A. PURPOSE

This standard specifies the requirements, procedures, and guidelines for preparing site-specific written examinations for the initial licensing of reactor operator (RO) and senior reactor operator (SRO) applicants at power reactor facilities.

B. BACKGROUND

The content of the written licensing examinations for ROs and SROs is dictated by 10 CFR 55.41 and 55.43, respectively. Each examination shall contain a representative selection of questions concerning the knowledge, skills, and abilities (K/As) needed to perform duties at the desired license level.

The written operator licensing examination is administered in two sections, including a generic fundamentals examination (GFE) and a site-specific examination. The GFE covers those K/As that do not vary significantly among reactors of the same type (i.e., pressurized or boiling water) and is generally administered early in the license training process (refer to ES-205 for a description of the program). The instructions in this standard apply only to the site-specific examination.

Except as noted in Section D.1.b, the "Knowledge and Abilities Catalog[s] for Nuclear Power Plant Operators: Pressurized [and Boiling] Water Reactors," NUREG-1122 and -1123, respectively, provide the basis for developing content-valid licensing examinations. Each K/A stem statement has been linked to the applicable item number in 10 CFR 55.41 and/or 55.43. Preparing the license examination using the appropriate K/A catalog, in conjunction with the instructions in this NUREG, will ensure that the examination includes a representative sample of the items specified in the regulations.

C. RESPONSIBILITIES

1. Facility Licensee

The facility licensee will perform the following activities, as applicable, depending upon the examination arrangements confirmed with the NRC regional office (in accordance with ES-201) approximately four months before the scheduled examination date:

a. Prepare the proposed examination outline(s) in accordance with Section D.1, and submit the outline(s) to the NRC regional office for review and approval in accordance with ES-201.

b. Submit the reference materials necessary for the NRC regional office to prepare and/or validate the requested examination(s) (refer to ES-201, Attachment 2).

c. Prepare the proposed examination(s) in accordance with Sections D.2 through D.4, review the examination(s) in accordance with Section E, and submit the examination(s) to the NRC regional office in accordance with ES-201.

d. Meet with the NRC in the regional office or at the facility, when and as

necessary, to review the proposed examination(s) and discuss potential changes (refer to ES-201).

e. Revise the proposed examination outline(s) and examination(s) as agreed upon with the NRC regional office; however, the NRC retains final authority to approve the examination.

f. Facility licensees that prepare the examination shall ensure that appropriate controls are implemented to keep the comprehensive audit or screening examination that is given at or near the end of the license training class from compromising the integrity of the licensing examination. Examples of acceptable control measures are as follows:

- the facility licensee could prepare the audit examination using a systematic and random sampling process that is similar to that used to prepare the NRC licensing examination as discussed in Section D; or

- the facility licensee could prepare and finalize the audit examination before it begins developing the NRC licensing examination outline as discussed in Section D; or

- the facility licensee could certify as part of the examination submittal that there is no question duplication between the facility licensee's audit and the NRC licensing examinations.

2. NRC Regional Office

The NRC regional office will perform the following activities:

a. Ensure that the examinations are prepared in accordance with Section D.

b. Ensure that the examinations are reviewed for quality as described in Section E.

c. Meet with the facility licensee, when and as appropriate, to prereview the examination(s) in accordance with ES-201.

D. EXAMINATION PREPARATION

1. Develop the Outline

Develop each written examination outline in accordance with the following general instructions:

a. Select the appropriate examination outline model for the licensing examination being developed (i.e., RO or SRO, BWR or PWR) from Forms ES-401-1 through ES-401-4; Form ES-401-5, "Generic Knowledge and Abilities Outline," applies to all examinations.

b. Systematically and randomly select specific K/A statements (e.g., K1.03 or A2.11) from NUREG-1122 (for PWRs) or -1123 (for BWRs) to complete each of

the three tiers (i.e., Tier 1, Emergency and Abnormal Plant Evolutions; Tier 2, Plant Systems; and Tier 3, Generic Knowledges and Abilities) of the examination outline. In order to maintain examination consistency, the facility licensee's site-specific K/A list shall not be used in place of the K/A catalog. Attachment 1 provides an example of an acceptable methodology for randomly selecting 100 K/As within the defined structure of the examination outline. Other methodologies may be used provided they are reproducible and scrutable and yield an examination outline that is free of bias, ~~and~~ adheres to the applicable examination model, and samples at the specific K/A statement level. The ~~examination author may be requested to explain to the NRC chief examiner the systematic~~ facility licensee shall, when it submits the examination outline to the NRC, describe (in sufficient detail for the NRC to confirm that it meets the systematic and random selection criteria) the process that was used to develop the examination outline. Examples of adequate documentation would include: (1) a statement that the facility licensee used the sampling process described in Attachment 1; (2) identification of the industry standard or widely-available commercial product that was used; (3) a statement that the NRC developed the examination outline; or (4) a description or copy of the facility licensee's process document.

~~Distribute the K/As among the three tiers as specified for the applicable outline, select topics from as many different systems and evolutions as possible, and distribute the topics among the K/A categories (e.g., K1 through K6, A1 through A4, and G, or generic, for Tier 1), with at least two topics from each category applicable to each tier of the outline. This will help ensure that a valid sample is maintained even if selected questions have to be deleted during the grading process. Avoid selecting more than two or three topics from a given system or evolution unless they are related to a plant-specific priority (refer to Item (c) below.~~ The topics for the generic K/A category in Tiers 1 and 2 (i.e., Column "G" on Forms ES-401-1 through ES-401-4) and the four K/A categories in Tier 3 (i.e., "Conduct of Operations," "Equipment Control," Radiation Control," and "Emergency Procedures/Plan") shall be selected from Section 2, "Generic Knowledges and Abilities," of the applicable K/A catalog. However, only those topics that are relevant to the selected evolution or system shall be included in the sample for Tiers 1 and 2.

If the systematic selection process identifies a K/A ~~topic~~ statement having an importance rating that is below 2.5, a K/A statement that clearly does not apply to the subject facility, or a K/A category that contains no K/A ~~topics~~ statements, systematically and randomly select another K/A category ~~and topic~~ and/or statement, as applicable. K/A ~~topics~~ statements with importance ratings below 2.5 may be justified on the basis of plant-specific priorities. Failure to train the applicants on a K/A statement is not an acceptable basis for rejecting the statement. The facility licensee shall document, and submit to the NRC with the completed outline, the basis for excluding from the examination outline any K/A statements that were randomly selected. Alternatively, if the facility licensee screened the entire K/A catalog to eliminate inapplicable K/A statements before beginning the random selection process, the associated documentation and justification shall be available for NRC review.

Enter the K/A statement numbers, a brief description of each topic, the topics' importance ratings for the license level of the exam, and the point totals (system, category, group, and tier) on the examination outline. The point totals for each group and tier must match the number specified on Form ES-401-1, 2, 3, or 4, as applicable.

