

2017 NRC – Industry Operator Licensing Workshop

Simulator Scenario Development & Experience

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- The simulator test outline and test shall be prepared in accordance with the guidelines in ES-301 and Appendix D.
- A facility supervisor or manager shall independently review the outline and the proposed examination before they are submitted to the NRC.
- An authorized representative of the facility licensee shall approve the examination outline and the proposed examination before they are submitted to the NRC for review and approval. The outline and examination should be forwarded to the NRC regional office with a cover letter signed by the facility representative.
- The materials must be complete and ready-to-use.

ES-201

Examination Outline Quality Checklist For

Form ES-201-2

| - | | - | - | - |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-----|
| em | Task Description | a | Initial | s |
| 1. | a. Verify that the outline(s) fit(s) the appropriate model, in accordance with ES-401. | - | | F |
| RI | Assess whether the outline was systematically and randomly prepared in accordance with Section D.1 of ES-401 and whether all K/A categories are appropriately sampled. | | | |
| r r | c. Assess whether the outline over-emphasizes any systems, evolutions, or generic topics. | \square | | F |
| 4 | d. Assess whether the justifications for deselected or rejected K/A statements are appropriate. | | | Г |
| 2. | Using Form ES-301-5, verify that the proposed scenario sets cover the required number of normal evolutions, instrument and component failures, technical specifications, and major transients. | | | 4 |
| | b. Assess whether there are enough scenario sets (and spares) to test the projected number and mix of applicants in accordance with the expected crew composition and rotation schedule without compromising exam integrity, and ensure that each applicant can be tested using at least one new or significantly modified scenario, that no scenarios are duplicated from the applicants' audit test(s), and that scenarios will not be repeated on subsequent days. | | | ¥ |
| R | c. To the extent possible, assess whether the outline(s) conform(s) with the qualitative and quantitative criteria specified on Form ES-301-4 and described in Appendix D. | | R | |
| 3. V r | a. Verify that the systems walk-through outline meets the criteria specified on Form ES-301-2: (1) the outline(s) contain(s) the required number of control room and in-plant tasks distributed among the safety functions as specified on the form (2) task repetition from the last two NRC examinations is within the limits specified on the form (3) no tasks are duplicated from the applicants' audit test(s) (4) the number of new or modified tasks meets or exceeds the minimums specified on the form (5) the number of alternate path, low-power, emergency, and RCA tasks meet the criteria on the form. | | | |
| | b. Verify that the administrative outline meets the criteria specified on Form ES-301-1: (1) the tasks are distributed among the topics as specified on the form (2) at least one task is new or significantly modified (3) no more than one task is repeated from the last two NRC licensing examinations | | | |
| | c. Determine if there are enough different outlines to test the projected number and mix of applicants and ensure that no items are duplicated on subsequent days. | | | |
| | Assess whether plant-specific priorities (including PRA and IPE insights) are covered in the appropriate exam sections. | | | |
| | b. Assess whether the 10 CFR 55.41/43 and 55.45 sampling is appropriate. | | | |
| 1 | c. Ensure that K/A importance ratings (except for plant-specific priorities) are at least 2 5. | | | |
| | d. Check for duplication and overlap among exam sections. | | | |
| | e. Check the entire exam for balance of coverage. | | | |
| | f. Assess whether the exam fits the appropriate job level (RO or SRO). | | | |
| Auth | or Printed Name/Signature | | Da | ate |
| Facil NRC NRC | ity Reviewer (*) Chief Examiner (#) Supervisor | | _ | |

Facility – Date of Exam

Using ES-301-5 – needs to be developed with the outline.

Make sure there are enough scenarios.

- Everyone <u>but</u> SRO-U will need to be ATC.
- ROs must also be BOP.
- Reference ES-301-5

Another form: ES-301-4

-These show up later.



D-41



Simulator Operating Test



- This is the most performance-based aspect of the operating test and is used to evaluate the applicant's ability to safely operate the plant's systems under dynamic, integrated conditions.
- The simulator test is administered in a team format with up to three applicants (or surrogates) filling the RO and SRO license positions (as appropriate) on an operating crew.
- Each team or crew of applicants is administered a set of scenarios designed so that the examiners can individually evaluate each applicant on a range of competencies applicable to the applicant's license level.
- Each applicant must demonstrate proficiency on every competency applicable to their license level. The only exception is that SRO Competency Number 3, "Control Board Operations," is optional for SROupgrade applicants.

