



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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REV 1 10/1/84

Instructions: File this change notice in the binder preceding page v,  
Contents. Replace superseded pages with new pages

NEW PAGES

Contents V - VIII  
ES 101 1-2  
ES 103 1-5  
ES 104 1-10  
ES 105 1-13  
ES 106 1-4  
ES 107 1-3  
ES 108 1-4  
ES 109 1-6  
ES 110 1-6  
ES 111 1-3  
ES 112 1-4  
ES 201 1-17  
ES 202 1-6  
ES 203 1-3  
ES 204 1-7  
ES 301 1-33  
ES 302 1-12  
ES 303 1-8  
ES 304 1-3  
ES 305 1-5  
ES 306 1-10  
ES 401 1  
ES 403 1-3  
ES 404 1-4  
ES 501 1-4  
ES 502 1-6  
ES 601 1-11

SUPERSEDED PAGES

Contents V - VIII  
ES 101 1  
ES 103 1-5  
ES 104 1-2  
ES 105 1-14  
ES 106 1-4  
ES 107 1-3  
ES 108 1-3  
ES 109 1-6  
New Standard  
New Standard  
ES 201a 1  
ES 201 1-21  
ES 202 1-6  
ES 203 1-3  
New Standard  
ES 301 1-35  
ES 302 1-12  
ES 303 1-9  
ES 304 1-3  
ES 305 1-7  
New Standard  
ES 401 1-2  
ES 403 1-3  
New Standard  
ES 501 1-5  
ES 502 1-6  
ES 601 1-15

8503200229 850228  
PDR NUREG  
1021 R PDR

CONTENTS

- ES-101 Purpose and Format of Operator Licensing Examiner Standards
- ES-102 Applicability of Commission Regulations and Guides to Operator Licenses
- ES-103 Assignment of Examiners To Administer Examinations
- ES-104 Procedures for Postexamination Activities
- ES-105 Indoctrination Program for New Examiners
- ES-106 Administration of Examinations at Multiunit Power Stations
- ES-107 Quality Assurance Program for Review of Written Examinations
- ES-108 Quality Assurance Program for Review of Graded Examinations
- ES-109 Eligibility Requirements for Reactor Operator or Senior Reactor Operator License Candidates
- ES-110 Eligibility Requirements for Reactor Operator or Senior Reactor Operator License Candidates - Non Power Reactors
- ES-111 Granting of Waivers from the Provisions of Operator Licensing Requirements Requested by Operator and Senior Operator Applicants
- ES-112 Appeals of License Denials
- ES-201 Administration of Written Examinations to Reactor Operator Candidates - Power Reactors
- ES-202 Scope of Written Examinations Administered to Reactor Operators - Power Reactors
- ES-203 Structure of Written Examinations Administered to Reactor Operators - Power Reactors
- ES-204 Administration and Preparation of Written Examinations for Reactor Operator Candidates - Non Power Reactors
- ES-301 Administration of Operating and Oral Examinations to Reactor Operators and Senior Reactor Operators - Power Reactors
- ES-302 Scope of Operating and Oral Examinations Administered to Reactor Operators and Senior Reactor Operators - Power Reactors



## CONTENTS (Continued)

- ES-303 Instructions on Use of Forms for Operating and Oral Examinations Administered to Reactor Operators - Power Reactors
- ES-304 Instructions on Use of Forms for Operating and Oral Examinations Administered To Upgrade Senior Reactor Operators - Power Reactors
- ES-305 Instructions on Use of Forms for Operating and Oral Examinations Administered to Instant Senior Reactor Operators - Power Reactors
- ES-306 Scope and Instructions for Operating Examinations Administered at - Non Power Reactors
- ES-401 Administration of Written Examinations to Senior Reactor Operators - Power Reactors
- ES-402 Scope of Written Examinations Administered to Senior Reactor Operators - Power Reactors
- ES-403 Structure of Written Examinations Administered to Senior Reactor Operators - Power Reactors
- ES-404 Scope and Structure of Written Examinations for Senior Operator Candidates - Non Power Reactors
- ES-501 Administration of Simulator Examinations to Reactor Operators and Senior Reactor Operators - Power Reactors
- ES-502 Scope of Simulator Examinations Administered to Reactor Operators and Senior Reactor Operators - Power Reactors
- ES-601 Administration of NRC Requalification Program Evaluation

## LIST OF ATTACHMENTS

- ES-103 Attachment 1, Check Sheet for Completion of Examination Assignment
- ES-103 Attachment 2, Request for Administration of Written and Operating Examination for Operator Licensing
- ES-104 Attachment 1, Exit Meeting Report
- ES-104 Attachment 2, Examination Report

LIST OF ATTACHMENTS (Continued)

- ES-105 Attachment 1, Observation Training Program
- ES-105 Attachment 2, Oral Exam Audit
- ES-107 Attachment 1, Written Examination Quality Assurance Checkoff Sheet
- ES-108 Attachment 1, Examination Grading Quality Assurance Checkoff Sheet
- ES-201 Attachment 1, Reference Material Requirements for Reactor/Senior Reactor Operator Licensing Examinations
- ES-201 Attachment 2, Requirements for Administration of Written Examinations
- ES-201 Attachment 3, Letter to Facility Formalizing Examination Schedule
- ES-201 Attachment 4, NRC/Facility Staff Written Examination Review Guide
- ES-201 Attachment 5, Power Plant Examination Results Summary
- ES-201 Attachment 6, Examination Administration Quality Assurance Checkoff Sheet
- ES-203 Attachment 1, Operator License Examination Cover Sheet
- ES-204 Attachment 1, Examination Results Summary Non-Power
- ES-204 Attachment 2, Non-Power Operator License Examination Cover Sheet
- ES-301 Attachment 1, Operator Examination Report
- ES-301 Attachment 2, Senior Operator Upgrade Examination Report
- ES-301 Attachment 3, Senior Operator Examination Report
- ES-302 Attachment 1, List of Topics for Oral Examinations - Boiling-Water Reactors
- ES-302 Attachment 2, List of Topics for Oral Examinations - Pressurized-Water Reactors
- ES-303 Attachment 1, Simulator Exam Report
- ES-305 Attachment 1, Sample Reactor Operator Examination Report

LIST OF ATTACHMENTS (Continued)

- ES-305 Attachment 2, Sample Instant Senior Reactor Operator Examination Report
- ES-306 Attachment 1, Topics for Operating Examinations Non-Power
- ES-403 Attachment 1, Senior Operator Examination Cover Sheet
- ES-404 Attachment 1, Non-Power Senior Operator Examination Cover Sheet
- ES-502 Attachment 1, Control Manipulations
- ES-601 Attachment 1, Assignment To Evaluate Licensed Operator Requalification Program
- ES-601 Attachment 2, Form Letter to Facility Vice President - Reference Material Required
- ES-601 Attachment 3, NRC-Administered Requalification Examination Results Summary Sheet
- ES-601 Attachment 4, Requalification Program Evaluation Report

## PURPOSE AND FORMAT OF OPERATOR LICENSING EXAMINER STANDARDS

### A. Purpose

The Operator Licensing Examiner Standards establish the procedures and practices for examining and licensing candidates for NRC licenses pursuant to Part 55 of Title 10 of the Code of Federal Regulations (10 CFR 55). These standards will

1. describe the provisions of the act and regulations on which the program is based
2. provide for equitable and consistent administration of examinations to all candidates at all facilities subject to the regulations
3. provide guidance for training of new examiners or other interested parties with respect to the details of the examining program

### B. Format

Each standard will explain rules, procedures, and practices for a particular aspect of the program. The designation of each standard will be in the form ES-xyy, where the xyy refers to a three-digit number designed to place the standards in logical groupings for ready reference. The digit symbolized by x ranges from 1 to 9. All standards beginning with each digit refer to aspects of the program in a given grouping, as follows:

1. general administrative standards
2. written examination, reactor operator
3. operating examination, senior reactor operator or reactor operator
4. written examination, senior reactor operator
5. simulator examination, senior reactor operator or reactor operator
6. requalifications examination
7. instructor certification examination
8. fuel handler foreman examination
9. unassigned

The two-digit number "yy" is a sequential number (01, 02, etc.) to differentiate standards within a particular group.

C. Reference

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, D.C.

## ASSIGNMENT OF EXAMINERS TO ADMINISTER EXAMINATIONS

### A. Purpose

This standard establishes the policy for the assignment of examiners for examination administration. Included in this standard are descriptions and use of examiner assignment sheets, assignments and duties of the chief examiner, and the number of examiners required to administer examinations to a group of applicants.

### B. Initiation of Requirement for an Examination

In the past, receipt of applications for operator licenses at headquarters was the first indication of the requirement for examinations. However, it has become a common occurrence for facilities to initiate contact well before applications are sent so that tentative examination dates can be established. Since resources have become more restricted, section chiefs should request an annual training and examination schedule from each plant for planning purposes.

Section chiefs are responsible for ensuring that examination assignments are completed. A "Check Sheet for Completion of Examination Assignment," Attachment 1 to this standard, may be used to track examination progress. Section chiefs shall assign available examiners to administer the examinations on the dates arranged with the facility. Section chiefs should ensure that Examination Assignment Sheets are prepared as far in advance as possible, but at least 2 weeks before the examinations. Examination Assignment Sheet distribution shall include all examiners assigned, the facility resident inspector, appropriate regional distribution as established by the regional administrator, and the operating reactor project manager or licensing project manager. If laboratory examiners are assigned, the assignment sheet shall include the control FIN number and shall include the laboratory group leader and the official contract file on distribution. Conflicts in scheduling contract examiners shall be resolved by the headquarters and regional section chiefs. If they cannot agree, the Branch Chief, OLB, and regional branch chiefs shall resolve the conflicts.

The chief examiner shall have the authority to resolve scheduling problems. Scheduling and rescheduling will be done directly by the facility contact and the chief examiner. The chief examiner shall be responsible for informing the section chief and assigned examiners of all scheduling changes. A letter confirming the examination dates and requesting submission of required information should be prepared by the section chief or chief examiner for signature by the appropriate regional authority. The letter normally should request information at least 60 days before the scheduled examination dates and, therefore, should be signed out at least 90 days before the examinations to allow the facility time to respond.



### C. Assignment of Examiners

The examiner's primary section assignment, other examination commitments, geographical location, and availability at the projected time should be considered in assignments. An examiner who administered the operator oral examination normally should not be assigned to administer the senior operator oral examination to the same candidate. An examiner who has failed a candidate normally should not be assigned to give the same candidate another oral examination. Examiners who have been previous employees of a facility shall not conduct or perform any portion of the examination process at that facility for a minimum period of 6 months. The extent and nature of the potential conflict of interest shall be made known to the section chief by the examiner. The level and amount of participation in the facility examination shall be at the discretion of the branch chief. An examiner who was previously employed by a facility is responsible for informing his immediate supervisor of any relevant facts or special circumstances pertaining to his examination assignment or other factors that might appear as being a conflict of interest. Other factors that should be disclosed by the examiner and considered by the supervisor are:

1. the length of time the examiner worked at the facility
2. the time that has elapsed since the examiner left the facility
3. the nature and extent of previous relationships with former associates being examined
4. reasons why the examiner terminated his employment
5. how the examiner regards the candidate(s) or his former associates at the facility
6. other factors that could impact upon the administration, performance, evaluation, or results of the examination.

Criteria that will identify every conflict of interest issue cannot be prescribed. The application of sound supervisory judgment on the facts of each case is necessary. In doubtful cases, advice from General Counsel should be obtained.

When the regional office operator licensing section chief determines a need for contract examiners, he should request OLB-HQ to assign contract examiners. Formal requests should be made at least 4 months prior to the date of the examinations. Requests for contract examiners less than 4 months prior to the date of the examination should be made as early as possible by telephone. Telephone requests should be followed up with a formal written request. Requests for contract examiners should specify: (1) the facility requesting the examinations, (2) the types of examinations required, (3) the number of candidates for each type of examination, (4) the dates of the examinations, (5) the regional office contact, (6) the facility

contact, and (7) the number of contract examiners required and the level of effort required of the contract examiners.

#### D. Number of Examiners

The target average replacement examination shall be eight candidates and will require two examiners to prepare and administer the written and oral examinations. Normally, a sufficient number of examiners should be assigned so that each examiner will complete no more than four operating examinations per visit regardless of whether the assignment is for cold or replacement examinations. In exceptional cases five complete oral examinations per visit may be required. Request by utilities for examinations for less than eight candidates should be discouraged in the advanced planning stage. If less than eight candidates are to be examined, the section chief shall ensure that the most efficient use of examiners is made and that proctors are obtained as necessary.

#### E. Chief Examiner

Whenever a group of examiners are assigned to administer the examinations, one member of this group will be designated as chief examiner. The chief examiner is responsible for coordinating the details of the examination schedule with the facility contact and the other examiners, and for keeping the assigning section chief informed. Because the need for rescheduling can occur on short notice, the rescheduling can be most expeditiously accomplished directly between the facility contact and examining team through the chief examiner. If rescheduling of examinations involving contract examiners is required, the project manager for the contract shall be notified as soon as possible. It is NRC policy that one member of the examining team shall be a regional examiner who will be assigned as chief examiner. If no regional examiner is on the team, a contract examiner will be designated chief examiner.