~~Ensure that the outline used during successive audit and licensing examinations does not become repetitive and predictable.~~ If a facility licensee proposes to use an outline that was previously used at the subject or another facility, it shall identify the source of the outline and explain what effect its reuse is expected to have on examination integrity.

c. Special attention is required to ensure that the SRO examination tests at the appropriate level and is distinguishable from the RO examination. The SRO outline shall include at least 25 K/A statements that relate to the topics in 10 CFR 55.43(b) or to 55.41(b) topics for which the facility licensee has SRO-only learning objectives. These K/A statements shall be distributed such that Tier 3 includes at least 10 SRO-only K/A statements, with at least 15 additional SRO-only statements about evenly distributed among the "(E)A2" and "G" K/A categories in Tiers 1 and 2. (Note that these are the only K/A categories in NUREG-1122 and -1123 that have been (or, in the case of Category "A2" in NUREG-1123, should have been) linked to 10 CFR 55.43.)

If the SRO outline is being adapted from a previously-completed RO outline, it is important to note that a system or evolution that is in one group on the RO outline may not be in the same group on the SRO outline. Therefore, some of the RO K/A statements may have to be replaced if they cause a group point total to exceed the number specified on the SRO outline. If all 36 K/A statements in Tier 1 of the RO outline are useable, the 7 additional K/A statements required to complete Tier 1 of the SRO outline (43 total) should be selected from K/A Categories "(E)A2" and "G." At most, 40 of the 51 K/A statements in Tier 2 of the RO outline will be useable on the SRO outline; some K/A statements may have to be replaced to reach an acceptable number of statements in Categories "A2" and "G."

~~c~~ d. After systematically selecting 100 K/As for the examination, the examination author may identify up to ten additional K/As based on the facility licensee's site-specific task list or other plant-specific, high-priority topics (e.g., operating events or problems, PRA-identified risk-important systems and operator actions[1], and recent technological developments) that are appropriate for testing on the written examination. Enter the applicable information in the space provided at the bottom of Tier 2, Group 3 of the examination outline (i.e., the system/topic, an indication of which systematically selected K/A the plant-specific priority topic will replace, a brief explanation for making the substitution, and the proposed

[1] Chapter 13 of NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," identifies a number of risk-important human actions that may be appropriate for examination. In determining important operator actions, do not overlook actions that are relied upon or result in specific events being driven to low risk contribution. This will help identify those human actions, assumed to be very reliable, that might otherwise not show up in a list of risk-dominant actions.

number of examination points applicable to the topic).

~~d~~ e. After completing the outline, check the selected K/As for balance of coverage within and across the three tiers. Ensure that every applicable K/A category is sampled at least twice within each of the three tiers so that a valid sample will likely be maintained in the event some questions are deleted as a result of post-examination comments ~~and that the outline for an SRO examination adequately samples the additional topics required by 10 CFR 55.43(b)~~. Make any adjustments that might be necessary by systematically and randomly selecting replacement K/A statements. Also check the overall balance of the entire licensing examination, including the walk-through and the dynamic simulator test, and make any necessary adjustments. Document (and justify) all changes and submit the documentation to the NRC with the completed outline.

~~e~~ f. Review and submit the completed outline to the NRC chief examiner for review and approval in accordance with ES-201. Facility-developed outlines shall be independently reviewed by a facility supervisor or manager before being submitted to the NRC regional office in accordance with ES-201. Facility licensees are responsible for ensuring that contractor-prepared outlines meet the guidelines herein. The NRC must receive the outlines by the date agreed upon when the examination arrangements were confirmed (normally approximately 75 days before the scheduled examination date).

~~f~~ g. The NRC chief examiner will review the outline within five working days (or as otherwise agreed with the facility licensee) and provide comments and recommended changes, as appropriate. The chief examiner shall review the sampling methodology, including all K/A rejections and changes, to ensure it is unbiased. The chief examiner shall also review and approve the site-specific item or topic substitutions.

2. Select and Develop Questions

a. Prepare the site-specific written operator licensing examination using a combination of existing, modified, and new questions ~~in accordance with~~ that match the specific K/A statements in the previously approved examination outline (refer to Item D.1 and ES-201) and the criteria summarized below.

If it becomes necessary to deviate from the previously approved examination outline, discuss the proposed deviations with the NRC chief examiner and obtain concurrence. Be prepared to explain why the original proposal could not be implemented and why the proposed replacement is considered an acceptable substitute.

b. Ensure that each question is technically accurate and free of the following psychometric flaws that could diminish the validity of the examination. Appendix B provides a detailed discussion and examples of questions containing each of these and other errors; the parenthetic references identify the applicable sections of Appendix B and its Attachment 2. Appendices A and B contain more detailed instructions and guidelines for preparing and formatting content-valid examinations and should be referred to as necessary while preparing the

examination.

- implausible distractors (C.2.g, h, k; D)
- confusing or ambiguous language (C.1.c; E)
- confusing or inappropriate negatives (C.2.e; E.3)
- collection of true/false statements (C.2.c; F)
- backward logic (C.1.h; G)
- specific determiners (C.2.m)

c. Ensure that the questions will differentiate between competent and less-than-competent applicants, that they are appropriate for the job level being examined, and that they are operationally oriented when possible. Refer to Appendix A (Section C.2) and Appendix B (Section C.1.a and Section B of Attachment 2) for additional discussion of and examples to illustrate the concept of operational validity.

Establish a level of difficulty that discriminates between applicants who have and have not mastered the required knowledge, skills, and abilities. See Appendices A (Section C.3) and B (Section C.1.e and Section C of Attachment 2) for further guidance on setting individual test question level of difficulty. The applicant should be able to complete and review the examination within ~~five~~four hours.

In order to maintain examination quality and consistency, between 50 and 60 percent of the questions on the examination shall be written at the comprehension/analysis level. The cognitive level of any question drawn directly from a bank will be counted at its face value. Refer to Appendix B (Section C.1.d and Section A of Attachment 2) for further guidance regarding the levels of knowledge and sample questions written at each level.

d. ~~When both RO and SRO examinations are to be given at the same time, duplicate no more than 75 percent of the RO examination questions on the SRO examination, even though the RO and SRO examination outlines differ by only 11 points (i.e., SROs have 11 fewer points in Tier 2, 7 additional points in Tier 1, and 4 additional points in Tier 3).~~ The 25 SRO-level questions shall evaluate the additional knowledge and abilities required for the higher license level per 10 CFR 55.43(b) or the facility licensee's learning objectives and should be distributed among the three tiers of the examination as discussed in Section D.1.c. Questions related to 10 CFR 55.41(b) topics may also be appropriate SRO-level questions if they evaluate knowledge and abilities at a level that is unique to the SRO job position.

~~Similarly, SRO examinations that are not developed in conjunction with an RO examination shall also include at least 25 questions that evaluate knowledge and abilities required for the SRO license level per 10 CFR 55.43(b) or the facility licensee's learning objectives. The remaining questions may be appropriate for either license level.~~

e. All test questions shall be in the multiple choice format described in Appendix B. Each question shall have four possible answer choices and be worth one point.

f. To avoid compromising the integrity and security of the examination and to enhance consistency, observe the following limits on ~~question repetition and~~ bank use when preparing the examination:

- ~~Repeat no more than 25 questions on the examination (or examination set if an RO and SRO examination are prepared concurrently) from examinations, quizzes, or tests administered to the license applicants during their license training class or from the past two licensing examinations at the facility (an RO and SRO examination given at the same time count as one examination). The facility test/quiz limit does not apply to NRC-developed examinations because those materials are generally not available to NRC examiners.~~

- ~~Facility-written examinations shall repeat no questions directly from the applicants' audit examination (or examinations in the case of retake applicants) or similar testing vehicle given at or near the end of the license training class, unless the two examinations are written independently (i.e., no interface between the examination authors). In such cases, up to five questions may be coincidentally duplicated, and the facility licensee shall identify the duplicates to the NRC chief examiner.~~

- Take no more than 50 percent of the questions for the examination directly from the facility licensee's written examination question bank without significant modification. Questions that the facility licensee has obtained from another bank (e.g., a facility's bank or the INPO question bank) ~~and deposited in its own bank may~~ should normally be treated as "bank" questions ~~provided they have an equal chance of being selected for use on the examination~~.