ES-303

Form ES-303-1

3.a PRIVACY ACT INFORMATION-FOR OFFICIAL USE ONLY

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|-------------------------------|---------------------------------------------------------------------------------------------|---------------|-----------------------------------------|--------------|-----------------|---------------------|
| | Competencies/ Rating Factors (RFs) | RF Weights | RF Scores | RF Grades | Comp. Grades | Comment Page No. |
| 1. Inte a. b | erpretation/Diagnosis Recognize and Verify Status Internet and Diagnose | - | <u></u> | 3 - | | |
| с. | Conditions Prioritize Response | _ | _ | _ | | _ |
| 2. Pro a. b. c. | ocedures/Tech. Specs. Reference Procedure Compliance Tech. Spec. Entry | | \equiv | | _ | \equiv |
| 3. Op Co a. b. c. | erate Plant Component htrols Locate and Manipulate Understanding Manual Control | | = | = | |]]] |
| 4. Co a. b. c. | mmunications Provide Information Receive Information Carry Out Instructions | | = | = | | |

[Note: Enter RF weights (nominal, adjusted, or "0" if not observed (N/O)); RF scores (0, 1, 2, 3, or N/O); and RF grades from Form ES-303-3 and sum to obtain Competency Grades.]

PRIVACY ACT INFORMATION-FOR OFFICIAL USE ONLY 3.b

ES-303

Form ES-303-1

PRIVACY ACT INFORMATION-FOR OFFICIAL USE ONLY

| Senior Reactor Operator Simulat | or Operatin | g Test Gra | ding Detail | s | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--------------|-----------------|---------------------|
| Competencies/ Rating Factors (RFs) | RF Weights | RF Scores | RF Grades | Comp. Grades | Comment Page No. |
| Interpretation/Diagnosis Recognize and Attend Ensure Accuracy Understanding Diagnose | | | | - | |
| 2. Procedures a. Reference b. EOP Entry c. Correct Use | | = | _ | 8 | |
| Operate Plant Component Controls Locate and Manipulate Understanding Manual Control | | | | Ţ | |
| Communications Clarity Crew and Others Informed Receive Information | \equiv | = | \equiv | _ | \equiv |
| 5. Directing Operations a. Timely and Decisive Action b. Oversight c. Solicit Crew Feedback d. Monitor Crew Activities | | | | _ | |
| 6. Technical Specifications a. Recognize b. Locate c. Compliance | | Ξ | | | |

[Note: Enter RF weights (nominal, adjusted, or "0° if not observed (N/O)); RF scores (0, 1, 2, 3, or N/O); and RF grades from Form ES-303-4 and sum to obtain Competency Grades.]

PRIVACY ACT INFORMATION-FOR OFFICIAL USE ONLY

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Responsibilities



The facility licensee is responsible for the following activities

- Prepare proposed examination outlines.
- Submit the reference materials necessary for the NRC regional office to prepare and/or review the requested examinations.
- Prepare and review the final operating tests in accordance with the previously approved examination outline and submit the tests to the NRC's regional office in accordance with ES-201.
- Review the comments on the proposed examination outlines and tests with the chief examiner via telephone, or in-person if necessary.
- Make the simulation facility available, as necessary, for NRC examiners to prepare for the operating tests.

Responsibilities



- Meet with the NRC examination team in the regional office or at the facility, when and as necessary, to review the proposed operating tests and discuss potential changes.
- Revise the operating test outlines and the final tests as applicable and <u>as</u> <u>agreed</u> upon by the NRC regional office.
- The NRC retains final authority to approve the operating tests.

GENERAL GUIDELINES



- Use the same simulator scenario all day, if possible. The same JPMs and simulator scenarios shall not be repeated on subsequent days.
- Operating tests may not duplicate test items from the applicants' audit test.
 - The facility licensee shall identify for the NRC chief examiner those simulator events that are similar to those that were tested on the audit examination.
- Sufficient operating test materials shall be developed to ensure that all applicants can be tested with the available personnel according to the schedule agreed upon by the NRC's regional office and the facility licensee.
- To the extent permitted for each part of the operating test, select and modify testing materials (i.e., JPMs and simulator scenarios) from your facility's examination banks.