#### F. Returning Facility-Provided Material

The chief examiner is responsible for ensuring that facility literature required by examiners to prepare for the examination is returned to the facility as soon as possible. All literature should be returned to the facility soon after expiration of the 20-day period allowed for appealing denials. If denials have been appealed, the chief examiner shall determine if all or part of the information must be retained and shall be responsible for ensuring that it is returned. If the examination resulted in no failures, then the material should be returned as soon as the licenses are issued. The chief examiner shall inform the other examiners when the literature should be returned.

ATTACHMENT 1  
CHECK SHEET FOR COMPLETION OF EXAMINATION ASSIGNMENT

Facility \_\_\_\_\_ Date of Exams \_\_\_\_\_

<u>ITEM</u>	<u>DUE DAYS</u>	<u>DESCRIPTION</u>	<u>INITIALS</u>	<u>DATE</u>
1	-120	Examination schedule agreement with facility	_____	_____
2	-120	Assignment of examiners	_____	_____
3	-90	Letter to vice-president sent	_____	_____
4	-60	Proctoring arranged	_____	_____
5	-60	Applications received (NRC 398 and 396)	_____	_____
6	-45	Applications reviewed	_____	_____
7	-60	Literature received	_____	_____
8	-30	Travel arrangements made	_____	_____
9	-30	Assignment sheet completed	_____	_____
10	-15	Examinations prepared	_____	_____
11	-7	Examinations reviewed and corrected	_____	_____
12	0	Examinations administered	_____	_____
13	15	Grading completed	_____	_____
14	15	Graded examinations received by NRC	_____	_____
15	20	Review completed	_____	_____
16	28	Licenses/denials typed	_____	_____
17	28	Licenses/denials mailed	_____	_____
18	30	Final Exam report	_____	_____
19	50	Literature returned	_____	_____
20	50	Examiners notified to dispose of records	_____	_____

ATTACHMENT 2

REQUEST FOR ADMINISTRATION OF WRITTEN AND OPERATING  
EXAMINATION FOR OPERATOR LICENSING

NRC EXAMINER(S):

REQUEST FOR ADMINISTRATION OF WRITTEN AND OPERATING EXAMINATION FOR  
OPERATOR LICENSING

Please make arrangements to administer written and operating examinations  
to the following applicants:

APPLICANT	DOCKET NO.	EXAMINATION TYPE
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Facility and Location:  
 Facility Contact:  
 Chief Examiner:  
 Written Examination To Be Prepared by RO:  
 SRO:  
 Dates of Examinations:

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Branch Chief

cc:

## PROCEDURES FOR POSTEXAMINATION ACTIVITIES

### A. Purpose

This standard describes the procedures and policy for postexamination debriefing with facility management and the submission of reports and recommendations concerning the examination.

### B. Debriefing Sessions

In addition to the written examination review conducted in conformance to ES 201 section H, the licensee is frequently interested in holding an exit meeting with the examiner(s) regarding the performance of the group of candidates. Although this is not a part of the examination procedure and will not affect the results regarding licensing of any current candidate, it is appropriate for NRC to assist the licensee in his efforts in training and providing qualified operators, and the examiner(s) should hold a debriefing session of this nature. The debriefing session is held with the staff members designated by the licensee, usually the plant or operations supervisor and/or training director. The current candidates shall not be present, and the review of the written examination shall not be reopened. The NRC resident inspector shall be informed of the meeting so he can attend if he so desires. The chief examiner shall advise the resident inspector of plant deficiencies before the meeting and incorporate the resident inspector's comments as appropriate.

In the discussion, the examiner should try to detail the areas of knowledge that have been identified as strong and weak points of the group of candidates overall. The chief examiner should provide a list of names of candidates who clearly passed the operating examinations. It should be pointed out that those not listed may pass but are considered marginal at that time. In addition, discussions concerning recent licensing activities may be of interest to the facility personnel, and the chief examiner should make every effort to answer questions to the fullest extent possible. Questions that are policy matters, or for which there are no clear answers, shall be referred to the appropriate regional section chief or branch chief for response, and the licensee shall be informed that the matter is being referred for reply. The question will be referred to the Branch Chief, OLB, if it is a generic or major policy issue.

### C. Submission of Reports and Recommendations

#### 1. Exit Meeting Report

Following the examination visit the chief examiner should report to the section chief the items discussed at the exit meeting and shall provide a written report of the exit meeting to the section chief if a written



report is requested or required by the section chief. A written report shall be provided to the section chief if there were licensee questions or comments that were not resolved in the exit meeting. Attachment 1 of this standard should be used for the exit meeting report whenever this report is required.

## 2. Final Examination Report.

It is a policy goal of the NRC to complete licensing or denial actions within 30 days of the last day of the examination visit. Section chiefs, chief examiners, and examiners shall establish priorities and schedules to achieve this goal. Grading of the written examination should not be delayed while awaiting facility comments. The grading of individual questions may be delayed until the chief examiner or section chief has reviewed the facility comments and has determined the validity of the question and the acceptable answers. Operating examinations report forms should be completed during and immediately following the operating examination.

The chief examiner shall be responsible for the preparation of the final examination report when the written examination grading has been completed in accordance with ES 201 K. The grading examiner shall prepare a summary of changes to the master examination and answer key that resulted from the facility review or written comments for inclusion in the final report. The grading examiner shall also prepare a "Power Plant Examination Results Summary" Attachment 5 to ES 201 for inclusion in the final examination report. Contract examiners shall complete the summary of changes to the master examination and answer key for examinations that they grade and shall complete the results summary for the written examination graded by that lab and for operating examinations conducted by that lab.

Upon completion of the final report the regional office shall forward a copy of the report to the utility. The final examination report shall document the facility examination review meeting and exit meeting. The report shall include a copy of the written examination(s) and answer key(s), and a results summary. Copies of this report with the results summary removed shall also be sent to public document rooms. A sample examination report is included as attachment 2 to this standard for the purpose of promoting uniformity of form of Final Examination Reports.

## D. Notifications of Results

All notifications regarding final examination results shall be made only after review and approval by the regional administrator or his delegate. A copy of the written examination and each candidate's answer sheet shall be forwarded to the candidate with either his license or a denial letter. An oral examination report (Form 157A, B, or C) shall be included with the denial letter if a candidate has failed the oral portion of the operating examination and a copy of the simulator examination report, Attachment 1 ES 303, shall be included if the candidate has failed the simulator portion of the operating examination. A copy of the results



summary, Attachment 5 ES 201, shall be sent to station management with the final examination report.

E. References

1. Memorandum from Harold R. Denton to Regional Administrators February 13, 1984 "Changes to ES-201, Section H, Facility Review of Written Examinations."
2. Title 10 of the Code of Federal Regulations part 2.790.

Attachment 1  
Exit Meeting Report

Plant/Unit \_\_\_\_\_ Examination Date \_\_\_\_\_

Exit meeting held \_\_\_ yes \_\_\_ no Date of meeting \_\_\_\_\_

Attendees: NRC Facility or Facility contractors

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_____	_____
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_____	_____
_____	_____

Clear passes operating examination: \_\_\_\_\_

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Open items (for resolution by section chief, the regional office, or  
branch chief OLB-HQ) \_\_\_\_\_

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Chief Examiner \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Section Chief review comments \_\_\_\_\_

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Section Chief \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Attachment 2  
Examination Report

North Carolina Power Authority  
ATTN: Mr. H. G. Jones  
Manager of Power  
550A Chestnut Street  
Anyplace, NC 37401

Gentlemen:

SUBJECT: EXAMINATION REPORT

On December 12-16, 1983, NRC administered examinations to employees of your company who has applied for licenses to operate your Edison Nuclear Power Station. At the conclusion of the written examinations, the examination questions were discussed with those members of your staff identified in the enclosed report, and preliminary results of the operating examinations were given at the exit meetings.

In accordance with 10 CFR 2.790(a), a copy of this letter and the enclosure will be placed in NRC's Public Document Room unless you notify this office by telephone within ten days of the date of this letter and submit written application to withhold information contained therein within thirty days of the date of this letter. Such application must be consistent with the requirements of 2.790(b)(1). The examination scores and results for individual applicants are exempt from disclosure by 10 CFR 2.790(a)(6) and, therefore, enclosure 3 will not be placed in the NRC's Public Document Room.

Should you have any questions concerning this letter, please contact us.

Sincerely,

David M. Smith, Chief  
Project Branch 1  
Division of Project and  
Resident Programs

Enclosures:

1. Examination Report
2. Examination(s) and Answer Key(s) (SRO/RQ)
3. Power Plant Examination Results Summary

cc: Plant Superintendent  
Plant Training Manager  
Examiner

SAMPLE  
EXAMINATION REPORT

Facility Licensee: North Carolina Power Authority  
500A Chesnut Street  
Anyplace, NC 37401

Facility Docket No.: 50-123

Facility License No.: CPPR-195

Examinations administered at Edison Nuclear Power Station near Spring City,  
North Carolina

Chief Examiner: \_\_\_\_\_  
Sam Y. Smith Date Signed

Approved by: \_\_\_\_\_  
Frank R. Adams, Section Chief Date Signed

Summary

Examinations on December 12-16, 1983

Written, oral, and simulator examinations were administered to four SROs, three ROs, and two instructor candidates. A written examination was administered to one additional RO candidate. Two SROs, two ROs and one instructor passed these examinations. All others failed.



REPORT DETAILS

1. Examiners

\*S. Y. Smith, NRC  
J. M. Johnson, EG&G  
R. F. Radio, EG&G

\*Chief Examiner

2. Examination Review Meeting

At the conclusion of the written examinations, the examiners met with R. P. Johnson, C. L. Boggs and M. E. Peoples of the Training Department to review the written examinations and answer key. As a result of this review, Questions 2.10 and 6.4 of the RO and SRO examinations respectively were deleted. It was determined that although these questions were obtained from facility supplied information, a recent vendor analysis negated the requirement for this system asked for in the questions. The design change was documented in DCM-83-16.

The facility questioned the applicability of Question 3.3 of the RO examination, but provided no supporting references. The question was considered appropriate by the staff and retained because the knowledge and skills covered by this question are important to the performance of his job as described in the job task analysis.

3. Exit Meeting

At the conclusion of the site visit the examiners met with representatives of the plant staff to discuss the results of the examinations. Those individuals who clearly passed the oral and/or simulator examination were identified in this meeting. The examiners made the following observations concerning your training program:

- a. Areas of generic weaknesses were found in the use of procedures, radiation protection, and theory, both nuclear and thermodynamic. The facility committed to place more emphasis in these areas in future training programs (Open Item 84- ).
- b. Areas in which the examiners believe that the candidates exhibited good training and knowledge were control room familiarization, instrumentation, and facility administrative procedures.

QUESTIONS DELETED FROM WRITTEN EXAMINATIONS

- Question 2.10
- a. Describe the accident which the Boron Injection Tank (BIT) is designed to mitigate. (1.0)
  - b. Describe the design features of the BIT, i.e., how does it accomplish its function during an accident situation. (1.0)

- Answer 2.10
- a. The ECCS including the BIT provides shutdown capability by means of boron injection. The most critical accident for shutdown capability in the main steam line break.
  - b. The BIT contains a nominal 12 wt.% boric acid and is connected to the discharge of the centrifugal charging pumps. Upon receipt of an SI signal, the charging pumps provide the pressure to inject the boric solution into the RCS when the isolation valves open.

REF: I&E Training Center, Systems Manual, Chapter 4.2.  
Also Edison NPS, STM 13-6.

Reason for deletion: Westinghouse Analysis, W-001, provided justification why the BIT was no longer required. The Tank is still in place, however, it's contents has been replaced with boron at RCS concentration. Automatic responses to SI signals have been removed (ref: DCM-83-16).

## INDOCTRINATION PROGRAM FOR NEW EXAMINERS

### A. Purpose

This standard describes the indoctrination program for all persons selected as NRC examiners for operator licenses. It is intended to ensure that persons initially participating in the examining program are given sufficient orientation to enable them to administer examinations in a manner consistent with current practices and standards. Although these standards apply directly to NRC examiners, similar procedures shall be applied for consultant and contractor examiners.

It is essential that all areas within the scope of 10 CFR 55 are equitably and completely covered in the examinations given to candidates and that examinations are administered with a high degree of consistency and uniformity in both level of knowledge required and content of the examination. This ensures that the basic requirement of equal treatment of all candidates is accomplished.