- If the bank contains more than one question that fits a specific K/A statement, randomly select from among the available questions unless there is an appropriate basis for selecting a specific question (e.g., higher cognitive level, better discrimination validity, more operationally oriented, or site-specific priority).

- Write at least 10 new questions at the comprehension and analysis level, as described in Appendix B. Questions from another facility's bank may be treated as new items if they have not been made available for review and study by the license applicants and there is no basis (e.g., historical precedent or reciprocal arrangements with the other facility licensee) for the applicants to predict their use on the examination.

- Select the remaining questions for the examination from the facility licensee's bank, but significantly modify each question by changing ~~the~~ at least one pertinent condition~~s~~ in the stem and at least one distractor. Changing the conditions in the stem such that one of the three distractors in the original question becomes the correct answer would also be considered a significant modification. The intent or objective of the question does not necessarily have to be changed~~, but a~~. Adding or

deleting irrelevant information and making minor changes (e.g., the unit number, component train, or power level when it makes no difference) would not be considered a significant modification to the question.

g. A technical reference and a cross-reference to the facility licensee's examination question bank, if applicable, shall be noted for every question. If the facility licensee has a learning objective applicable to the question, it should be referenced as well. However, the absence of a learning objective does not invalidate the question provided it has an appropriate K/A and technical reference. Refer to ES-201 for additional instructions regarding the documentation of the source of questions on facility-written examinations.

To facilitate the review process, examination authors should consider providing a brief explanation of why the answer is correct, and each of the distractors is plausible but incorrect. This ***optional*** practice increases the efficiency of the examination review process and promotes the detection and correction of problem questions before the examinations are administered.

Reference materials such as diagrams, sketches, and portions of facility procedures may be used on a selective basis as attachments to the written examination. Ensure that any reference material used in the examination is easy to read and clearly marked, provides an effective and objective way for the applicant to demonstrate knowledge of the topic or concept, and does not give away the answers to other questions on the examination.

Form ES-401-6 is a sample worksheet for use in preparing the written examination questions. Facility licensees may use that or a similar form to document the information related to each proposed question that is submitted to the NRC for review and approval.

3. Review and Submit the Examination

a. Review the entire examination to ensure that the criteria on Form ES-401-7, "Written Examination Quality Checklist," are satisfied.

b. Forward the examination package, including all proposed attachments, and the completed quality checklist to the first reviewer. Section E provides instructions for conducting the quality reviews.

Facility-developed examinations must be reviewed by a supervisor or manager before they are sent to the NRC regional office in accordance with ES-201. Facility authors shall submit their examinations for management review in time to support their delivery to the NRC regional office approximately 45 days before the scheduled examination date.

NRC examiners shall submit their examinations to the chief examiner for review at least one week before the scheduled prereview by the facility licensee (refer to ES-201).

4. Assemble the Examinations

a. Format the examinations using the one-question-per-page layout specified in Appendix B or by placing as many complete questions as possible on each page.

b. Use a cover sheet in the format shown in Form ES-401-8, "Site-Specific Written Examination Cover Sheet," for all RO and SRO written examinations. Fill out all items in the upper section of the cover sheet, except the name of the applicant, when preparing the examinations.

E. QUALITY REVIEWS

When reviewing questions, reviewers should try to put themselves in the position of the applicants by attempting to answer the questions without using reference material or referring to the answer key. Reviewers should ensure that the conditions and requirements posed in the question are complete and unambiguous, all necessary information is provided, all unnecessary information is deleted, the intended answer clearly follows from what is asked in the question, and the distractors are plausible.

1. Facility Management Review

If the examination was prepared by the facility licensee, it shall be independently reviewed by a supervisor or manager before it is submitted to the NRC regional office for review and approval in accordance with ES-201. The reviewer should evaluate the examination using the criteria on Form ES-401-7 and include the signed form in the examination package submitted to the NRC. Facility licensees are responsible for ensuring that contractor-prepared examinations meet the guidelines herein and are encouraged to verify the origin of the questions used to construct the examination.

2. NRC Examiner Review

a. The NRC regional office staff shall review the examination as soon as possible after receipt so that supervisory approval can be obtained before the final review with the facility licensee, which is normally scheduled about two weeks before the examination date. It is especially important that the region promptly review examinations prepared by a facility licensee because of the extra time that may be required if extensive changes are necessary. The chief examiner shall consolidate the comments from all NRC reviewers and submit one set of comments to the author or facility contact.

b. If the NRC prepared the examination, the NRC chief examiner shall independently review all examination questions for content, wording, operational validity, and level of difficulty. As a minimum, the chief examiner shall check the items listed on Form ES-401-7. ~~Item 4 on the quality checklist applies only to the last two NRC licensing examinations at the facility. Moreover, Item 5 and~~ The facility reviewer blocks in Column "b" are not applicable for NRC-prepared examinations. If the chief examiner wrote the examination, another NRC examiner must perform the independent review.

c. If the facility licensee developed the examination, the licensee is primarily responsible for ensuring compliance with the items listed on Form ES-401-7.

However, the regional office staff is expected to take reasonable measures, including the selective review of reference materials, individual questions, and past examinations, to verify these items when reviewing the examination; exclusive reliance on the facility author's and reviewer's initials is *not* adequate. Depending upon the expected technical quality of the examination and the time available before the scheduled review with the facility licensee, the regional office staff shall independently review and verify the technical accuracy of a sample of the written examination questions. The regional office staff shall also confirm that the question content for a selected sample of the questions accurately implements the intent of the associated K/A statement from the previously approved examination outline. The sample shall include at least 30 questions with an emphasis on those questions taken directly from the facility licensee's examination bank. If more than 20 percent of the sampled questions clearly do not match the intent of the associated K/A statement, the region shall verify the K/A conformance on the remainder of the examination and, as appropriate, discuss its findings with the operator licensing program office and facility licensee and assess the number of questions that were repeated from the applicants' audit examination and the last two NRC licensing examinations at the facility.

With regard to assessing the psychometric quality of the proposed examination questions, the regional office shall begin by systematically selecting a sample of questions for detailed review. The sample is based on the nominal 50/40/10 (bank/modified/new) question distribution discussed in Section D.2.f above and the question background information provided by the facility licensee (using Form ES-401-6 or similar method). The sample shall include 10 of the new questions on the examination and 20 additional questions that are randomly selected from among the remaining questions that have not been prevalidated through successful use on an NRC licensing examination administered at that facility since October 1, 1995. The regional office shall conduct and document the review of the 30 selected questions using Form ES-401-9, "Written Examination Review Worksheet."