- Consider the K/As associated with normal, abnormal, and emergency tasks and evolutions as a source of topics for use in evaluating applicant competency in each part of the operating test.
- The K/As associated with the tasks and questions planned for the operating test should have importance factors of at least 2.5.
- The K/As should be appropriate to the plant-specific requirements for the applicant's license level. Your facility licensee's site-specific task list may be used to supplement or override, on a case-by-case basis, selected individual items in the NRC's K/A catalogs.
- When selecting and developing scenarios for the operating test, ensure that the materials contribute to the test's overall capacity to differentiate between those applicants who are competent to safely operate the plant and those who are not.
- SRO applicants, whether upgrade or instant, will be examined for the highest on-shift position for which the SRO's license is applicable



To differentiate the SRO operating test from that of an RO:

- ✓ In directing licensed activities, the SRO must evaluate plant performance and make operational judgments accordingly.
- In directing licensed activities, the SRO must have a broader and more thorough knowledge of facility administrative controls and methods, including limitations imposed by the regulations and the facility's technical specifications and their bases.
- The SRO may be assigned responsibilities for auxiliary systems that are outside the control room (e.g., waste disposal and fuel handling systems) and are not normally operated by licensed operators. Because the SRO may have these additional responsibilities, the SRO license applicant should demonstrate knowledge of the designs of such systems as they relate to maximum permissible concentrations, effluent release rates, and other radiological considerations.

Specific Instructions for the "Simulator Operating Test"



- Based on the anticipated crew compositions, determine the number of scenarios and scenario sets necessary to rotate each RO and SRO-I applicant into the "at-the-controls" position.
- The crews and scenarios will have to be planned so that every SRO applicant (U and I) fills the supervisory role and every RO applicant rotates through the balance-of-plant (BOP) position for at least one scenario.
- SRO-U applicants are given credit for their previous RO license evaluation and experience and are normally not required to manipulate the controls.
- The initial conditions, normal operations, malfunctions, and major transients should be varied among the scenarios and should include startup, low-power, and full-power situations.

- You should have a spare scenario in accordance with ES-302.
- The simulator operating tests will be constructed by selecting and modifying scenarios from existing facility licensee or NRC scenario banks and by developing new scenarios.
 - Compliance with ES-301-4, "Simulator Scenario Quality Checklist" and ES-301 D.5.
 - The quantitative attribute target ranges that are specified on the form are not absolute limitations; a scenario that does not fit into these ranges shall be evaluated to ensure that the level of difficulty is appropriate.
- To maintain test integrity, <u>every scenario shall be new or</u> <u>significantly modified</u> to ensure that the applicant has not had the opportunity to rehearse or practice the scenario. A significant modification means that, at least two events have not been used on the previous two NRC initial licensing operating exams.
 - Reactivity manipulation events are exempt from this overlap limit.



Critical Tasks (CTs)

Covered in Appendix D and ES-303

The CTs initially incorporated into the scenario are referred to as "preidentified CTs."

- ES-301-4 outlines the target number of preidentified CTs per scenario.
- CTs are described on each ES-D-1 form
- CTs include two parts:
 - Expected action
 - Safety-significant boundary conditions that clearly identify at what point a CT must be accomplished
- Whenever possible, CTs should be distributed so that each applicant is required to respond

Operator actions during the scenario (individual or crew) may "create" a new CT. These are considered "post scenario CTs."

• Boundary conditions are inherent to the CT itself.