### B. Indoctrination Program

The following program is recommended as a minimum indoctrination program for new examiners:

#### 1. Headquarters/Region Indoctrination

Each new examiner should begin his indoctrination in the headquarters office of the Operator Licensing Branch (OLB) or in the regional offices. During a minimum period of 2 days, the branch chief or appropriate section leader or section chief should discuss the program, as outlined in Items 2 and 3 below, and acquaint the new examiner with branch administrative procedures that apply directly to operator licensing. The section leader or section chief will develop and provide the new examiner with a training program, discuss the program with the new examiner, and determine a schedule for completion of the program. Special attention should be given to ensuring that the new examiner has firsthand knowledge of plant operations. Depending on education, training, and experience of a new examiner, the section leader or regional section chief may require that the examiner participate in one or more of the following training programs:

- a. nuclear power plant fundamentals
- b. plant systems
- c. plant operations
  - (1) simulator

- (2) onsite training and observation (guidelines are included as Attachment 1 to this standard. The scope and length of observation training should be tailored to the new examiner's previous experience.)

- d. examination methods

## 2. Provision of Briefing Materials

Each new examiner shall be supplied by headquarters or the regional office with the following:

- a. copies of 10 CFR 2, 9, 20, 50, and 55
- b. copies of each Operator Licensing Examiner Standard
- c. copies of instruction manuals for accessing the examination questions bank
- d. other general information that may be considered pertinent to the program

## 3. Discussion of Briefing Materials

A certified examiner will discuss the program with the new examiner, using the briefing materials as a basis. This discussion will permit clarification of objectives and content which are often, by necessity, couched in statutory language. Use of computer aids will be demonstrated to ensure that the new examiner candidate has access to basic information.

## 4. Observation of Actual Examinations

Before administering an examination, each new examiner will observe an actual reactor operator and senior reactor operator examination by one or more certified examiners to become familiar with the methods, techniques, and time elements involved. No written discussion can adequately describe items such as level of knowledge or oral examination procedure; therefore, observation of at least one actual examination, preferably on a fairly complex facility, is necessary. The examiner shall debrief the examiner candidate at the completion of the examination, shall, as a minimum, have the examiner candidate complete an Oral Report Form, and make a final recommendation. Differences in observations should be discussed with the examiner candidates during the debriefing session.

## 5. Discussion of Initial Examination

During the first examination administered at a power plant by the new examiner, a certified examiner shall be present to observe and subsequently discuss the examination with the new examiner. The

certified examiner shall be an NRC examiner. This observation and discussion are necessary so NRC can ensure and document that consistent techniques and requirements are being used. They will further serve to identify improved ideas and methods that may be used and to incorporate them into the program. The examiner shall prepare a written evaluation of the examiner candidate including as a minimum the "Oral Exam Audit," NRC Form 308, included as Attachment 2 to this standard, and forward it to the appropriate section leader. The evaluation shall include an evaluation of the candidate's knowledge, an evaluation of the candidate's program preparation and effectiveness, and an evaluation of the candidate's demonstrated ability to examine. A recommendation for certification shall be included.

#### 6. Other Indoctrination

If considered desirable or necessary, additional indoctrination may be provided. It is the responsibility of headquarters and/or regional offices to provide all examiners with sufficient information and guidance to participate effectively in the program. No examiner should be requested to administer an examination unless both he and headquarters and/or the regional office believe that he has received sufficient orientation and training. All deficiencies and weaknesses identified in the written examination and the observed oral examination shall be discussed with the candidate. All deficiencies shall be corrected before certification.

#### 7. Certification of Examiners

At the completion of the indoctrination period, each new examiner shall be certified by the regional branch chief to the Branch Chief, OLB, as being qualified to conduct licensing examinations of reactor operators and senior reactor operators in accordance with 10 CFR 55. If the examiner is transferred to a section that conducts examinations for reactors significantly different from those for which he was previously certified, he should receive appropriate indoctrination and training. As a minimum an additional observed oral examination should be conducted and certification on the new reactor type provided to the Branch Chief, OLB. Certification shall be vendor specific, and additional certification shall be made for each vendor type. Entries should be made in the examiner's personnel record as well. Examiners who are not certified shall not be chosen to administer examinations.

#### 8. Annual Review

At intervals of approximately 1 year, each examiner shall be accompanied by the appropriate section leader or regional section chief, or his designated alternate, during the administration of a written examination and a minimum of one operating test. If a contractor or consultant examiner accepts assignments from two section leaders

or regional section chiefs each year, he may be audited by each supervisor on an approximately annual basis.

During this annual review the examiner and the reviewing examiner will discuss at length current examining policies and practices and other appropriate examining activities, and openly exchange views on the general subject of operator training and licensing.

At the completion of the annual review, the reviewing examiner shall complete a review form, NRC Form 308, which should be filed with the appropriate office with a copy sent to the person reviewed. The reviewer shall discuss with the examiner the evaluation of his techniques and make any suggestions for improvement.

#### 9. Examiner's Training Meeting

OLB headquarters will schedule a meeting of all examiners, usually annually, during which new examining methods and procedures and relevant operating experience will be discussed and all examiners will be able to exchange information and experience that will assist other examiners. All examiners will be expected to attend. Schedules for examinations and training should be adjusted as necessary to minimize conflicts with the examiner's conference. When sufficient examiner training and retraining programs are in place at the Technical Training Center or other facilities and effective procedures for exchange of operating experience and other information have been developed, the need for an annual training meeting will be reevaluated.



## ATTACHMENT 1

## OBSERVATION TRAINING PROGRAM

TRAINING OBJECTIVES

1. To familiarize the potential operator licensing examiner with an operating power plant of the same nuclear steam supply system (NSSS) type as that for which he will be conducting examinations
2. To acquaint the potential examiner with the day-to-day nuclear station routine
3. To acquaint the potential examiner with a typical station's records and procedures
4. To expose the potential examiner to nuclear plant maintenance conducted under radiological control regulations

GENERAL COMMENTS

1. The plant to be used may be any operating power plant - the objective will be to select a plant that is most typical of the majority of plants of the specific type the potential examiner will be examining.
2. The schedule for the plant also will consider that plant with the most significant upcoming events, i.e., fuel loading, turbine maintenance, load changes, surveillance testing, and plant startup/shutdown.
3. The course will be conducted after the potential examiner has completed the required academic courses - when the training will be most meaningful to him.
4. The observation guide is just that - a guide. If an event of interest occurs (such as a major surveillance or plant recovery from a scram), the potential examiner should adjust his schedule so that he will be able to observe the event.
5. The potential examiner shall observe all rules and regulations in effect at the facility.
6. The potential examiner shall only observe operation of equipment; he shall not actually operate equipment (with the exception of portable radio equipment, as authorized by the facility).

7. The potential examiner shall not request any equipment to be operated, nor any tests or surveillances to be conducted.
8. The potential examiner shall arrive at the site sufficiently early to observe the shift turnover.
9. After observing an event (e.g., surveillance, equipment test, maintenance, startup, and shutdown) or tracing a system, the potential examiner shall record it in the space provided on the daily training schedule. Once the observation training has been completed, the training schedule will be filed in the examiner's training folder.
10. The section leader or regional section chief or a certified examiner designated by him to be in charge of the potential candidates observation training will provide a list of systems to be traced out.
11. During this training period, the potential examiner should observe the use of procedures by the operators and follow the event with a spare copy of the procedures, if possible.
12. The potential examiner should pay attention to administrative procedures (e.g., tag outs, jumper log, and key log) used by the operator and shift supervisor.

#### TYPICAL DAY

1. Review previous day's control room log.
2. Review previous day's control room operation and discuss unusual events with instructor.
3. Review day's control room schedule and observe any periodic surveillance tests to be run, any load changes or equipment changes to be made, and startups or shutdowns.
4. Review previous day's chemistry and radiological logs.
5. Review day's radiological control schedule and observe any special sampling or radiological procedures to be performed.
6. Review previous day's maintenance log.
7. Review day's maintenance schedule and observe any special maintenance to be performed, e.g., control rod drives.
8. Proceed to scheduled plant area and begin day's tasks.

COURSE SCHEDULE

	WEEK 1							WEEK 2							WEEK 3							WEEK 4						
	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
Shift	2	2	2	2	2	0	0	3	3	3	3	3	0	0	4	4	4	4	4	0	0	2	2	2	2	2	0	0
Day Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Shift:

- 2 - days (8 am-4 pm)
- 3 - afternoon (4 pm-12 midnight)
- 4 - graveyards (12 midnight-8 am)
- 0 - off





Events Observed/Systems Traced

Day 18 Review Logs - Control Room  
                   - Maintenance  
                   - Rad Control  
 Tour - Reactor Building  
  
 Daily Recapitulation

Day 19 Review Logs - Control Room  
                   - Maintenance  
                   - Rad Control  
 Tour - Reactor Building  
       (a) Emergency Core Cooling Systems  
       (b) Process Instrumentation  
  
 Daily Recapitulation

Day 20 Off

Day 21 Off

Day 22 Review Logs - Control Room  
                   - Maintenance  
                   - Rad Control  
 Tour - Turbine Building  
  
 Daily Recapitulation

Day 23 Review Logs - Control Room  
                   - Maintenance  
                   - Rad Control  
 Tour - Area Radiation Monitors  
       (Observe Levels and Locations  
       - Turbine Building

Day 24 Review Logs - Control Room  
                   - Maintenance  
                   - Rad Control  
 Tour - Results Shop/Rad Control Lab  
       (Observe Rad Control Procedures  
       and Analysis)  
       - Reactor Protection System and  
       Reactor Process Instrumentation  
  
 Daily Recapitulation

Events Observed/Systems Traced

Day 25 Review Logs - Control Room  
                  - Maintenance  
                  - Rad Control

Tour - Control Room

Daily Recapitulation

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Day 26 Review Logs - Control Room  
                  - Maintenance  
                  - Rad Control

Tour - Control Room

Daily Recapitulation

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Day 27 Off

Day 28 Off



HOMEWORK

1. Read station Technical Specifications.
2. Review system description before inplant tour.
3. Review system operating procedures.
4. Review station emergency procedures.
5. Review radiological control fundamentals.

ATTACHMENT 2  
ORAL EXAM AUDIT

NRC FORM 308 (12-82)		U.S. NUCLEAR REGULATORY COMMISSION				TYPE OF EXAM	
ORAL EXAM AUDIT						RO	INITIAL
						SRO UPGRADE	RETAKE
						SRO INSTANT	REQUALIFICATION
EXAMINER			FACILITY				
APPRISER			DATE APPRAISED		DATE OF LAST ORAL APPRAISAL		
RATING FACTORS			EXCEL	GOOD	FAIR	POOR	COMMENTS
1. CONFORMANCE TO THE EXAMINER STANDARDS							
a. OPERATING DEMONSTRATION							
b. CONTROL ROOM (Major, Auxiliary & Engineered Safety Sys)							
c. CONTROL ROOM (Nuclear and Radiation Instruments)							
d. CONTROL ROOM (Electrical)							
e. PLANT WALKTHROUGH							
f. INTEGRATED PLANT RESPONSE							
g. THEORY NUCLEAR							
h. THEORY THERMO, H.T., FLUID DYN.							
i. RADIATION PROTECTION							
2. KNOWLEDGE OF FACILITY AND ITS PROCEDURES							
a. GENERAL KNOWLEDGE OF FACILITY							
b. SPECIFIC KNOWLEDGE OF FACILITY							
c. SPECIFIC KNOWLEDGE OF FACILITY PROCEDURES							
3. ABILITY TO EVALUATE CANDIDATE'S KNOWLEDGE							
a. QUALITY OF QUESTIONS							
b. ASKS FOLLOW UP QUESTIONS WHEN NECESSARY							
c. APPROPRIATE QUESTIONS FOR TYPE OF CANDIDATE							
d. TEST OF CANDIDATE'S "BOARDSMANSHIP"							
4. DEMEANOR OF EXAMINER (Comment Required)							
5. APPROPRIATE BALANCE OF EXAM (Operational vs. Theoretical) (Comment Required)							
6. EXAMINATION REPORT							
a. COMMENTS JUSTIFIED							
b. SUMMARY EVALUATIONS ADEQUATELY SUPPORTED							
c. COMPLETE AND ACCURATE REPORT							
7. COMMENTS							

## ADMINISTRATION OF EXAMINATIONS AT MULTIUNIT POWER STATIONS

### A. Purpose

This standard specifies the policy and evaluation methods for examination of reactor operators and senior reactor operators who apply for licenses at multiunit power stations. This standard also may be used for guidance on examination requirements for identical or similar units not located at the same site.

### B. Background

In the construction of a dual or multiunit power station, the units are normally brought on line with approximately 1 to 2 years between the fuel load dates of each unit. When the second (or subsequent) unit is brought on line most, if not all, of the candidates will hold current licenses on the first unit. If the units are nearly identical, there are provisions for waiver of examination requirements providing certain conditions are met.

The three conditions specified in 10 CFR 55.24 are:

1. The candidate has had extensive actual operating experience at a comparable facility within 2 years before the date of application.
2. The candidate has discharged his responsibilities competently and safely.
3. The candidate has learned the operating procedures for, and is qualified to operate competently and safely, the facility designated in his application.