When the sample review is complete, the chief examiner shall consult with the responsible supervisor and proceed as directed to evaluate the remainder of the examination.

d. There are no minimum or maximum limits on the number or scope of changes the regional office may direct the author or facility contact to make to the proposed examinations, provided that they are necessary to make the examinations conform with established acceptance criteria. All unacceptable flaws identified by using Form ES-401-9 shall be corrected by rewriting or replacing the questions before the examination is administered. Other flaws of a minor nature (e.g., editorial clarifications or enhancements) should, as time permits, be corrected before the examination is administered, but the NRC expects such corrections to be made before the question is ~~reused on another NRC examination~~ deposited in any examination bank.

e. Upon supervisory approval, generally at least 14 days before the examinations are scheduled to be given, the chief examiner will review the written

examinations with the facility licensee in accordance with ES-201.

When providing feedback to the facility licensee regarding unacceptable questions, the chief examiner shall, at a minimum, *explain* how the Appendix B psychometric quantitative and qualitative attributes are not being met. For example, if the question is determined to have more than one implausible distractor, the attendant explanation shall articulate the reasons the examiner believes each of the faulty distractors is not credible.

Examinations that are written by the NRC shall be clean, properly formatted, and "ready-to-give" before they are reviewed with the facility licensee. The region shall not rely on the facility licensee to ensure that the quality of the examination is acceptable for administration.

f. After reviewing the examination with the facility licensee, the chief examiner will ensure that any comments and recommendations are resolved and the examination is revised as necessary. If the facility licensee developed the examination, it will generally be expected to make whatever changes are recommended by the NRC.

g. After the necessary changes have been made and the chief examiner is satisfied with the examination, he or she will sign the quality checklist and forward the examination package to the responsible supervisor for final approval. If the examination was written by the facility licensee, the chief examiner should include a copy of the original submittal with the examination package.

3. NRC Supervisory Review

a. The responsible supervisor shall review all questions determined to have unacceptable flaws in accordance with Form ES-401-9 before any comments are provided to the facility licensee. The responsible supervisor shall review the entire examination before authorizing the chief examiner to proceed with the facility prereview per ES-201. The supervisory review is not intended to be another technical review, but rather a general assessment of examination quality, including a review of the changes being recommended by the chief examiner, and a check to ensure that all the applicable administrative requirements have been implemented.

b. Based on the results of the sampling review conducted in accordance with Section E.2.c above, the responsible supervisor (in coordination with regional management and the NRR operator licensing program office, as appropriate) will continue the examination review as follows:

· If fewer than six of the 30 sampled questions contain unacceptable flaws as determined by using Form ES-401-9, then the regional office shall review in detail the remainder of the examination (excluding those questions that were prevalidated by the NRC) using Form ES-401-9 and provide comments to the facility licensee for rework and correction. The NRC-validated questions need not be reviewed in detail but will be evaluated as necessary to complete Form ES-401-7 (including the identification and correction of technical and psychometric flaws that cause the question to have no or multiple correct answers) before

reviewing the examination with the facility licensee. The responsible supervisor will review and approve each comment that would require the facility licensee to rework an NRC-validated question.

- If six or more of the 30 sampled questions contain unacceptable flaws as determined by using Form ES-401-9, then the regional office may return the written examination (with explanatory comments) to the facility licensee for rework and correction without reviewing the remainder of the examination (refer to Section C.2.h of ES-201 for additional guidance regarding examination delays). The facility licensee will be expected to correct the unacceptable flaws in the sampled questions and like-kind flaws that exist in the remainder of the examination. When the facility licensee resubmits the examination, every question (excluding the NRC-validated questions) will be subject to NRC review using Form ES-401-9. The NRC-validated questions will be reviewed as discussed above.

  Alternatively, if the responsible supervisor concludes that the remainder of the examination (excluding the NRC-validated questions) can be reviewed and corrected in time for the scheduled examination date, the regional office should continue the review using Form ES-401-9 and provide comments to the facility licensee for correction.

c. The responsible supervisor should ensure that any significant deficiencies in the original examinations submitted by a facility licensee are evaluated in accordance with ES-201 to determine the appropriate course of action. At a minimum, the supervisor should ensure that they are addressed in the final examination report in accordance with ES-501.

d. Following the facility review, the responsible supervisor should again review the examination to ensure that the concerns expressed by the facility licensee and the NRC have been appropriately addressed. The supervisor shall not sign Form ES-401-7 until he or she is satisfied that the examination is acceptable to be administered.

4. Facility Peer Review

As a final check of the examination's technical accuracy, facility management should consider administering the NRC-approved examination (under security agreements) to one or more licensed personnel who were previously uninvolved in developing the examination. ~~As discussed in Section D.2.d of ES-201, the NRC regional office may deny the facility licensee's proposal to~~ In light of examination security concerns, the NRC discourages the use of certain individuals (e.g., the applicants' supervisors or coworkers) to validate the examination. Any comments made and problems identified during the trial administration shall be discussed with the NRC chief examiner and resolved before the examination is administered to the license applicants. The intent of the review is to identify and correct deficiencies that may affect the validity of the examination.

F. ATTACHMENTS/FORMS

Attachment 1, "Example Systematic Sampling Methodology"

Form ES-401-1, "BWR SRO Examination Outline"
Form ES-401-2, "BWR RO Examination Outline"
Form ES-401-3, "PWR SRO Examination Outline"
Form ES-401-4, "PWR RO Examination Outline"
Form ES-401-5, "Generic Knowledge and Abilities Outline"
Form ES-401-6, “Sample Written Examination Question Worksheet”
Form ES-401-7, "Written Examination Quality Checklist"
Form ES-401-8, "Site-Specific Written Examination Cover Sheet"
Form ES-401-9, “Written Examination Review Worksheet”

The following process, which uses the BWR SRO outline (Form ES-401-1) for illustration, *may be used* for each group in Tiers 1 and 2 of the examination outline.

1. Review each group and delete those items (Emergency/Abnormal Plant Evolutions (E/APEs) for Tier 1 and systems for Tier 2) that clearly do not apply to the facility for which the examination is being written; be prepared to explain the basis for the deletions to the NRC chief examiner.

2. Sequentially number the remaining items in the group and sequentially annotate the same number of tokens. If we assume that none of the 20 E/APEs in Tier 1, Group 1 was deleted in Step 1, there should be 20 tokens, numbered from 1 to 20.

    a. If the number of items remaining in the group (in this case 20) is smaller than the required number of points for the group specified in the right hand column of the examination outline (in this case 26), then each item in the group would be sampled at least one time. The rest of the sample would be determined by randomly selecting and removing tokens (in this case 6 of the 20) until the required total number of points is reached. Update Form ES-401-1 to note the selected items.

    b. If the number of items remaining in the group is larger than the required number of points for the group (e.g., Tier 1, Group 2 has 20 items but only requires 17 points), then randomly select and remove the required number of tokens and note them on Form ES-401-1.

3. After selecting the topics to be sampled in each group as described in Step 2, count the number of K/A categories in the group (e.g., 6 for each group in Tier 1; i.e., K1, K2, K3, A1, A2, and G) and sequentially annotate the same number of tokens (in this case 6). For each E/APE (and system) selected in Step 2, randomly select and remove a token and note the K/A category on Form ES-401-1. If the E/APE (or system) was sampled more than once per Step 2.a, randomly select a second K/A category. If the selected K/A category contains no K/A statements having an importance rating that is above 2.5, systematically select another K/A category, unless the lower importance is justified based on plant-specific priorities. Then replace all the tokens in the container and repeat the process for every selected item in each group.