ES-301

Simulator Scenario Quality Checklist

Form ES-301-4

| Facilit | y: Date of Exam: Scenario Numbers: | / / Operat | ting Test | No.: | | Realistic |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------|----------|---------|--------------------------------|
| QUALITATIVE ATTRIBUTES | | | | Initials | | Related Events |
| The initial conditions are realistic in that some equipment and/or instrumentation may be out of service, but it does not cue the operators into expected events. | | | K | | | |
| 2. The scenarios consist mostly of related events. | | | K | | | Event Descriptions |
| 3. Each event description consists of the following: the point in the scenario when it is to be initiated the malfunction(s) or conditions that are entered to initiate the event the symptoms/cues that will be visible to the crew | | | K | | | Laws of Nature |
| | the event termination point (if applicable) | | | | | Reasonable Sequence |
| . т | he events are valid with regard to physics and thermodynamics. | | K | | | T |
| Sequencing and timing of events is reasonable and allows the examination team to obtain complete evaluation results commensurate with the scenario objectives. | | | | | | Time Compression |
| If time compression techniques are used, the scenario summary clearly so indicates. Operators have sufficient time to carry out expected activities without undue time constraints. Cues are given. | | | | | | No Sim Software Changes |
| т. т | The simulator modeling is not altered. | | * | | | Validated Scenarios |
| 8. The scenarios have been validated. Pursuant to 10 CFR 55.46(d), any open simulator performance deficiencies or deviations from the referenced plant have been evaluated to ensure that functional fidelity is maintained while running the planned scenarios. | | | * | ++ | | Seconario Quality (D/44 shares |
| 9. 5 | Scenarios are new or significantly modified in accordance with Section D.5 of ES-301. | | + | | | Scenario Quality (R/11 change |
| 10. A | Il individual operator competencies can be evaluated, as verified using Form rm along with the simulator scenarios). | ES-301-6 (submit the | + | | | All competencies |
| 11.] | he scenario set provides the opportunity for each applicant to be evaluated i ating factors. (Competency rating factors as described on Forms ES-303-1 | in each of the applicable and ES-303-3.) | + | | | Min # of T&E for grading |
| Each applicant will be significantly involved in the minimum number of transients and events specified on Form ES-301-5 (submit the form with the simulator scenarios). | | | | | | |
| Applicants are evaluated on a similar number of preidentified critical tasks across scenarios, when possible. | | | * | | | Min. # of T&E for evaluation |
| 4. 1 | he level of difficulty is appropriate to support licensing decisions for each cre | w position. | K | | | Critical Tasks (D(11 shanse) |
| | Target Quantitative Attributes per Scenario (See Section D.5.d) | Actual Attributes | - | - | | Cilical lasks (R/II change) |
| È. | Malfunctions after EOP entry (1-2) | 1 1 | | | | Loval of Difficulty |
| 2. | Abnormal events (2-4) | 1 1 | | | - 1 - 2 | Level of Difficulty |
| 8. | Major transients (1-2) | 1 1 | | | | Ovelitetive Attailentes |
| Ē. | EOPs entered/requiring substantive actions (1-2) | 1 1 | | - | | Qualitative Attributes |
| 5. | Entry into a contingency EOP with substantive actions (\geq 1 per scenario set) | 1 1 | | | | |
| 6. | Preidentified critical tasks (≥ 2) | 1 1 | | | | |



- The required instrument and component failures should normally be completed before starting the major transient; those that are initiated after the major transient should be carefully reviewed because they may require little applicant action and provide little insight regarding their performance.
- Any normal evolution, component failure, or abnormal event (other than a reactor trip or other automatic power reduction) that requires the operator to perform a *controlled* power or reactivity change will qualify as a reactivity manipulation.
- Each scenario set must also allow the examiner to evaluate the applicant's performance on each competency and rating factor that is germane to the applicant's license level.



- To minimize the need to run an additional scenario if an applicant makes a single, uncompensated error related to a rating factor (refer to ES-302, Section D.3.n), it is recommended that each applicant be given multiple opportunities to demonstrate competence in any particular area.
- If you normally operate with and are required by technical specifications to have more than two ROs in the control room, the chief examiner may authorize the use of additional surrogates to fill out the crews.
- Appendix D provides detailed instructions for completing Form ES-D-1, the "Scenario Outline," and Form ES-D-2, the "Required Operator Actions," that examiners will use to administer the simulator operating tests.



- When the proposed simulator operating test outlines are complete, forward them to the NRC chief examiner.
- Operating test outlines reviewed and comments provided to licensee within 2 weeks.
- After the NRC chief examiner approves the simulator test outline, prepare the final simulator test materials by revising any Form ES-D-1 as requested by the NRC chief examiner and completing a detailed operator action form (ES-D-2) for each event.
- Review the completed simulator operating test for quality using Form ES-301-4, "Simulator Scenario Quality Checklist," and make any changes that might be necessary.
- Submit the entire operating test package to the NRC chief examiner for review and approval. The NRC's chief examiner must receive the test approximately 75 days before the scheduled administration date.



- The outline and the proposed test shall be independently reviewed by a supervisor/manager before they are submitted to the NRC for approval.
- The NRC chief examiner shall ensure each operating test is independently reviewed for content, wording, operational validity, and level of difficulty, per ES-301-3, ES-301-4, and ES-301-7.
- The NRC chief examiner will review any changes that need to be made with the branch chief before reviewing the examinations with the author or facility contact.
- Upon branch chief approval, and generally at least **35** days before the operating tests are scheduled to be given, the chief examiner will review the test comments with the facility licensee.

Attachments/Forms



- Attachment 1, "Open-Reference Question Guidelines"
- Attachment 2, "Verifiable Action Guidelines"
- Form ES-301-1, "Administrative Topics Outline"
- Form ES-301-2, "Control Room/In-Plant Systems Outline"
- Form ES-301-3, "Operating Test Quality Checklist"
- Form ES-301-4, "Simulator Scenario Quality Checklist"
- Form ES-301-5, "Transient and Event Checklist"
- Form ES-301-6, "Competencies Checklist"
- Form ES-301-7, "Operating Test Review Worksheet"