Before 1979, it was the practice of the Operator Licensing Branch (OLB) to require each utility that wanted its operators and senior operators to be dual licensed to administer the appropriate training to fulfill the requirements of 10 CFR 55.24(a), (b), and (c). The utility would be responsible for the evaluation of this training by administering an examination that was reviewed by the NRC.

As a result of the accident at Three Mile Island, Unit 2, the NRC required a higher level of training of the operators and greater confidence in the testing requirements. OLB, therefore, required a complete NRC-administered examination in view of the 10 CFR 55.24 waiver policy. The training programs have been significantly upgraded in the last few years, and the NRC has further increased confidence in the examination requirements through NRC-administered requalification examinations. Requests for waivers will be favorably considered providing the facility has sufficient justification concerning the degree of similarity between the units and the details of the training and certification program.

For replacement examinations at a dual or multiunit station, the candidate must have completed the training program for all units with emphasis on the differences. The NRC examination will then test the candidate on all features of the station.

### C. Criteria for Dual Licensability

For a reactor operator or senior reactor operator to be eligible to hold simultaneous valid licenses on more than one nuclear facility, the utility must justify to the Commission that the differences between the units are not so significant that they impact the ability of the licensed personnel to operate safely and competently both or all facilities. Further, the utility must submit for NRC review the details of the training and certification program. The analyses and summary of the differences that must be performed will include

1. facility design and systems relevant to control room personnel
2. Technical Specifications
3. procedures, primarily abnormal and emergency operating procedures
4. control room design and instrument location
5. operational characteristics

The utility also should describe the expected method of rotating personnel between units and the refamiliarization to be conducted before responsibility on a new unit is assumed. Generally, only those facilities designed by the same nuclear steam supply system vendor and operated at approximately the same power level will be considered for dual licensability. Examples of facilities (and vendors) where dual (or multi-licenses) have been issued are:

<u>Facility</u>	<u>Vendor</u>
Oconee 1, 2, and 3	Babcock & Wilcox
Calvert Cliffs 1 and 2	Combustion Engineering
Browns Ferry 1, 2, and 3	General Electric
Brunswick 1 and 2	General Electric
Dresden 2 and 3	General Electric
Peach Bottom 2 and 3	General Electric
Farley 1 and 2	Westinghouse
Point Beach 1 and 2	Westinghouse
Salem 1 and 2	Westinghouse
Surry 1 and 2	Westinghouse

Dual licensability will not be automatically denied for those facilities failing to meet the criteria of same vendor and similar power level. However, special justification must be submitted for review and approval by the NRC. Exceptions are rare and are usually limited to selected operations management personnel.

#### D. Waiver of Examination

In addition to the three criteria specified in 10 CFR 55.24, the NRC may require additional justification before granting waivers of examination requirements for second or subsequent units. The two criteria are

1. a formal training and evaluation program in the five categories of plant differences specified in Paragraph C of this standard
2. satisfactory performance on the most recent NRC-administered requalification examination

Instead of Criterion 2 above (or additionally if the situation warrants) other examination requirements may be imposed such as NRC-administered examinations (oral and/or written) on the plant differences. Submittals should be requested and evaluated by the regional office. Results of the evaluations should be submitted to the Director, Division of Human Factors Safety, NRC for concurrence.

#### E. Hot or Replacement Examinations at Multiunit Stations

This section describes the examination requirements at those stations where both (or all) units are in an operational status (have received operating licenses and/or are commercial). Candidates may apply for dual licenses, assuming the criteria are met, and be examined simultaneously on all applicable units. The oral and written examinations shall be developed in accordance with the appropriate standards but must include questions that investigate the candidate's knowledge of the different design, procedural, and operational characteristics. It is recommended that approximately 10% of the written examination include questions of this nature. These questions should not be confined to a specific category. For example, plant differences are most evident in system design, but design differences usually require different operating procedures. Identical plants may have different fuel designs, and pressurized-water reactors (PWRs) will have different boron concentrations. Questions on nuclear theory can be developed from these considerations.

During the course of the oral examinations, the examiners should diversify their coverage of the units and not become predictable in conducting examinations only on one unit. Different candidates may be examined on different units, or a specific candidate may be asked to explain how control board layout or system/instrumentation differences may require different procedural actions between one unit and another.

Many dual or multiunit stations will have a simulator that is modeled after only one unit. During the course of the oral examination, the examiner should ensure that the candidate is properly tested on the different systems, control board layout, and other aspects of the other unit(s). Following a simulator examination on Brown's Ferry Unit 1, for example, the control room portion of the plant walkthrough should be conducted primarily on Unit 2 and/or Unit 3.



#### F. Examination Requirements on Different Units

Different units owned or managed by a single utility are defined for purposes of this standard as:

1. same vendor manufacturer but significantly different age and/or power level (e.g., Dresden Units 1 and 2).
2. same vendor manufacturer and similar units but different location (e.g., Sequoyah and Watts Bar, Byron and Braidwood).
3. different vendor manufacturer (PWR only) but located at the same site (e.g., Arkansas Units 1 and 2, Millstone Units 2 and 3).

Generally, personnel will not be examined on or allowed to hold licenses on different units simultaneously. Although some allowances have been made for this in the past, future exceptions will be rare.

#### G. Waivers of Portions of the Examinations for Previously Licensed Operators

Waivers of portions of the examinations will be considered depending on the justification submitted by the utility as provided for in 10 CFR 55.24. For personnel licensed on one facility and transferring to another, written examination categories such as theory (Categories 1 and 5) may be waived and abbreviated oral examinations concentrating on plant differences may be administered. Requests for waivers in these instances should be evaluated by the regional office. Headquarters should concur with the results of the evaluations. Examiners will be notified of such waivers through the appropriate section leader or regional section chief and on the Examination Assignment Form.

PRE-ADMINISTRATION QUALITY ASSURANCE PROGRAM FOR REVIEW  
OF WRITTEN EXAMINATIONS

A. Purpose

This standard defines the procedure to be followed for quality assurance (QA) review of written examinations before their administration.

B. Responsibility

Examiners should review their own examination in detail, as discussed in this standard and in Standard ES-201. The appropriate regional section chief is responsible for ensuring that an independent review is conducted of written examinations prepared by examiners in his section. A spot check review should be performed by another examiner. Section chiefs shall not review examinations that they prepared. The QA review required by this standard is only a spot check, or sampling test, after the detailed review by the preparing examiner. The Section chief will then certify the review has been completed.

C. Review Procedure

Both the examination author and the reviewer should use the "Written Examination Quality Assurance Checkoff Sheet," ES-107 Attachment 1, to document their review. As a minimum, the following items should be checked by the Exam Author and spot checked by the reviewer.

1. Review all questions for clarity of intent.
2. Review all questions for applicability of terminology and systems to facility. Ensure all questions are in proper category.
3. Review all categories for weights assigned, in accordance with Standards ES-203 and ES-403.
4. Verify that the totals of points for questions in each category are correct and that these totals correspond to weights given on the cover sheet.
5. Verify that no single question and/or topic is worth more than 20% of that category.
6. Verify that subjects required by 10 CFR 55.21 for reactor operators (ROs) and 55.22 for senior reactor operators (SROs) are covered in the examination. Standards ES-202 and ES-402 group these subjects in the format required for power reactor examinations, and Standard ES-204 groups these subjects in the format required for non-power reactor examinations.



- \*7. Review all questions and answer keys to ensure there is no double jeopardy.
  8. Review the answer key to ensure all questions are answered concisely and clearly. Each question should have numerical values assigned for partial credit; that is, when the question elicits a complex multifaceted response, a scheme should be enumerated for scoring each of these facets. For example, a single question worth 3 points of a 25-point category might have as many as 10 facets, each of which should be assigned a value.
  9. Verify that there is a reference to the plant training material for each answer, if available.
  10. Review questions and answers to ensure they correspond to the required level of knowledge (i.e., RO or SRO level), as described in Standard ES-202.
  11. Ensure that "lone questions" of a section are flagged on a previous page by a "continued on next page" statement.
  12. Ensure that each category is concluded with the statement "End of Category \_\_\_\_\_".
- D. Documentation

When the review is completed, the "Written License Examination Quality Assurance Checkoff Sheet," attachment 1 of this standard, should be approved by regional section chief and filed with the record copy of the examination.

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\*See Standard ES-202, p. 5 of 6.

Attachment 1

WRITTEN EXAMINATION QUALITY ASSURANCE CHECKOFF SHEET

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>AUTHOR'S INITIALS/DATE</u>
1	Clarity of intent of questions	_____
2	Applicability of questions to facility	_____
3	Category weights correct. All questions in proper category.	_____
4	Each category total correct and corresponding to weights on the cover sheet	_____
5	End of each category indicated by statement "End of category ____".	_____
6	No question worth more than 20% of that category weight	_____
7	Verify that 10 CFR 55.21 and 55.22 subjects are covered.	_____
8	No double jeopardy questions	_____
9	Answers clear and concise on answer key	_____
10	References to plant material for each question, as applicable	_____
11	Proper level of knowledge (RO/SRO)	_____
12	Partial credit points indicated, if applicable	_____

Author: \_\_\_\_\_ Date: \_\_\_\_\_

Contract Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_  
(If applicable)

Region Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

Review Completed: \_\_\_\_\_ Date: \_\_\_\_\_  
(Section Chief)

Facility/Unit: \_\_\_\_\_ Exam Date: \_\_\_\_\_

Senior / / Operator / /

POST-ADMINISTRATION QUALITY ASSURANCE PROGRAM FOR REVIEW OF  
GRADED EXAMINATIONS

A. Purpose

This standard defines the procedures to be followed for quality assurance (QA) review of written examinations after they are graded by the examiners.

B. Responsibility

Examiners should review their own grading in detail, as discussed in this standard and in Standard ES-201. The appropriate regional section chief is responsible for ensuring that an independent review is conducted of written examination grading. The QA review required by this standard is only a spot check, or sampling test, after the detailed review by the grading examiner.

Whenever possible the written examination shall be graded by the examiner who prepared the examination. If, due to class size or unavailability of the preparing examiner, the examination is graded in whole or in part by an examiner who did not prepare the examination then a more thorough supervisory review of the grading should be made. The regional office operator licensing section chief shall be notified that an examiner who did not prepare the examination graded or participated in the grading of the written examination.

C. Review Procedure

The reviewer should use the "Examination Grading Quality Assurance Checkoff Sheet," Attachment 1 of this standard, to document his review. As a minimum, the following items should be checked:

1. Spot check at least 50% of the examination category totals and overall grades assigned for errors in addition for each examination.
2. Review in detail the answers and grades assigned for at least one question in 50% of the categories for 50% of the applicants. This review will allow the examiner to determine consistency of response and grades, indications of cheating or collusion, and performance on individual questions.
3. Review and recalculate grading assigned for all borderline cases (i.e.,  $70\% \pm 2\%$  for each category or  $80\% \pm 2\%$  overall).
4. Compare the highest failing and the lowest passing examination, to ensure that the fail/pass decision is justified. Check at least one question in every category in both cases. Confirm failures with the next highest failing examination, if appropriate.

5. Spot check other failing examinations to be assured of justification for denial of license.
  6. Review overall performance in each category and individual questions to determine if there are problems in the facility training program, in the wording of the questions, or in other areas.
  7. If the above reviews indicate significant problems, conduct a detailed review, as necessary.
- D. Documentation

When the QA reviewer has completed his review, the "Examination Grading Quality Assurance Checkoff Sheet," ES-108 Attachment 1, should be approved by the regional section chief and filed with the record copy of the examination.

Attachment 1

EXAMINATION GRADING QUALITY ASSURANCE CHECKOFF SHEET

Grader(s) Name \_\_\_\_\_

Facility \_\_\_\_\_ Date of Exam \_\_\_\_\_

Examination: Operator \_\_\_\_\_ Senior \_\_\_\_\_

Post-Examination Procedures

<u>Item</u>	<u>Description</u>	<u>Examiner Initial/date</u>	<u>Review Initial/date</u>
1.	No apparent indication of cheating or collusion	_____	_____
2.	Partial credit consistent for each candidate	_____	_____
3.	Section and cumulative scores checked for addition (Reviewer spotcheck 25% of category totals)	_____	_____
4.	Grading for all borderline cases reviewed (70% ± 2%/ section or 80% ± 2% overall)	_____	_____
5.	Detailed review, 1 question per category, 50% of categories, 50% of applicants	_____	_____
6.	Highest failing/lowest passing examinations compared to justify fail/pass decision	_____	_____
7.	All other failing examinations checked to be assured of justification for failure	_____	_____
8.	Individual question performance checked for training deficiencies, wording problems, etc.	_____	_____

Grader: \_\_\_\_\_

Date: \_\_\_\_\_

Contract Reviewer:  
(If applicable) \_\_\_\_\_

Date: \_\_\_\_\_

Region Reviewer: \_\_\_\_\_

Date: \_\_\_\_\_

Review Completed: \_\_\_\_\_

Date: \_\_\_\_\_

Section Chief



ELIGIBILITY REQUIREMENTS FOR OPERATOR OR SENIOR  
OPERATOR LICENSE CANDIDATES AT POWER REACTORS.