4. Use a similar method to randomly select from among the K/A statements under each selected K/A category. Describe each K/A topic in the space provided on Form ES-401-1 and enter the importance rating. K/As having importance ratings less than 2.5 can be used if justified based on plant priorities; the facility contact should be prepared to explain the basis to the NRC chief examiner.

For Tier 3 (Plant-Wide Generics) of the examination outline, randomly select K/As from Section 2 of the NRC K/A catalog so that each of the four K/A categories (i.e., “Conduct of Operations,” “Equipment Control,” Radiation Control,” and “Emergency Procedures/Plan”) has at least two items.

Facility: Date of Exam: Exam Level:

Tier	Group	K/A Category Points											Point Total
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	
1. Emergency & Abnormal Plant Evolutions	1												26
	2												17
	Tier Totals												43
2. Plant Systems	1												23
	2												13
	3												4
	Tier Totals												40

3. Generic Knowledge and Abilities	Cat 1	Cat 2	Cat 3	Cat 4	17

Note:
1. Ensure that at least two topics from every K/A category are sampled within each tier (i.e., the "Tier Totals" in each K/A category shall not be less than two).
2. Actual point totals must match those specified in the table.
3. Select topics from many systems; avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
4. Systems/evolutions within each group are identified on the associated outline.
5. The shaded areas are not applicable to the category/tier.
6.* The generic K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system.
7. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings for the SRO license level, and the point totals for each system and category. K/As below 2.5 should be justified on the basis of plant-specific priorities. Enter the tier totals for each category in the table above.

ES-401	BWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1							Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
295003 Partial or Complete Loss of AC Pwr / 6									
295006 SCRAM / 1									
295007 High Reactor Pressure / 3									
295009 Low Reactor Water Level / 2									
295010 High Drywell Pressure / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1									
295015 Incomplete SCRAM / 1									
295016 Control Room Abandonment / 7									
295017 High Off-site Release Rate / 9									
295023 Refueling Accidents Cooling Mode / 8									
295024 High Drywell Pressure / 5									
295025 High Reactor Pressure / 3									
295026 Suppression Pool High Water Temp. / 5									
295027 High Containment Temperature / 5									
295030 Low Suppression Pool Water Level / 5									
295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Power Above APRM Downscale or Unknown / 1									
295038 High Off-site Release Rate / 9									
500000 High Containment Hydrogen Conc. / 5									
K/A Category Totals:							Group Point Total:		26

ES-401	BWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2							Form ES-401-1	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4									
295002 Loss of Main Condenser Vacuum / 3									
295004 Partial or Total Loss of DC Pwr / 6									
295005 Main Turbine Generator Trip / 3									
295008 High Reactor Water Level / 2									
295011 High Containment Temperature / 5									
295012 High Drywell Temperature / 5									
295018 Partial or Total Loss of CCW / 8									
295019 Partial or Total Loss of Inst. Air / 8									
295020 Inadvertent Cont. Isolation / 5 & 7									
295021 Loss of Shutdown Cooling / 4									
295022 Loss of CRD Pumps / 1									
295028 High Drywell Temperature / 5									
295029 High Suppression Pool Water Level / 5									
295032 High Secondary Containment Area Temperature / 5									
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9									
295035 Secondary Containment High Differential Pressure / 5									
295036 Secondary Containment High Sump/Area Water Level / 5									
600000 Plant Fire On Site / 8									
K/A Category Point Totals:							Group Point Total:		17

ES-401	BWR SRO Examination Outline Plant Systems - Tier 2/Group 1												Form ES-401-1	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
201005 RCIS														
202002 Recirculation Flow Control														
203000 RHR/LPCI: Injection Mode														
206000 HPCI														
207000 Isolation (Emergency) Condenser														
209001 LPCS														
209002 HPCS														
211000 SLC														
212000 RPS														
215004 Source Range Monitor														
215005 APRM / LPRM														
216000 Nuclear Boiler Instrumentation														
217000 RCIC														
218000 ADS														
223001 Primary CTMT and Auxiliaries														
223002 PCIS/Nuclear Steam Supply Shutoff														
226001 RHR/LPCI: CTMT Spray Mode														
239002 SRVs														
241000 Reactor/Turbine Pressure Regulator														
259002 Reactor Water Level Control														
261000 SGTS														
262001 AC Electrical Distribution														
264000 EDGs														
290001 Secondary CTMT														
K/A Category Point Totals:												Group Point Total:		23

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
201001 CRD Hydraulic														
201002 RMCS														
201004 RSCS														
201006 RWM														
202001 Recirculation														
204000 RWCU														
205000 Shutdown Cooling														
214000 RPIS														
215002 RBM														
215003 IRM														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode														
234000 Fuel Handling Equipment														
239003 MSIV Leakage Control														
245000 Main Turbine Gen. and Auxiliaries														
259001 Reactor Feedwater														
262002 UPS (AC/DC)														
263000 DC Electrical Distribution														
271000 Offgas														
272000 Radiation Monitoring														
286000 Fire Protection														
290003 Control Room HVAC														
300000 Instrument Air														
400000 Component Cooling Water														
K/A Category Point Totals:												Group Point Total:		13

ES-401	BWR SRO Examination Outline Plant Systems - Tier 2/Group 3	Form ES-401-1

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
201003 Control Rod and Drive Mechanism														
215001 Traversing In-core Probe														
233000 Fuel Pool Cooling and Cleanup														
239001 Main and Reheat Steam														
256000 Reactor Condensate														
268000 Radwaste														
288000 Plant Ventilation														
290002 Reactor Vessel Internals														
K/A Category Point Totals:												Group Point Total:		4

Plant-Specific Priorities

System / Topic	Recommended Replacement for...	Reason	Points
Plant-Specific Priority Total (limit 10):			

Facility: Date of Exam: Exam Level:

Tier	Group	K/A Category Points											Point Total
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	
1. Emergency & Abnormal Plant Evolutions	1												13
	2												19
	3												4
	Tier Totals												36
2. Plant Systems	1												28
	2												19
	3												4
	Tier Totals												51

3. Generic Knowledge and Abilities	Cat 1	Cat 2	Cat 3	Cat 4	
					13

Note:
1. Ensure that at least two topics from every K/A category are sampled within each tier (i.e., the "Tier Totals" in each K/A category shall not be less than two).
2. Actual point totals must match those specified in the table.
3. Select topics from many systems; avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
4. Systems/evolutions within each group are identified on the associated outline.
5. The shaded areas are not applicable to the category/tier.
6.* The generic K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system.
7. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings for the RO license level, and the point totals for each system and category. K/As below 2.5 should be justified on the basis of plant-specific priorities. Enter the tier totals for each category in the table above.

