) requires two parts

   - Plant walk-through
   - Simulation facility

2. Procedurally divided into three categories

   - Administrative Topics
   - Systems (Control room and In-plant)
   - Integrated Plant Operations (dynamic simulator test)

3. Examination Standards organized according to operating test phases

   - Preparation - ES-301
   - Administration - ES-302
   - Documentation / Grading - ES-303

SCENARIO DEVELOPMENT PROCESS

1. Identify objectives
2. Identify initial conditions
3. Select events
4. Identify endpoints
5. Complete Scenario Outline
6. Determine Expected Operator Actions
7. Check for adequacy of coverage
8. Submit for review
9. Validate the scenario

Senior Reactor Operator Competencies

a. Understand and Interpret Annunciators and Alarm Signals

The ability to *notice and attend* to alarms, prioritize attention, *interpret the significance* of each alarm, and *verify* that it is *consistent* with plant (with the use of ARPs, as appropriate). It does *not* include the ability to diagnose overall plant and system status on the basis of other indications.

b. Diagnose Events and Conditions Based on Signals and Readings

The ability to *diagnose* plant conditions that do not meet specifications, including the ability of both the supervisor and the crew to *recognize and analyze off-normal trends* and *use* control room *reference materials*. It does *not* include knowledge of system operation or the understanding of how one's actions affect the plant/system conditions.

c. Understand Plant and System Response

Knowledge of system operation, including set points, interlocks, and automatic actions. It includes the ability to *locate and remain attentive* to control room indicators, *interpret* those indicators to *verify* the status and operation of systems, and *understand* how one's *actions and directives affect plant and system conditions*. It does *not* include the ability to notice or attend to annunciator and alarm signals or to diagnose events.

d. Comply With and Use Procedures

The ability to *refer to and comply with* normal, abnormal, emergency, and administrative *procedures* in a timely manner (i.e., in sufficient time to avoid adverse impacts on plant status), including the ability to ensure correct *implementation by the crew*.

Senior Reactor Operator Competencies

e. Operate the Control Boards

The ability to *locate and manipulate* controls to attain a desired plant/system response, including the ability to take *manual control* of automatic functions, when appropriate.

f. Communicate and Interact With the Crew and Other Personnel

The ability to *provide and receive* pertinent *information* in a clear, easily understood manner, including the ability to *keep crew and outside personnel informed.*

g. Direct Shift Operations

The ability to take *timely and decisive actions*, give *timely and well thought out directions* that show *concern for safety*, encourage a *team approach* by *soliciting and incorporating crew feedback*; and to remain in a position of *oversight.*

h. Comply With and Use Technical Specifications

The ability to *recognize* conditions covered by TS, including the ability to *locate* the appropriate TS and *ensure correct compliance* with any conditions and actions.

QUANTITATIVE SCENARIO ATTRIBUTES

1.	Total malfunctions	5-8
2.	Malfunctions after EOP entry	1-2
3.	Abnormal events	2-4
4.	Major transients	1-2
5.	EOPs entered/requiring substantive actions	1-2
6.	EOP contingencies requiring substantive actions	0-2
7.	Critical tasks	2-3

CRITICAL TASK CRITERIA

1. Safety significance
2. An external stimulus/cue
3. Measurable performance indicators
4. Performance feedback

SCENARIO SOURCES AND REFERENCES

1. PWR / BWR K/A Catalogs
2. BWR / PWR Off-Normal Events Description (NUREG-1291)
3. Facility scenarios
4. Regional scenario banks
5. Actual events (LERs)
6. Other facility documents
    - Procedures
    - Technical Specifications
    - Training material
    - Simulator manual
    - PRA/IPE

GENERAL SCENARIO GUIDELINES

1. Integration
2. Sequencing
3. Normal evolutions
4. Make them show their stuff
5. Maintain realism and credibility
6. Timing
7. Level of difficulty

DRAFT REV 9
SIMULATOR CHANGES

- Category C ⇨ "Simulator Operating Test"
- Reactivity and normal evolutions may be replaced with additional instrument or component malfunctions
- ES-D-2 "expected"⇨ "required" actions
- Some competencies on Form ES-301-6 have been consolidated

BUILDING A JPM

1. Specify initial conditions and an initiating cue

2. Identify references and tools

3. Develop performance criteria

   - Task standard
   - Critical steps and other expected actions
   - Important observations
   - Sequence restrictions

4. Develop examiner cues

   - System response
   - Other instructions

5. Develop a time standard

6. Be prepared to ask questions

WALK-THROUGH DEVELOPMENT PROCESS

Category B

1. Select systems
2. Select tasks
3. Review / develop JPMs
4. Review / develop questions
5. Complete Test Outline

ALTERNATIVE PATH JPMS SHOULD ...

1. have a facility-endorsed success path

2. be driven by procedure or policy

3. be logical and realistic

4. not rely on other control room operators

5. be validated in advance

WALK-THROUGH DEVELOPMENT PROCESS

Category A

1. Coverage options
    a. Administrative JPMs
    b. Prescripted questions
2. Maximize integration
3. Save for last

SYSTEM WALK-THROUGH COVERAGE REQUIREMENTS

LICENSE LEVEL	SUBCATEGORY B.1	SUBCATEGORY B.2	TOTAL JPMS
RO & SRO(I)	7	3!	10+
SRO(U)	2/3@	3/2!	5#

Each system or evolution in a subcategory should be from a different safety function and the same system should not be used for more than one safety function in a subcategory.

At least 1 JPM shall be related to a shutdown or low power condition and 40% of the JPMs shall require the applicant to exercise alternate procedural paths.

\+ Evaluate at least 7 different safety functions.

@ One system or evolution must be an ESF.

\# Each system or evolution must be from a different safety function.

! One task shall evaluate response to an emergency or abnormal condition and one shall require entry to the RCA.

MAXIMIZE EXAM VALIDITY AND RELIABILITY

1. To ensure consistency, develop and administer exams IAW ES

2. Maximize use of facility exam material

3. Minimum K/A importance of 2.5

4. Integrate the three segments of the examination

5. Maximize use of higher order questions

6. Maximize use of the simulator to administer JPMs

MAXIMIZE EFFICIENCY

1. Integrate Categories A, B and C to the extent possible

2. Maximize use of facility-developed material

3. Minimize simulator bottlenecking: minimize setup time; use parallel paths when possible

4. All examiners can administer same walk-through each day or administer one test incrementally during week; run back-to-back simulator tests

DRAFT REV 9
WALK-THRU CHANGES

- Categories A and B ⇨ "Walk-Through"
- The "Walk-Through" will be all JPMs
- RO administrative and control room systems coverage changed
- Alternate path JPMs from 40 - 60%