A. Purpose

This standard lists the various requirements on training, educational experience, and certification that must be met before a candidate can apply for an NRC reactor operator or senior operator license. The purpose of this standard is to aid the examiners in their review of individual applications to determine the eligibility of candidates before the NRC reactor operator or senior reactor operator licensing examination.

B. Reactor Operator Eligibility Requirements

1. Experience Requirements

- a. Minimum of 2 years of power plant experience of which at least 1 year shall be nuclear power experience. Training time to meet the requirements for this license shall not be counted as a part of this minimum 2 years of power plant experience.
- b. Minimum of 6 months at the site for which the license is sought.
- c. Military power (propulsion) plant operating experience may be substituted on a one for one basis for the power plant experience required in paragraph B.1.a.

2. Training Requirements

- a. Minimum of 3 months' training in the control room as an extra man on shift on a day to day basis in the capacity of the position for which the applicant seeks a license and under the direct supervision of the licensed personnel assigned to the position on the plants operating shift i.e., operator or shift supervisor positions.
- b.<sup>1</sup> Training in (1) heat transfer, (2) fluid flow, (3) thermodynamics, (4) use of installed plant systems to control or mitigate an accident in which the core is severely damaged, and (5) reactor and plant transients.
- c.<sup>1</sup> Total of 500 hours of lectures on: (1) principles of reactor operation, (2) design features of the nuclear power plant involved, (3) general operating characteristics of the nuclear power plant involved, (4) instrumentation and control systems, (5) safety and emergency systems, (6) standard and emergency operating procedures, and (7) radiation control and safety procedures.

- d.<sup>1</sup> Satisfactory completion of a NRC approved training program of at least one week duration at a nuclear power plant simulator. The simulator training center should certify the applicant's ability during a reactor startup to manipulate the controls, keep the reactor under control, predict instrument response, use instrumentation, follow procedures, and explain annunciator alarms that occur during operation.
- e. Manipulation of the controls of the facility during five significant reactivity changes as described in the operator requalification program. Every effort should be made to diversify reactivity changes.
- f. Participation in reactor and plant operation at power levels of at least 20% power operation.

### 3. Education Requirements

- a. High school diploma or equivalent.<sup>2</sup>

### C. Senior Reactor Operator - Candidates Without 4-Year Degree in Engineering or Applied Science

#### 1. Experience Requirements

- a. Minimum of 4 years of responsible power plant experience as a control room operator (fossil or nuclear) or as a power plant staff engineer involved in the day-to-day activities of the facility commencing with the final year of construction. Of this 2 years shall be nuclear power plant experience.
- b. Licensed reactor operator at the same facility for at least a year. Experience for 1 year as a licensed reactor operator or senior reactor operator at another nuclear power plant may be substituted. Actual operating experience for 1 year in a position that is equivalent to a licensed operator or senior reactor operator at military propulsion reactors may be substituted on a one-for-one basis. Navy ratings that are considered equivalent are (1) Propulsion Plant Watch Officer, (2) Engineering Watch Supervisor, (3) Engine Room Supervisor, (4) Reactor Operator, (5) Chief, Reactor Watch, (6) Engineering Officer of Watch, and (7) Propulsion Plant Watch Supervisor.
- c. Minimum of 6 months at the site for which the license is sought.

#### 2. Training Requirements

- a. Minimum of 3 months on shift as an extra person in training for a position as senior reactor operator.
- b.<sup>1</sup> Training in (1) heat transfer, (2) fluid flow, (3) thermodynamics, (4) use of installed plant system to control or mitigate an accident in which the core is severely damaged, (5) reactor and plant transients, (6) reactor theory, (7) handling and disposal of radioactive materials,

(8) specific operating characteristics of the plant(s) for which the license is sought, (9) fuel handling and core parameters, and (10) administrative procedures, conditions and limitations.

3. Education Requirements

a. High school diploma or equivalent.<sup>2</sup>

D. Senior Reactor Operator - Candidates With 4-Year Degree in Engineering or Applied Science

1. Experience Requirements

a. Minimum of 2 years of responsible nuclear power plant experience which may be as a staff engineer involved in the day-to-day operation of the plant.

b. Minimum of 6 months at the site for which the license is sought.

2. Training Requirements

a. Minimum of 3 months on shift as an extra person in training for an SRO position.

b.<sup>1</sup> Training in (1) heat transfer, (2) fluid flow, (3) thermodynamics, (4) use of installed plant systems to control or mitigate an accident in which the core is severely damaged, (5) reactor and plant transients (6) reactor theory, (7) handling and disposal of radioactive materials, (8) specific operating characteristics of the plant(s) for which the license is sought, (9) fuel handling and core parameters, and (10) administrative procedures, conditions and limitations.

c.<sup>1</sup> Total of 500 hours of lectures on: (1) principles of reactor operation and reactor theory, (2) design features and specific operating characteristics of the plant(s) involved, (3) instrumentation and control systems, (4) safety and emergency systems, (5) standard and emergency operating procedures, (6) administrative procedures, conditions and limitations, (7) radiation control and safety procedures, and (8) handling and disposal of radioactive materials.

d.<sup>1</sup> Satisfactory completion of a NRC approved training program of at least one week duration at a nuclear power plant simulator. The simulator training center should certify the applicant's ability during a reactor startup to manipulate the controls, keep the reactor under control, predict instrument response, use instrumentation, follow procedures, and explain annunciator alarms that occur during operation.

e. Manipulation of the controls of the facility during five significant reactivity changes as described in the operator requalification program. Every effort should be made to diversify reactivity changes.

f. Participation in reactor and plant operation at power levels up to at least 20% power operation.

3. Education Requirements

a. At least a 4-year degree in engineering or applied science.

E. Eligibility Requirements for Cold Examinations

1. Cold examinations are those examinations administered before initial criticality.
2. Each candidate has to complete satisfactorily the training programs that are submitted in Section 13.2 of the Final Safety Analysis Report and approved by the NRC.
3. The Licensee Qualification Branch, Division of Human Factors Safety, reviews and approves these programs before examinations by OLB and initial fuel loading.
4. The basis for review and approval is contained in Section 13.2.1 of the Standard Review Plan (SRP) (NUREG-0800).
5. SRP Section 13.2.1 allows the applicant for an operating license to vary the training program for the following three classes of individuals:
  - a. individuals with no previous experience
  - b. individuals who have had nuclear experience at facilities not subject to licensing
  - c. individuals who hold, or have held, licenses for comparable facilities
6. The letter sent to all power reactor applicants and licensee from H. Denton, NRR, dated March 28, 1980, stated that precritical applicants (candidates) will be required to meet unique qualifications designed to accommodate the fact that their facility has not been in operation. Generally, these unique qualifications apply to areas of experience at their own plant because the plant has not yet been in operation. For example,
  - a. Cold training programs for persons with no previous experience are required to contain observation programs at plants that are as similar to their own as possible.
  - b. Cold training programs for persons with no previous experience usually contain simulator training programs.

The approved cold training program should be used as the basis for determining cold examination eligibility.

7. Eligibility for examinations for licenses at second or third units of multiunit stations is addressed in Standard ES-106.
- F. Contents of Applications
1. Each application shall be made on NRC Form 398. Form 398 contains all of the requirements of 10 CFR 55.10 and must be completely filled out and signed by the appropriate personnel.
  2. A report of medical examination (NRC Form 396) completed by a licensed practitioner shall be submitted.
  3. If a candidate is reapplying following a denial, 10 CFR 55.12 applies and a new complete form 398 shall be submitted. Training received after the denial should be highlighted in item 15, comments.
    - a. If a candidate's application has been denied because of failure of the written or operating test or both, a new application may be filed 2 months after the date of denial. A third application can be filed 6 months after date of denial and successive applications 2 years after date of denial.
    - b. If the candidate passed either the written or operating portion of the test, he can request a waiver from that portion already passed.
    - c. The reapplication should identify those areas in which the applicant demonstrated weaknesses during the previous examination and the additional training received to correct these specific deficiencies.
    - d. The medical certificate, Form NRC 396, is good for 6 months from the date the NRC physician signs it. For reapplication following a denial or withdrawal by the license candidate the regional office may waive the requirement for a new medical certificate if the date of the original medical was within one year of the scheduled reexamination and a waiver of the requirement for a new medical certificate is requested by the applicant. The request for waiver should be made in item 15, Comments, on NRC form 398 or by separate letter with the reapplication. The disposition of the waiver request shall be documented by a note on the NRC Form 396 originally submitted and in accordance with ES-111.
- G. Failure To Meet Eligibility Requirements
1. If an applicant fails to document or meet the eligibility requirements of this standard, he shall not be permitted to sit for the examination and the administrative procedure of ES-112 section E should be followed.
- H. References
1. American National Standards Institute, ANSI N 18.1-1971, "Selection and Training of Nuclear Power Plant Personnel."



2. American National Standards Institute/American Nuclear Society, ANSI/ANS-3.1-1981, "Selection, Qualifications and Training of Personnel for Nuclear Power Plants."
3. Letter from H. Denton (NRC) to All Power Reactor Applicants and Licensees, Subject: Qualifications of Reactor Operators, Mar. 28, 1980.
4. Title 10 of the Code of Federal Regulations, Part 55, "Operators Licenses."
5. U.S. Nuclear Regulatory Commission, NUREG-0094, "NRC Operator Licensing Guide," July 1976.
6. ---, NUREG-0737, "Clarification of TMI Action Plan Requirements," Nov. 1980.
7. ---, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," July 1981.
8. Title 10 of the Code of Federal Regulations section 2.103(b)(1) and (2). |

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<sup>1</sup>These training requirements can be met by successful completion of an NRC-approved training program.

<sup>2</sup>Equivalent is a GED certificate. Some states (e.g., New York) use a term other than GED certificate, but these certificates are equivalent to a GED certificate.



ELIGIBILITY REQUIREMENTS FOR REACTOR OPERATOR OR SENIOR  
REACTOR OPERATOR LICENSE CANDIDATES - NONPOWER REACTORS

A. Purpose

The purpose of this standard is to aid the examiners in their review of individual applications to determine the eligibility of candidates to be administered the NRC reactor operator or senior reactor operator licensing examination at a non power reactor. This standard lists the various requirements on training, educational experience, and certification that must be met before a candidate can apply for an NRC reactor operator or senior operator license at non power reactors.

B. Reactor Operator Eligibility Requirements

1. Certification Requirements

- a. Certification by responsible facility management that the individual has received sufficient training at the facility to safely assume the duties and responsibilities of a licensed operator. (Form 398, block 17.b)

2. Training Requirements

In consideration of the individual's previous experience, training and level of responsibility, the training performed shall:

- a. Be adequate to ensure the safe operation of the facility.
- b. Include the topics identified in reference 1, Section 5.4.
- c. Include operation of the reactor and its related systems under the supervision of licensed operators and senior operators.

3. Education Requirements

There are no formal education requirements specifically endorsed by the NRC to be eligible for a non power reactor operator examination. However, historically the NRC has viewed the education requirements of candidates for power and non power licenses to be identical. If a candidate has not completed high school or received an equivalent certification, the number of years of education shall be identified on the candidates application and evaluated for eligibility prior to examination. Successful completion of the NRC operator licensing examinations requires a knowledge of reading, writing and mathematics

equivalent to that possessed by a high school graduate with the proper academic subject background.

C. Senior Reactor Operator Eligibility Requirements

1. Experience and Certification Requirements

- a. Minimum of 3 years of nuclear related experience. A maximum of 2 years equivalent full-time academic training may be substituted for 2 of the 3 years. (Reference 1)
- b. Certification by responsible facility management that the individual has received appropriate and sufficient training at the facility to safely assume the duties and responsibilities of a licensed senior operator. (Form 398, Block 17b.)

2. Training Requirements

In consideration of the individual's previous experience, training and level of responsibility, the training performed shall:

- a. Be adequate to ensure the safe operation of the facility.
  - b. Include the topics identified in reference 1, Section 5.3.
  - c. Include operation of the reactor and its related control systems.
3. Education Requirements

There are no formal education requirements specifically endorsed by the NRC to be eligible for a non power reactor senior reactor operator examination. However, historically the NRC has viewed the education requirements of candidates for power and non-power reactor licenses to be identical. If a candidate has not completed high school or received an equivalent certification, the number of years of education shall be identified on the candidates application (Form 398) and evaluated for eligibility. Successful completion of the NRC senior operator licensing examinations requires a knowledge of reading, writing and mathematics equivalent to that possessed by a high school graduate with the proper academic subject background.

D. Contents of Applications

1. Each application for reactor operator or senior reactor operator shall be made on personal qualifications statement (NRC Form 398). Also see Reference 3. Form 398 contains all of the requirements of 10 CFR 55.10 and must be completely filled out and signed by the appropriate personnel. Those sections or items that are not applicable to operators at non-power reactors shall be marked

"NA" to indicate they are not applicable. Additionally, training criteria contained in ANSI/ANS-15.4 (1977) N380 should be followed in completing Item No. 12 (TRAINING) on NRC Form 398.