ES-401	BWR RO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1							Form ES-401-2	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
295005 Main Turbine Generator Trip / 3									
295006 SCRAM / 1									
295007 High Reactor Pressure / 3									
295009 Low Reactor Water Level / 2									
295010 High Drywell Pressure / 5									
295014 Inadvertent Reactivity Addition / 1									
295015 Incomplete SCRAM / 1									
295024 High Drywell Pressure / 5									
295025 High Reactor Pressure / 3									
295031 Reactor Low Water Level / 2									
295037 SCRAM Condition Present and Power Above APRM Downscale or Unknown / 1									
500000 High Containment Hydrogen Conc. / 5									
K/A Category Totals:							Group Point Total:		13

ES-401	BWR RO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2							Form ES-401-2	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4									
295002 Loss of Main Condenser Vacuum / 3									
295003 Partial or Complete Loss of AC Pwr / 6									
295004 Partial or Complete Loss of DC Pwr / 6									
295008 High Reactor Water Level / 2									
295011 High CTMT Temperature / 5									
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295016 Control Room Abandonment / 7									
295017 High Off-site Release Rate / 9									
295018 Partial or Complete Loss of CCW / 8									
295019 Part. or Comp. Loss of Inst. Air / 8									
295020 Inadvertent Cont. Isolation / 5 & 7									
295022 Loss of CRD Pumps / 1									
295026 High Suppression Pool Water Temp. / 5									
295027 High Containment Temperature / 5									
295028 High Drywell Temperature / 5									
295029 High Suppression Pool Water Level / 5									
295030 Low Suppression Pool Water Level / 5									
295033 High Sec. Cont. Area Rad. Levels / 9									
295034 Sec. Cont. Ventilation High Rad. / 9									
295038 High Off-site Release Rate / 9									
600000 Plant Fire On Site / 8									
K/A Category Point Totals:							Group Point Total:		19

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
295021 Loss of Shutdown Cooling / 4									
295023 Refueling Accidents / 8									
295032 High Secondary Containment Area Temperature / 5									
295035 Secondary Containment High Differential Pressure / 5									
295036 Secondary Containment High Sump/Area Water Level / 5									
K/A Category Point Totals:							Group Point Total:		4

ES-401	BWR RO Examination Outline Plant Systems - Tier 2/Group 1												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
201001 CRD Hydraulic														
201002 RMCS														
201005 RCIS														
202002 Recirculation Flow Control														
203000 RHR/LPCI: Injection Mode														
206000 HPCI														
207000 Isolation (Emerg.) Condenser														
209001 LPCS														
209002 HPCS														
211000 SLC														
212000 RPS														
215003 IRM														
215004 SRM														
215005 APRM / LPRM														
216000 Nuclear Boiler Instrumentation														
217000 RCIC														
218000 ADS														
223001 Primary CTMT and Auxiliaries														
223002 PCIS/Nuclear Steam Supply Shutoff														
239002 SRVs														
241000 Reactor/Turbine Pressure Regulator														
259001 Reactor Feedwater														
259002 Reactor Water Level Control														
261000 SGTS														
264000 EDGs														
K/A Category Point Totals:												Group Point Total:		28

ES-401	BWR RO Examination Outline Plant Systems - Tier 2/Group 2												Form ES-401-2	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
201003 Control Rod and Drive Mechanism														
201004 RSCS														
201006 RWM														
202001 Recirculation														
204000 RWCU														
205000 Shutdown Cooling														
214000 RPIS														
215002 RBM														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode														
239001 Main and Reheat Steam														
245000 Main Turbine Gen. and Auxiliaries														
256000 Reactor Condensate														
262001 AC Electrical Distribution														
262002 UPS (AC/DC)														
263000 DC Electrical Distribution														
271000 Offgas														
272000 Radiation Monitoring														
286000 Fire Protection														
290001 Secondary CTMT														
290003 Control Room HVAC														
300000 Instrument Air														
400000 Component Cooling Water														
K/A Category Point Totals:												Group Point Total:		19

ES-401	BWR RO Examination Outline Plant Systems - Tier 2/Group 3	Form ES-401-2

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
215001 Traversing In-core Probe														
233000 Fuel Pool Cooling and Cleanup														
234000 Fuel Handling Equipment														
239003 MSIV Leakage Control														
268000 Radwaste														
288000 Plant Ventilation														
290002 Reactor Vessel Internals														
K/A Category Point Totals:												Group Point Total:		4

Plant-Specific Priorities

System / Topic	Recommended Replacement for...	Reason	Points
Plant-Specific Priority Total: (limit 10)			

Facility: Date of Exam: Exam Level:

Tier	Group	K/A Category Points											Point Total
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	
1. Emergency & Abnormal Plant Evolutions	1												24
	2												16
	3												3
	Tier Totals												43
2. Plant Systems	1												19
	2												17
	3												4
	Tier Totals												40
3. Generic Knowledge and Abilities		Cat 1			Cat 2			Cat 3			Cat 4		17

Note:
1. Ensure that at least two topics from every K/A category are sampled within each tier (i.e., the "Tier Totals" in each K/A category shall not be less than two).
2. Actual point totals must match those specified in the table.
3. Select topics from many systems; avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
4. Systems/evolutions within each group are identified on the associated outline.
5. The shaded areas are not applicable to the category/tier.
6.* The generic K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system.
7. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings for the SRO license level, and the point totals for each system and category. K/As below 2.5 should be justified on the basis of plant-specific priorities. Enter the tier totals for each category in the table above.

ES-401	PWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1							Form ES-401-3	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1									
000005 Inoperable/Stuck Control Rod / 1									
000011 Large Break LOCA / 3									
W/E04 LOCA Outside Containment / 3									
W/EO1 & E02 Rediagnosis & SI Termination / 3									
000015/17 RCP Malfunctions / 4									
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
000024 Emergency Boration / 1									
000026 Loss of Component Cooling Water / 8									
000029 Anticipated Transient w/o Scram / 1									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4									
CE/A11; W/E08 RCS Overcooling - PTS / 4									
000051 Loss of Condenser Vacuum / 4									
000055 Station Blackout / 6									
000057 Loss of Vital AC Elec. Inst. Bus / 6									
000059 Accidental Liquid RadWaste Rel. / 9									
000062 Loss of Nuclear Service Water / 4									
000067 Plant Fire On-site / 9									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4									
BW/E03 Inadequate Subcooling Margin / 4									
000076 High Reactor Coolant Activity / 9									
BW/A02&A03 Loss of NNI-X/Y / 7									
K/A Category Totals:							Group Point Total:		24

ES-401	PWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2							Form ES-401-3	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000007 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
BW/A01 Plant Runback / 1									
BW/A04 Turbine Trip / 4									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3									
BW/E08; W/E03 LOCA Cooldown - Depress. / 4									
W/E11 Loss of Emergency Coolant Recirc. / 4									
000022 Loss of Reactor Coolant Makeup / 2									
000025 Loss of RHR System / 4									
000027 Pressurizer Pressure Control System Malfunction / 3									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7									
000037 Steam Generator Tube Leak / 3									
000038 Steam Generator Tube Rupture / 3									
000054 (CE/E06) Loss of Main Feedwater / 4									
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									
000058 Loss of DC Power / 6									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
W/E16 High Containment Radiation / 9									
000065 Loss of Instrument Air / 8									
CE/E09 Functional Recovery									
K/A Category Point Totals:							Group Point Total:		16

ES-401	PWR SRO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 3							Form ES-401-3
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000028 Pressurizer Level Malfunction / 2									
000036 (BW/A08) Fuel Handling Accident / 8									
000056 Loss of Off-site Power / 6									
BW/E13&E14 EOP Rules and Enclosures									
BW/A05 Emergency Diesel Actuation / 6									
BW/A07 Flooding / 8									
CE/A16 Excess RCS Leakage / 2									
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5									
K/A Category Point Totals:							Group Point Total:		3

ES-401	PWR SRO Examination Outline Plant Systems - Tier 2/Group 1												Form ES-401-3	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
001 Control Rod Drive														
003 Reactor Coolant Pump														
004 Chemical and Volume Control														
013 Engineered Safety Features Actuation														
014 Rod Position Indication														
015 Nuclear Instrumentation														
017 In-core Temperature Monitor														
022 Containment Cooling														
025 Ice Condenser														
026 Containment Spray														
056 Condensate														
059 Main Feedwater														
061 Auxiliary/Emergency Feedwater														
063 DC Electrical Distribution														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
K/A Category Point Totals:												Group Point Total:		19

ES-401	PWR SRO Examination Outline Plant Systems - Tier 2/Group 2												Form ES-401-3	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
002 Reactor Coolant														
006 Emergency Core Cooling														
010 Pressurizer Pressure Control														
011 Pressurizer Level Control														
012 Reactor Protection														
016 Non-nuclear Instrumentation														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
029 Containment Purge														
033 Spent Fuel Pool Cooling														
034 Fuel Handling Equipment														
035 Steam Generator														
039 Main and Reheat Steam														
055 Condenser Air Removal														
062 AC Electrical Distribution														
064 Emergency Diesel Generator														
073 Process Radiation Monitoring														
075 Circulating Water														
079 Station Air														
086 Fire Protection														
103 Containment														
K/A Category Point Totals:												Group Point Total:		17

ES-401	PWR SRO Examination Outline Plant Systems - Tier 2/Group 3	Form ES-401-3

System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
005 Residual Heat Removal														
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
076 Service Water														
078 Instrument Air														
K/A Category Point Totals:												Group Point Total:		4

Plant-Specific Priorities

System / Topic	Recommended Replacement for...	Reason	Points
Plant-Specific Priority Total: (limit 10)			

Facility: Date of Exam: Exam Level:

Tier	Group	K/A Category Points											Point Total
		K 1	K 2	K 3	K 4	K 5	K 6	A 1	A 2	A 3	A 4	G *	
1. Emergency & Abnormal Plant Evolutions	1												16
	2												17
	3												3
	Tier Totals												36
2. Plant Systems	1												23
	2												20
	3												8
	Tier Totals												51

3. Generic Knowledge and Abilities	Cat 1	Cat 2	Cat 3	Cat 4	
					13

Note:
1. Ensure that at least two topics from every K/A category are sampled within each tier (i.e., the "Tier Totals" in each K/A category shall not be less than two).
2. Actual point totals must match those specified in the table.
3. Select topics from many systems; avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
4. Systems/evolutions within each group are identified on the associated outline.
5. The shaded areas are not applicable to the category/tier.
6.* The generic K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system.
7. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings for the RO license level, and the point totals for each system and category. K/As below 2.5 should be justified on the basis of plant-specific priorities. Enter the tier totals for each category in the table above.

ES-401	PWR RO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1							Form ES-401-4	
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000005 Inoperable/Stuck Control Rod / 1									
000015/17 RCP Malfunctions / 4									
BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4									
000024 Emergency Boration / 1									
000026 Loss of Component Cooling Water / 8									
000027 Pressurizer Pressure Control System Malfunction / 3									
000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4									
CE/A11; W/E08 RCS Overcooling - PTS / 4									
000051 Loss of Condenser Vacuum / 4									
000055 Station Blackout / 6									
000057 Loss of Vital AC Elec. Inst. Bus / 6									
000062 Loss of Nuclear Service Water / 4									
000067 Plant Fire On-site / 9									
000068 (BW/A06) Control Room Evac. / 8									
000069 (W/E14) Loss of CTMT Integrity / 5									
000074 (W/E06&E07) Inad. Core Cooling / 4									
BW/E03 Inadequate Subcooling Margin / 4									
000076 High Reactor Coolant Activity / 9									
BW/A02&A03 Loss of NNI-X/Y / 7									
K/A Category Totals:							Group Point Total:		16

ES-401	PWR RO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2	Form ES-401-4

E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000001 Continuous Rod Withdrawal / 1									
000003 Dropped Control Rod / 1									
000007 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1									
BW/A01 Plant Runback / 1									
BW/A04 Turbine Trip / 4									
000008 Pressurizer Vapor Space Accident / 3									
000009 Small Break LOCA / 3									
000011 Large Break LOCA / 3									
W/E04 LOCA Outside Containment / 3									
BW/E08; W/E03 LOCA Cooldown/Depress. / 4									
W/E11 Loss of Emergency Coolant Recirc. / 4									
W/EO1 & E02 Rediagnosis & SI Termination / 3									
000022 Loss of Reactor Coolant Makeup / 2									
000025 Loss of RHR System / 4									
000029 Anticipated Transient w/o Scram / 1									
000032 Loss of Source Range NI / 7									
000033 Loss of Intermediate Range NI / 7									
000037 Steam Generator Tube Leak / 3									
000038 Steam Generator Tube Rupture / 3									
000054 (CE/E06) Loss of Main Feedwater / 4									
BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4									
000058 Loss of DC Power / 6									
000059 Accidental Liquid RadWaste Rel. / 9									
000060 Accidental Gaseous Radwaste Rel. / 9									
000061 ARM System Alarms / 7									
W/E16 High Containment Radiation / 9									
CE/E09 Functional Recovery									
K/A Category Point Totals:							Group Point Total:		17

ES-401	PWR RO Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 3							Form ES-401-4
E/APE # / Name / Safety Function	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Points
000028 Pressurizer Level Malfunction / 2									
000036 (BW/A08) Fuel Handling Accident / 8									
000056 Loss of Off-site Power / 6									
000065 Loss of Instrument Air / 8									
BW/E13&E14 EOP Rules and Enclosures									
BW/A05 Emergency Diesel Actuation / 6									
BW/A07 Flooding / 8									
CE/A16 Excess RCS Leakage / 2									
W/E13 Steam Generator Over-pressure / 4									
W/E15 Containment Flooding / 5									
K/A Category Point Totals:							Group Point Total:		3

ES-401	PWR RO Examination Outline Plant Systems - Tier 2/Group 1												Form ES-401-4	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
001 Control Rod Drive														
003 Reactor Coolant Pump														
004 Chemical and Volume Control														
013 Engineered Safety Features Actuation														
015 Nuclear Instrumentation														
017 In-core Temperature Monitor														
022 Containment Cooling														
025 Ice Condenser														
056 Condensate														
059 Main Feedwater														
061 Auxiliary/Emergency Feedwater														
068 Liquid Radwaste														
071 Waste Gas Disposal														
072 Area Radiation Monitoring														
K/A Category Point Totals:												Group Point Total:		23

ES-401	PWR RO Examination Outline Plant Systems - Tier 2/Group 2												Form ES-401-4	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
002 Reactor Coolant														
006 Emergency Core Cooling														
010 Pressurizer Pressure Control														
011 Pressurizer Level Control														
012 Reactor Protection														
014 Rod Position Indication														
016 Non-nuclear Instrumentation														
026 Containment Spray														
029 Containment Purge														
033 Spent Fuel Pool Cooling														
035 Steam Generator														
039 Main and Reheat Steam														
055 Condenser Air Removal														
062 AC Electrical Distribution														
063 DC Electrical Distribution														
064 Emergency Diesel Generator														
073 Process Radiation Monitoring														
075 Circulating Water														
079 Station Air														
086 Fire Protection														
K/A Category Point Totals:												Group Point Total:		20