All sections of Form 398 should be completed as per the instructions. Other pertinent information specifically for Non-Power Reactor License candidates should be completed on NRC Form 398 as follows:

Section 4: Type of Application

- Items:
- a.2 applies only to new reactor facilities prior to criticality
  - f.3 not applicable to non-power facilities
  - e. "Reapplication" and f. "Reapplication waiver request." If the application is a reapplication subsequent to a prior failure, the requirement of 10 CFR 55.12(a), Reapplications, regarding a statement on retraining, is to be included. This requirement may be met by detailing the information in Block 12 or 15, or by a separate letter attached to the application. On reapplications any waivers to be considered are requested by checking the appropriate blocks and identifying the categories of the written exam to be waived, if applicable.

Section 10: Current position at facility

- Items:
- a, b, c, e, f, i are not directly applicable to non-power reactors. Therefore, the item; "other" should be used for position descriptions. For example, Director of facility, Chief Reactor Supervisor, etc. Items g and h are only for licensed personnel. A non-licensed control room operator trainee should not be listed as a control room operator (item h) but, instead, should be listed as a trainee under item j.

Section 12: Training

This section should contain only training received specifically for the license for which the application is submitted. Non-power facilities normally do not have a formalized training program, therefore, the period of training should be identified (month and year from - to) and "condensed" to the appropriate number of weeks.

Example: A candidate spends four months in training from 1 June through 30 September with two hours a week devoted to fundamentals, two hours a week tracing systems, one hour

a week in the control room, and one hour a week in actual manipulation (two reactivity changes per manipulation). The "condensed" training would be from 6/84 to 10/84; Fundamental (16 week x 2 hr/week); approximately one week, plant systems observation; one week, control room operations; one week, and reactivity manipulation 32. Numbers do not have to be precise, but should be representative.

- Items:
3. "Simulator Operation" and "Simulator Name(s)," are not applicable to non-power facilities.
  5. "Extra Person on Shift," is not applicable to non-power facilities.
  6. The entry of "continuous" or similar entry for the number of weeks in requalification is not sufficient. The actual number of weeks (condensed in one time period) spent in requalification must be listed as per the example in Section 12 "Training".

#### Section 13: Experience

Experience must be current up to the date of application and fitted into the categories as well as possible. Use of items 13.5, 13.9 and 13.16; "other", should be encouraged. In all cases the experience should be briefly and fully described in Block 14.

#### Section 17:

Item 17 a.: Signature - Applicant

The applicant's signatures must appear on the application.

Item b. or c.: Training Coordinator and Highest Level of Corporate Management for Plant Operations

This Item is normally the Non Power Facility Director or equivalent position. "Higher" authority is not needed. If the Facility Director is also the "Training Coordinator" then he/she must sign both items.

2. A report of medical examination (NRC Form 396) completed by a licensed practitioner.
3. If the candidate is reapplying for a license, 10 CFR 55.12 applies and a new Form 398 should be used. The contents of 10 CFR 55.12

are very similar to those of 10 CFR 55.10, and information that has not changed should not be duplicated on the new form.

- a. If a candidate's application has been denied because of failure of the written or operating test or both, a new application may be filed 2 months after the date of denial. A third application can be filed 6 months after date of denial and successive applications after 2 years.
- b. If the candidate passed either the written or operating portion of the test, he can request a waiver from the portion already passed.
- c. The reapplication should identify those areas in which the applicant demonstrated weakness during the previous examination and the additional training received to correct these specific deficiencies.
- d. The medical certificate for the initial examination, Form NRC 396, is good for 6 months from the date the NRC physician signs it. However, this requirement may be waived in accordance with (ES-111) item G.

## REFERENCES

1. ANSI/ANS 15.4-1977 (N308), "Selection of Training of Personnel for Research Reactors."
2. 10 CFR Part 55, "Operators' Licenses."
3. Letter to "All Non-Power Reactor Licensees," from Darrell G. Eisenhut, July 11, 1983.



GRANTING OF WAIVERS FROM THE  
PROVISIONS OF OPERATOR LICENSING REQUIREMENTS  
REQUESTED BY OPERATOR AND SENIOR OPERATOR APPLICANTS

A. PURPOSE

This standard specifies and provides guidance to the examiner, of the requirements, for the granting or denial of waivers that may be requested by applicants for an NRC operators license. To maintain consistency and standardization across the regions, for the granting or denying of waivers, this standard lists those waiver requests that may be routinely granted by the Regional Offices. The purpose of this standard is to clarify both the NRR (OLB) policy pertaining to waivers of the Operator and Senior Operator Licensing examination requirements and the Regional and Headquarters responsibilities and interactions for granting or denying waivers.

B. BACKGROUND

As part of decentralization of the Operator Licensing Branch (OLB) the functions of the Operator Licensing Program were transferred to the Regional Offices. The delegation of authority to the Regional Offices regarding the operator licensing functions required that waivers to Operator and Senior Operator examination requirements be administered by (OLB) Headquarters. Many requests were made by the Regional Offices to clarify the OLB Headquarters policies pertaining to the waiver of Operator and Senior Operator examination requirements. As a result, several types of waiver requests, submitted by applicants, have been identified to be of a recurring nature and classified as routine. In order to provide expediency in determining the resolution of waiver requests, these standard waiver items have been delegated to the Regional Office for administration. The waiver items are identified in Paragraph D of this standard.

C. ADMINISTRATION OF WAIVERS

1. It is not the general policy of OLB to delegate waiver responsibility. However, in specific waiver request cases that have well defined acceptance criteria, the waiver requested may be administered by Regional Office Management. None of the waivers from the provisions of the operator licensing examination requirements shall be granted automatically but will be evaluated on a case basis. The waiver request may be denied if the evaluation and judgment of the case by the regional or Headquarters Staff so warrants. All waivers, whether granted or denied, shall be documented on the Personal Qualifications Statement (NRC-398), on which the request for a waiver was made.
2. Operator and Senior Operator Waivers

The following list (Paragraph D) of routine waivers may be granted by a Regional Office. For any other waiver requests or special cases, OLB Headquarters shall be consulted to ensure that all waivers are uniformly and consistently applied by all the regions. Waivers of

experience requirements, completion of training, or completion of examinations, not specifically included in the List below should not be granted unless approved by OLB Headquarters.

### 3. Submittal of Waiver Requests

All waiver requests, whether routine or special, should be submitted by the applicant to the responsible region for disposition. Any waivers forwarded to OLB, Headquarters for review and resolution will be evaluated in conjunction with the requesting regions input and recommendations.

## D. REGIONAL ADMINISTERED STANDARD WAIVERS

1. If a candidate fails one category of the written exam (<70%), but has an overall grade of >80% and satisfactorily completes the oral and simulator exams (if administered), the Region may waive those three categories of the written exam for which the candidate received >70% and the oral and simulator examinations. This standard waiver is only applicable for the first retake exam.
2. If a candidate fails only one examination area (i.e., written or operating), the Region may waive those areas which were passed. Only applicable for first retake examination.
3. The requirement to perform actual plant start-up may be waived if simulator start-ups have been performed. (Some utilities have included this waiver request even though their candidates have received simulator start-up certification.) Provisions of the Examiner Standards regarding cross check during the oral exam should be followed. This waiver is not applicable to research reactors, Ft. St. Vrain, LaCrosse, and Big Rock Pt.
4. A utility's request for waiver of specific FSAR training requirements may be granted when waiver of those specific requirements is authorized by the approved FSAR and the candidate otherwise meets NRC requirements. (For example, waiver of some training requirements for candidates previously licensed at a comparable facility.)
5. The requirement for receipt of license renewal applications 30 days prior to the license expiration (timely submittal) may be waived for 5 days, to allow for transit time, if all signatures on the Forms 398 and 396 are dated prior to the 30 day cut-off. The submittal will not be considered timely if received less than 25 days prior to license expiration unless positive evidence (post mark, docketing stamp or other evidence of receipt by the U.S. Postal Service or U.S.N.R.C.) is included. The waiver will not be granted unless both the application (Form 398) and Medical Certification (Form 396) are received.

6. Up to a maximum of one month of the three months on shift in training can be waived for determining eligibility to sit for an examination. The waiver should be granted only if there is good cause (i.e., good faith effort by utility to complete training, no other exam administration planned for some time, license needed to meet NRC requirement), the candidate has completed all other eligibility requirements, and the utility agrees to complete training in a timely manner and certify in writing as to successful completion prior to final licensing action. The region should ensure that the utility's schedule for completion is compatible with the schedule for finalizing licensing actions.
7. The Medical Certificate, Form NRC 396, is good for 6 months from the date the NRC physician signs it. Waivers may be granted on a case basis for reapplications following a license denial or a voluntary withdrawal by the license candidate, i.e., a new medical certificate need not be submitted if the original medical evaluation was performed within one year of the scheduled examination or re-examination.
8. Substitutions allowed by Regulatory Guide 1.8 and ANSI N18.1 or ANSI/ANS 3.1 (depending on the licensee's commitment) are not considered to be waivers and, therefore, do not require approval. For example, substitution of related technical training for up to two years of experience is not a waiver. However, related technical training would not include training required to be eligible for the examination applied for, e.g., an SRO candidate with one year of technical school (electrical technician training at a community college), one year of RO training, including nuclear fundamentals, two years of experience as a licensed RO on-shift in the control room, and 9 months of SRO training would meet the eligibility requirements. However, if after 15 months as an RO on-shift, he had been put into the SRO training course, he would not be eligible because he does not have two years of experience as required. He has 15 months of experience and 9 months of required SRO training.

## APPEALS OF LICENSE DENIALS

### A. PURPOSE

This standard specifies the policy and procedures for processing appeals of license denials on the basis of written and operating examination results.

### B. BACKGROUND

An applicant who is denied a license must be notified of the nature of any deficiencies or the reason for the denial and of his right to demand a hearing within twenty (20) days from the date of the notice or such longer period as may be specified in the notice.

Any contact (i.e., telephone) by the applicant or his facility questioning the grading of the examination or the basis for the denial shall be regarded as a request for a hearing for the purpose of meeting the requirements to demand a hearing within twenty (20) days. The regional office may accept appeals that are received up to ten (10) days after the appeal period has expired if there is reasonable cause for the delay such as delay in the mail or in receiving material necessary to determine that the appeal of the denial should be made.

### C. PROCEDURES FOR PROCESSING APPEALS OF WRITTEN EXAMINATION RESULTS

1. A separate certified examiner is assigned to review the appeal.
2. The assigned examiner reviews the appeal against the Master Examination Answer Key for the specific examination, the supporting material that was provided by the utility for preparation of the examination, and the comments and supporting material provided by the candidate. The entire examination is regraded, not just the questions commented on by the candidate.
3. If, based upon the new information provided by the applicant with the request for regrade, the candidate's examination score (total or category) changes significantly, examinations of other candidates who scored similarly to the regraded candidate will also be subject to review and regrading. (A "significant" change is not defined here in terms of a specific percentage point number, but would include, for example, a regrade that resulted in the passing of a candidate who initially failed the exam. Changes of 2% or less generally would not be considered significant). For example, 1) if the regrade increases a candidate's category score from 64% to 70% a (+6%) change, and this changes his examination outcome from fail to pass, the examinations of all other candidates who failed because they scored between 64% - 69% in that section should



also be regraded to determine if the new information will similarly affect their licensing decisions. This applies to the total examination score also; for example, 2) a regrade similarly increases a candidate's total score from 76% to 82% a (+6%) change, the examinations of all other candidates with a total score between 74% - 79% should also be regraded. The regrade should include the entire examination, not just the failed section or the disputed portions of the examination. Alternatively, for example, 3) if regrading results in a point decrease of 65% to 59% a (-6%) change, the entire examinations of all candidates who scored between 70% - 76% in that section should be reviewed and regraded to determine if their scores should be similarly altered. This also applies to the total exam score; for example, 4) a decrease in total exam score from 80% to 74% a (-6%) change, the examination of all other candidates with a total score between (85%-79%) should also be regraded.

4. The examiner indicates the changes to the examination scoring, the reasons for the changes, and any necessary supporting material. A summary of the grading changes is prepared, and the grading changes and summary are forwarded to the section chief.
5. The section chief reviews the regrading. He may regrade sections, review changes to the original grading or discuss the regrading with the examiners. Based on his review, the section chief shall determine if sufficient justification exists to sustain or overturn the licensing decision.
6. A licensing recommendation is made by modifying and initialing the original Examination Report and resubmitting it to the branch chief. The branch chief sustains or overturns the denial based on the section chief's recommendations and his own review.
7. If the denial is overturned, the license is issued with an effective date consistent with that of the other licensing candidates who took the examination at the same time.
8. If the license denial is sustained by the Regional Administrator or his designated representative, a copy of the entire package is sent to the Director and Chief Counsel, Regional Operations and Enforcement Division, Office of Executive Legal Director, and to the Chief, Operator Licensing Branch, Office of Nuclear Reactor Regulation (NRR), for evaluation. The candidate is informed of the results of the initial reevaluation and that it has been forwarded to the legal staff and NRR, as appropriate, for final evaluation.