ES-401	PWR RO Examination Outline Plant Systems - Tier 2/Group 3												Form ES-401-4	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Points
005 Residual Heat Removal														
007 Pressurizer Relief/Quench Tank														
008 Component Cooling Water														
027 Containment Iodine Removal														
028 Hydrogen Recombiner and Purge Control														
034 Fuel Handling Equipment														
041 Steam Dump/Turbine Bypass Control														
045 Main Turbine Generator														
076 Service Water														
078 Instrument Air														
103 Containment														
K/A Category Point Totals:												Group Point Total:		8

Plant-Specific Priorities

System / Topic	Recommended Replacement for...	Reason	Points
Plant-Specific Priority Total: (limit 10)			

Facility:	Date of Exam:		Exam Level:	
Category	K/A #	Topic	Imp.	Points
Conduct of Operations	2.1.			
	2.1.			
	2.1.			
	2.1.			
	2.1.			
	2.1.			
	Total			
Equipment Control	2.2.			
	2.2.			
	2.2.			
	2.2.			
	2.2.			
	2.2.			
	Total			
Radiation Control	2.3.			
	2.3.			
	2.3.			
	2.3.			
	2.3.			
	2.3.			
	Total			
Emergency Procedures/ Plan	2.4.			
	2.4.			
	2.4.			
	2.4.			
	2.4.			
	2.4.			
	Total			
Tier 3 Point Total (RO/SRO)				13/17

Examination Outline Cross-reference:

Level	RO	SRO
Tier #	_____	_____
Group #	_____	_____
K/A #	_____	
Importance Rating	_____	_____

Proposed Question:

Proposed Answer: _____

Explanation (Optional):

Technical Reference(s): _____ (Attach if not previously provided)
_____

Proposed references to be provided to applicants during examination: _____

Learning Objective: _____ (As available)

Question Source:
Bank # _____
Modified Bank # _____ (Note changes or attach parent)
New _____

~~Question History:~~
~~Previous NRC Exam~~ _____
~~Previous Quiz / Test~~ _____

Question Cognitive Level:
Memory or Fundamental Knowledge _____
Comprehension or Analysis _____

10 CFR Part 55 Content:
55.41 _____
55.43 _____

Comments:

Facility: Date of Exam: Exam Level: RO/SRO

	Item Description	Initial a	b*	c#
1.	Questions and answers technically accurate and applicable to facility			
2.	a. NRC K/As referenced for all questions b. Facility learning objectives referenced as available			
3.	RO/SRO overlap is no more than 75 percent, and SRO questions are appropriate per Section D.2.d of ES-401			
~~4.~~	~~No more than 25 questions are duplicated from [practice exams, quizzes, and] the last two NRC licensing exams; enter the actual number of duplicated questions at right~~ ~~NRC~~ / ~~Other~~			
4.	~~[No (Less than 5 percent)~~ Question duplication from the license screening/audit exam ~~(if independently written)]~~ was controlled as indicated below (check the item that applies) and appears appropriate: __ the audit exam was systematically and randomly developed; or __ the audit exam was completed before the license exam was started; or __ the licensee certifies that there is no duplication; or __ the license exam was prepared by the NRC			
5.	Bank use meets limits (no more than 50 percent from the bank, at least 10 percent new, and the rest modified); enter the actual question distribution at right — Bank / Modified / New			
6.	Between 50 and 60 percent of the questions on the exam (including 10 new questions) are written at the comprehension/analysis level; enter the actual question distribution at right — Memory / C/A			
7.	References/handouts provided do not give away answers			
8.	Question content conforms with specific K/A statements in the ~~distribution meets~~ previously approved examination outline; deviations are justified			
9.	Question psychometric quality and format meet ES, Appendix B, guidelines			
10.	The exam contains 100, one-point, multiple choice items; the total is correct and agrees with value on cover sheet			

	Printed Name / Signature	Date
a. Author		
b. Facility Reviewer(*)		
c. NRC Chief Examiner(*)		
d. NRC Regional Supervisor(*)		

Note: * The facility reviewer's signature is not applicable for NRC-developed examinations; two independent NRC reviews are required.
See special instructions (Section E.2.c) for Items 1, ~~4,~~ 5, and ~~6~~8.
~~[ ] The items in brackets do not apply to NRC-prepared examinations.~~

U.S. Nuclear Regulatory Commission
Site-Specific
Written Examination

Applicant Information	
Name:	Region: I / II / III / IV
Date:	Facility/Unit:
License Level: RO / SRO	Reactor Type: W / CE / BW / GE
Start Time:	Finish Time:

Instructions

Use the answer sheets provided to document your answers. Staple this cover sheet on top of the answer sheets. The passing grade requires a final grade of at least 80.00 percent. Examination papers will be collected five hours after the examination starts.

Applicant Certification

All work done on this examination is my own. I have neither given nor received aid.

_____
Applicant's Signature

Results	
Examination Value	_____ Points
Applicant's Score	_____ Points
Applicant's Grade	_____ Percent

Q#	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5. U/E/S	6. Explanation
			Stem Focus	Cues	T/F	Cred. Dist.	Partial	Job-Link	Minutia	#/ units	Back-ward		

Instructions

[Refer to Appendix B for additional information regarding each of the following concepts.]

1. Enter the level of knowledge (LOK) of each question as either (F)undamental or (H)igher cognitive level.

2. Enter the level of difficulty (LOD) of each question using a 1 - 5 (easy - difficult) rating scale (questions in the 2 - 4 range are acceptable).

3. Check the appropriate box if a psychometric flaw is identified:
   - The stem lacks sufficient focus to elicit the correct answer (e.g., unclear intent, more information is needed, or too much needless information).
   - The stem or distractors contain cues (i.e., clues, specific determiners, phrasing, length, etc).
   - The answer choices are a collection of unrelated true/false statements.
   - More than one distractor is not credible.
   - One or more distractors is (are) partially correct (e.g., if the applicant can make unstated assumptions that are not contradicted by stem).

4. Check the appropriate box if a job content error is identified:
   - The question is not linked to the job requirements (i.e., the question has a valid K/A but, as written, is not operational in content).
   - The question requires the recall of knowledge that is too specific for the closed reference test mode (i.e., it is not required to be known from memory).
   - The question contains data with an unrealistic level of accuracy or inconsistent units (e.g., panel meter in percent with question in gallons).
   - The question requires reverse logic or application compared to the job requirements.

5. Based on the reviewer's judgment, is the question as written (U)nacceptable (requiring repair or replacement), in need of (E)ditorial enhancement, or (S)atisfactory?

6. For any "U" ratings, at a minimum, explain how the Appendix B psychometric attributes are not being met.

Q#	1. LOK (F/H)	2. LOD (1-5)	3. Psychometric Flaws					4. Job Content Flaws				5.	6.
			Stem Focus	Cues	T/F	Cred. Dist.	Partial	Job-Link	Minutia	#/ units	Back-ward	U/E/S	Explanation

Intentionally Blank