9. Questions between the legal and operator licensing staffs are worked out, and then the legal staff informs the candidate of the decision to sustain the denial. The procedure for pursuing the applicant's right to a hearing is explained, and a representative of the legal staff is identified for future contact concerning the appeal.
- D. PROCEDURE FOR PROCESSING APPEALS BASED ON OPERATING EXAMINATION RESULTS
1. Due to the more subjective nature of the operating tests, appeals are reviewed by the section chief and then discussed with the examiner who recommended license denial. The section chief determines if the operating examination report provides sufficient justification to support the denial and that the examiner maintains the original evaluation considering the comments and justification provided by the candidate.
  2. A licensing recommendation is made by modifying and initialing the examination report and resubmitting it, and a written justification for the action, to the branch chief. The branch chief sustains or overturns the denial based on the section chief's recommendation and his own review.
  3. Actions for overturning or sustaining of denial from this point are the same as actions 7, 8, and 9 for written examination appeals.
- E. PROCEDURE FOR PROCESSING APPEALS BASED ON OTHER REQUIREMENTS
1. If on review of NRC Form 398 an applicant has not met the requirements outlined in ES-109, the Regional Office shall contact the training coordinator of the applicant and explain the deficiencies noted. The applicant will be given the opportunity to supply supplemental information or a new more complete 398 form. If after supplying complete information the applicant still does not meet the requirements to sit for the examination, the applicant shall be formally notified by letter of his right to request a waiver of the requirement and to provide information or arguments to support his waiver request. The waiver request should be processed in accordance with ES-111.
  2. If an applicant is finally denied the right to sit for an examination after a review of complete information on his experience, training and education and after denial of a waiver of the requirement where he was deficient, he shall be formally notified of the denial, the reason for the denial, and of his right to appeal under 10 CFR 2.103(b).



3. If an applicant is denied the right to sit for an examination or is denied a license for any reason not covered in the standard, the applicant shall be formally notified of the reason for denial and of his right to appeal under 10 CFR 2.103(b).
4. Actions for processing the appeal from this point are the same as C. 7, 8, and 9 of this standard.

ADMINISTRATION OF WRITTEN EXAMINATIONS TO REACTOR  
OPERATOR CANDIDATES - POWER REACTORS

A. Purpose

This standard specifies the various requirements and procedures for the preparation, administration, and grading of reactor operator license examinations. Examiner preparation, examination review by the facility, and proctor requirements also are included.

B. Assignment

The assignment of a chief examiner will be indicated on the Request To Administer an Examination. The chief examiner shall be responsible for ensuring that the written examination is prepared, administered, and graded in accordance with the examiner standards.

The assignment of the examination includes preparing, administering, and grading the examination unless other arrangements have specifically been made.

C. Orientation Trips

All examiners will prepare written examinations periodically. Preparation of an examination at a facility that the examiner has not previously visited may require that the examiner make an orientation trip to the facility a few weeks before the scheduled examination. The need for an orientation trip shall be determined by the examiner in consultation with the appropriate section chief. To minimize the need for orientation trips, examiners are expected to make maximum use of training material provided by the facility through self study and discussions with other examiners.

D. Provision of Literature

Reference material to be used in preparing examinations should be requested from the facility far enough in advance of the examination to allow for possible delivery delays and for inventorying the material received. If the material is inadequate, it is essential to request additional material immediately from the facility. The training coordinator is usually the best person to contact for the material.

A list of appropriate reference material to be used as a guide is given in Attachment 1 to this standard. The examiner who requests this information shall inform the appropriate section chief of the date of request and person contacted. During these initial contacts, the examiner shall inform the facility contact of the requirements for administration of the examination, as given in Attachment 2 to this standard.

Attachment 3 to this standard contains an example of the letter that will be mailed to the facility, formalizing the examination schedule and statement of requirements. Attachments 1 and 2 of this standard are examples for attachments to the letter. The appropriate section leader or chief is responsible for having this letter typed, signed by the regional branch chief, and sent. The letter should be addressed to the person at the highest level of corporate management who is responsible for plant operations (e.g., Vice President of Operations) and should be mailed 90 days before the first examination date. The exact wording of the letter may be modified as necessary to reflect the situation.

#### E. Preparation of Examination

The examiner shall prepare the examination and answers using Standards ES-202 and ES-203 as guidance. The examiner should conduct a detailed review of the examination using attachment 1 of ES-107 as a guide. Attachment 1 of ES-107 should be filed with the master copy of the examination.

#### F. Quality Assurance Review of Examination

The regional section chief, or his designee, shall review the examination in accordance with Standard ES-107. The completed examination shall be submitted for review at least 1 week before the scheduled date of its administration. If changes to the examination are necessary, the examiner shall be notified at least two working days before the administration of the examination, provided the necessary lead time was allowed. If no instructions to the contrary have been received, the examination should be given as prepared.

#### G. Administration of Examination

1. The examiner should distribute the examination questions to the candidates, explaining the rules to be observed during the examination.
2. The examiner should read the following instructions verbatim to the candidates. Additional items may be discussed, as necessary.

During the administration of this examination the following rules and guidance apply:

- a. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.
- b. You should sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This should be done after the examination has been completed.

- c. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with noncandidates outside the examination room to avoid even the appearance or possibility of cheating.
- d. When you complete your examination, you shall
  - (1) Turn in your copy of the examination and all pages used to answer the examination questions.
  - (2) Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.
  - (3) Leave the examination area, as defined by the examiner. If after leaving you are found in this area while the examination is still in progress, your license may be denied.
- e. Print your name in the blank provided on the cover sheet of the examination.
- f. Fill in the date on the cover sheet of the examination.
- g. Print your name in upper right-hand corner of the first page of each section of the answer sheet.
- h. Consecutively number each answer sheet, write "End of Category \_\_\_" as appropriate and "Last Page" on last answer sheet, and write on only one side of paper.
- i. Number each answer as to category and number, for example, 1-4, 6-3.
- j. Use black ink or dark pencil only to facilitate legible reproductions.
- k. Use abbreviations only if they are commonly used in facility literature.
- l. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the questions or not.
- m. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.
- n. If parts of the examination are not clear as to intent, ask questions of the examiner only.



The examiner shall follow the proctoring procedure agreed upon with the section chief and/or branch chief, as required, to ensure the integrity of the examination. In rare cases, variations from the procedure may be necessary. However, these variations must be documented. Every effort must be made to ensure the integrity of the examination.

#### H. Facility Staff Review of Examination

Due to recent interest generated by the Industry and NUMAFC, this section of ES-201-H is being considered for revision and will be issued in the near future. The current review policy will remain in effect until any future revisions occur.



## I. Proctoring of Examinations

All written examinations shall be adequately proctored to ensure the integrity of the examinations. Two individuals shall be available for proctoring. One proctor shall be in the examination room at all times giving his full attention to the candidates taking the examination. The proctor shall not read facility procedures or other material, grade examinations, or engage in any other activities in a manner or depth that may divert his attention from the candidates and possibly cause the examination to be compromised.

Before the administration of the examination, the proctors shall have a clear understanding of their responsibilities. The chief examiner is responsible for ensuring 100% proctoring of the examination.

The chief examiner shall determine the means to be used to ensure adequate proctoring of the examination. Consideration shall be given to

1. using Office of Inspection and Enforcement (IE) part-time secretarial help

2. using more than one examiner
3. using IE resident inspectors
4. using local high school and/or college teachers/professors or other Federal, State, or local employees.

If a proctor who is not an NRC employee is used, the chief examiner shall be responsible for obtaining the proctor and ensuring that a contract has been properly placed with the proctor.

At least one examiner shall be available to provide clarification to the candidates on the examination questions. Therefore, if the person writing the examination is not available, the other examiners must be certain that they are familiar with the intent of the questions.

#### J. Length of Examinations

Although the written examinations must be appropriately thorough and comprehensive, they should not be so long that a knowledgeable candidate cannot complete the examination in the time allotted. The duration of a power reactor examination is 6 hours. Refer to Standard ES-202 for information on the scope of the written examinations. Reexaminations, which are partial examinations containing only one category, will be limited to one-quarter of the allotted time. All candidates shall be informed of the time limits at the beginning of the examination.

#### K. Grading of Examinations

All corrections to questions and answer keys shall be processed expeditiously before the written examinations are graded. The original copy or legible, reproducible copies of the original proposed corrections shall be annotated with their disposition and kept with the copy of the master examination.

Grading should be performed as expeditiously as possible. The number of points given to, or taken off, for each answer should be indicated on the candidate's answer sheet, in red pen or pencil. Also, a brief notation as to the reason for less than full credit should be entered. This may be a notation of the correct answer, a missing item, an indication of poor method, or some suitable brief notation. The points and notations should be reproducible and distinguishable from the candidates answer when reproduced.

After the grading is completed, Columns 3 and 4, "Candidate's Score" and "% of Category Value," on the cover sheet shall be filled out. The examiner shall conduct a detailed review of his grading using Attachment 1, ES-108-1, as a guide. After the examinations are graded, sufficient copies of the master copy of the examination shall be reproduced so

that at least one copy is forwarded to the regional office. If an appeal of the graded reactor operator written examination is received, the procedures in Standard ES-112 should be followed.

#### L. Administrative Details

The grading examiner shall complete the written examination cover sheet showing the results of the grading and the appropriate portions of the "Power Plant Examination Results Summary," ES-201 attachment 5, and the "Examination Grading Quality Assurance Checkoff Sheet" Attachment 1, ES-108-1. The examiners in the team shall communicate the written grades to the grading examiner so that Examination Reports (Forms 157A, B, and C) and the "Power Plant Examination Results Summary Sheet" (ES-201 Attachment 5) are filled out as completely as possible before being forwarded to the regional office by certified mail. Written examination results should not be held pending completion of other portions of the examination. If oral and/or simulator results are not available at the same time as the written results, then appropriate sections of Form 157 should be completed and forwarded to the regional section chief. The chief examiner is responsible for ensuring that all results are reported to the section chief.

The chief examiner shall complete ES-201 Attachment 5 and assemble the following in one package to be forwarded to the regional section chief.

1. original and one copy of master examination and answers
2. all written examinations
3. all oral and operating reports (NRC Forms 157A, B, and C)
4. Attachments ES-107-1, ES-108-1, ES-201-5, and ES-201-6.
5. copy of the corrected Examiner Assignment Sheet

#### M. Quality Assurance Review of Graded Examinations

The appropriate section chief, or his designee, shall ensure that all examination results and documentation are completed and shall conduct an independent review of written answers after the examinations are graded by examiners in his section, as required in Standard ES-108.

## ATTACHMENT 1

REFERENCE MATERIAL REQUIREMENTS FOR REACTOR/SENIOR REACTOR  
OPERATOR LICENSING EXAMINATIONS

1. Procedure Index (alphabetical by subject)
2. All administrative procedures (as applicable to reactor operation or safety)
3. All integrated plant procedures (normal or general operating procedures)
4. Emergency procedures (emergency instructions, abnormal or special procedures)
5. Standing orders (important orders that are safety related and may supersede the regular procedures)
6. Fuel-handling and core-loading procedures, (initial core-loading procedure, when appropriate)
7. Annunciator procedures (alarm procedures, including set points)
8. Radiation protection manual (radiation control manual or procedures)
9. Emergency plan implementing procedures
10. Technical Specifications
11. Lesson plans (training manuals, plant orientation manual, system descriptions, reactor theory, thermodynamics, etc.)
12. System operating procedures
13. Piping and instrumentation diagrams, electrical single-line diagrams, or flow diagrams
14. Technical Data Book, and/or plant curve information as used by operators
15. Any other material the examiner feels is necessary to adequately prepare a written examination, such as reactor traces of significant plant evolutions.
16. Questions and answers that licensee has prepared (voluntary by licensee)

17. Malfunction and initial condition material for simulator (if applicable)

The above reference material should be approved, final issues and should be so marked. If a plant has not finalized some of the material, the chief examiner is responsible for ensuring that the most complete, up-to-date material is available and that agreement has been reached with the licensee for limiting changes before the administration of the examination. All procedures and reference material should be bound or in the form used by the control room operators, with appropriate indexes or tables of contents so that they can be used efficiently.

## ATTACHMENT 2

## REQUIREMENTS FOR ADMINISTRATION OF WRITTEN EXAMINATIONS

Operator Licensing Branch requirements are:

1. A single room shall be provided for completing the written examination. The location of this room and supporting restroom facilities shall be such as to prevent contact with all other facility and/or contractor personnel during the duration of the written examination. If necessary, the facility should make arrangements for the use of a suitable room at a local school, motel, or other building. Obtaining this room is the responsibility of the licensee.
2. Minimum spacing is required to ensure examination integrity as determined by the chief examiner. Minimum spacing should be one candidate per table, with a 3-ft space between tables. No wall charts, models, and/or other training materials shall be present in the examination room.
3. Suitable arrangements shall be made by the facility if the candidates are to have lunch, coffee, or other refreshments. These arrangements shall comply with Item 1 above. These arrangements shall be reviewed by the examiner and/or proctor.
4. The facility may arrange to have knowledgeable personnel available to review the written examination and answer key. The maximum number of reviewers should be limited to one reviewer for each examination section to be reviewed and the length of the review should be limited to two hours. The chief examiner shall schedule and control the written examination review.
5. The licensee shall provide pads of 8-1/2- by 11-in. lined paper in unopened packages for each candidate's use in completing the examination. The examiner shall distribute these pads to the candidates. All reference material needed to complete the examination shall be furnished by the examiner. Candidates can bring pens, pencils, calculators, or slide rules into the examination room, and no other equipment or reference material shall be allowed.
6. Only black ink or dark pencils should be used for writing answers to questions.



## ATTACHMENT 3

## LETTER TO FACILITY FORMALIZING EXAMINATION SCHEDULE

To:

Date:

Subject: Reactor Operator and Senior Reactor Operator Licensing Examinations

In a telephone conversation between Mr. \_\_\_\_\_ (title, i.e., training coordinator) and Mr. \_\_\_\_\_ (section leader, OLB) arrangements were made for the administration of the examinations at the (facility name).

The written examinations are scheduled for (date). The simulator/operating examinations are scheduled for (date) and the (name) simulator. The plant oral examinations are scheduled for (date).

In order for us to meet the above schedule, it will be necessary for the facility to furnish the approved reference material listed in Attachment 1, "Reference Material Requirements for Reactor/Senior Reactor Operator Licensing Examinations," by (date). Any delay in receiving this material will result in a delay in administering the examinations. Our examinations are scheduled far in advance with considerable planning to utilize our present limited examiner manpower and to meet the examination dates requested by the various facilities. Therefore, missing the (date) deadline, even by a few days, likely will result in a long delay because it may not be possible to reschedule examinations at other facilities. Mr. \_\_\_\_\_ has been advised of our reference material requirements, the number of reference material sets that are required, and the examiner's names and addresses where each set is to be mailed.

The facility management is responsible for providing adequate space and facilities in order to properly conduct the written examinations. Attachment 2, "Administration of Reactor/Senior Reactor Operator Licensing Written Examinations," describes our requirements for conducting these examinations. Mr. \_\_\_\_\_ has also been informed of these requirements.

All reactor operator and senior reactor operator license applications normally should be submitted at least 60 days before the first examination dates so that we will be able to review the training and experience of the candidates, process the medical certifications, and prepare final examiner assignments after candidate eligibility has been determined. If the applications are not received at least 30 days before the examination dates, it is likely that a postponement will be necessary.

This request for information was approved by the Office of Management and Budget under Clearance Number 3050-0101, which expires June 30, 1986. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports Management Room 3208, New Executive Office Building, Washington, D.C. 20503.

Thank you for your consideration in this matter. If you have any questions regarding the examination procedures and requirements, please contact Mr. \_\_\_\_\_ (appropriate section leader and telephone number), or Mr. \_\_\_\_\_ (OLB Branch Chief) or (regional section chief and telephone number).

Sincerely,

(OLB Branch Chief or appropriate regional representative)

Distribution: Project Manager  
Resident Inspector  
Regional Section Leader  
Examiners  
Chief Examiner  
NRC Project Offices

## ATTACHMENT 4

## NRC/FACILITY STAFF WRITTEN EXAMINATION REVIEW GUIDE

Facility \_\_\_\_\_ Examination Date \_\_\_\_\_

1. This examination and answer key is provided for a limited period of time for review only.
2. No copies of this examination or answer key are to be made under any circumstances.
3. This examination and answer key is to be returned to the chief examiner along with comments and supporting material, if any, at the end of the examination review.
4. Contact between facility personnel or facility contract personnel and examination candidates after the written examination begins is strictly forbidden until the candidates have turned in their examinations and left the examination area. No contact is allowed between the examination candidates and those facility personnel involved in the examination review until after the examination review is completed.
5. After comments and supporting material are provided to the chief examiner, no other comments on the written examination will be accepted by the examiners. Any additional comments on the written examination should be provided in writing to the appropriate regional branch chief.
6. All comments and supporting materials supplied on this review are subject to release on request under the Freedom of Information Act. Therefore, any material considered to be proprietary should be appropriately marked.



ATTACHMENT 6

EXAMINATION ADMINISTRATION QUALITY ASSURANCE CHECKOFF SHEET

Plant/Unit \_\_\_\_\_ Examination Date \_\_\_\_\_

Examiner(s) \_\_\_\_\_ Proctor(s) \_\_\_\_\_

EXAMINATION: Operator \_\_\_\_\_ Senior \_\_\_\_\_

Examination Administration

- | <u>Item</u> | <u>Description</u>   | <u>Chief Examiner<br/>Initial/date</u> |
|-------------|--|--|
| 1.          | Adequate Spacing during examination  | _____                                  |
| 2.          | Examination Room and Restroom facilities adequate to prevent examination compromise.         | _____                                  |
| 3.          | Continuous proctoring maintained throughout examination                                      | _____                                  |
| 4.          | Examination and answer key review not started until after completion of written examination. | _____                                  |
| 5.          | Candidates did not participate in review of examination                                      | _____                                  |
| 6.          | Record names of facility reviewers of RO Examination   |  |

<u>Name</u>	<u>Area reviewed</u>
_____	_____
_____	_____
_____	_____
_____	_____

7. Record names of facility reviewers of SRO Examination

<u>Name</u>	<u>Area reviewed</u>
_____	_____
_____	_____
_____	_____
_____	_____

\_\_\_\_\_  
Chief Examiner Signature

\_\_\_\_\_  
Date



SCOPE OF WRITTEN EXAMINATIONS ADMINISTERED  
TO REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard provides guidelines for the content of each category of the reactor operator written examination. Guidance on question depth, format, sources and general preparation is also presented.

B. Scope

The required scope of the written examination is set forth in 10 CFR 55. To implement this scope and to provide for identification and documentation of strengths and weaknesses within certain areas of knowledge, the written examination shall be divided into the following four categories:

1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer, and Fluid Flow

This category shall contain questions relating to basic nuclear reactor behavior, elementary nuclear reactor theory, technical terminology, and an appreciation of the processes taking place in a nuclear power plant. These processes include controlled and variable parameters of the reactor, primary and secondary coolant, and auxiliary systems. Values that are expressed as normal or operating parameters or values that are measured as resultant characteristics shall be included in this category.

Also included shall be questions relating to the traces that one would see on recorders during normal and abnormal transients, with the emphasis on facility behavior rather than instrument characteristics. Secondary system transients that induce reactor transients also shall be subject questions in this category.

This category also shall contain questions on fundamentals of hydraulics and fluid flow, heat transfer and heat generation, and thermodynamics and simple calculational problems to determine understanding in this area. These questions will test the candidates' knowledge and understanding of the concepts of temperature measurement, density, viscosity, pressure, and volume and the effects of parametric changes on fluids. Questions relating to the use of steam tables may also be included. The principles of heat transfer by conduction, convection, and radiation, as well as characteristics of heat exchanger operation and natural circulation, shall be investigated in this category. Also included may be questions concerning the applicability of these fundamentals to operational situations and transients and the ability to recognize and mitigate the consequences of core damage.

Answering these questions may require mathematical ability including algebra and fundamental knowledge in reactor physics. Questions in this category shall be related to reactors in general and reactors of the type used at the facility.

2. Plant Design, Including Safety and Emergency Systems

This category shall contain questions on the design features of the particular facility, with emphasis on those systems that are designed to maintain, and protect against, the uncontrolled release of radioactive materials. The candidate should be able to reproduce, from memory, sketches or descriptions of various hydraulic, pneumatic, or electrical distribution systems and mechanical components. Questions on design intent, construction, operation, and interrelationships of those systems most directly associated with normal nuclear power plant operation and reactor safety can also be included. The candidate should be familiar with the conditions that require the use of safety and emergency systems and why such protection is required, with emphasis on areas where a malfunction will require immediate operator action.

3. Instruments and Controls

This category shall contain questions on the characteristics and interrelationship of the nuclear, process, and radiological instrumentation and facility control systems. The candidate should have sufficient knowledge of the nuclear instruments (e.g., source, intermediate, and power), the process instruments (e.g., temperature, pressure, level, and flow), and radiological instruments (e.g., ionization, G-M, and scintillation), to answer questions concerning principles of detector operations, location and setpoints of instruments, and diagrammatic representation of instrumentation systems. Questions on control systems (e.g., control rod drive, level, pressure, electrohydraulic control, and integrated control) will include function, operation, interlocks, and interrelationships with other plant systems.

A candidate is not expected to have the knowledge of an instrument technician, but answers should indicate the ability to recognize the indications and consequences of improper instrument performance (e.g., overcompensation, power failure, air supply failure, and signal failure), including the traces that recorders would show. He also should be able to make use of all available instrumentation to provide checks or verification of observed readings.

4. Procedures - Normal, Abnormal, Emergency, and Radiological Control

This category shall contain questions on the knowledge and use of facility procedures including normal, abnormal, emergency, administrative, and radiological control procedures. The candidate is not expected to have normal procedures committed to memory but should

be able to explain reasons, cautions, and limitations of normal operating procedures. In general, the candidate must demonstrate complete knowledge and understanding of the symptoms, automatic actions, and immediate action steps specified by abnormal and emergency procedures. Questions concerning radiological control procedures will be asked to the extent that the operator is responsible for personnel protection against the hazards of radiation and for controlling, discharging, and monitoring radiological releases. Administrative procedures, including operating restrictions, limitations in the facility license, and Technical Specifications, may be included to the extent they are directly applicable to an operator and the safe operation of the facility.

#### C. Facility Management Control

The scope of the written examination will include aspects of the management philosophy as set forth in facility documents. Because the examination and license are applicable only at the facility under application, it is appropriate for the examiner to include the applicable administrative controls. These questions are best included in the categories covering operating procedures and health physics.

The continuous availability of health physics and chemistry personnel for routine and emergency monitoring and investigation reduces the need of an operator to be proficient in the use of portable monitoring equipment. This fact should be considered when questions are constructed in this category.

#### D. Accident-Related Questions

It is recognized that the study of incidents or accidents at other reactor facilities can provide valuable lessons for an operator at his facility. It is appropriate and desirable to hypothesize accidents or circumstances leading to accidents at the facility under application and examine the candidate's analysis, corrective actions, and other responses. Therefore, postulating circumstances, in the examination, that are similar to those that have occurred elsewhere is both appropriate and realistic.

#### E. General Guidance

1. Technical Specification questions for reactor operators should be conceptual in nature (e.g., recognition of limiting conditions for operation and Technical Specifications that exist for a given area).
2. Memorization of symptoms and automatic and operator actions of all procedures that require immediate action is necessary for the examination.

3. The examination should include questions to determine a candidate's understanding of his responsibilities related to the administrative procedures, precautions, environmental and radiation release requirements, and pressure/temperature limits.
4. Questions on health physics and chemistry procedures should be determined on the basis of the facilities' type of health physics coverage.
5. Extended definitions questions (e.g., 6-factor formula) should be avoided.
6. Questions on detailed system characteristics or instrumentation, such as annunciator logic or setpoints, should be avoided unless required for safety system operations.
7. Questions should be based on
  - a. a review by the examiner of material provided by the facility
  - b. a review of past examinations given at the facility
  - c. content validity study results, when available
8. Other sources of questions are
  - a. standard questions and answers
  - b. Examination Question Bank
  - c. examinations on similar facilities
  - d. personal file of questions and answers
9. A rule of thumb is
  - a. approximately 55 to 70 responses for a 6-hour examination
  - b. a response that requires about 3 to 4 minutes to write
10. Examinations shall be 5 hours long.
11. Examination questions should consist of short word sentences using the terminology of the facility as much as practicable.
12. "Discuss"-type questions should be avoided; questions should be specific to elicit short precise answers.
13. Practical realistic questions that relate to operator knowledge and required operating practice should be used.
14. Multipart questions should be broken down into logical sequential parts. The answer sheet should show points assigned for subparts of answers.

15. Double-jeopardy questions should not be used.

An example of a double-jeopardy question is:

- 1.3(a) Draw a single-line diagram of the cleanup system showing all automatic control valves.
- (b) Explain the principal of operation for each control valve in part (a) above. (Rationale - If a candidate shows only (3) of (4) valves in part (a), he would lose points in part (b).)

A better way to state the question is:

- 1.3 Attached is a single-line diagram of the cleanup system. For the valves marked A-D on the diagram:
- (a) Identify the valve, and
- (b) Explain the principal of operation for the valve.

16. The value of a question should be compared with that of other questions in the category to determine if the value makes sense. Simple numerical answers should not be worth more than 0.5.
17. The questions should be read and reviewed for clarity and intent to determine if the required response will be given.
18. Open-ended questions should be avoided. If a specific number of responses are required, the question should clearly state that expectation so the candidate will know when the answer is complete.

An example of an open-ended question is:

- 3.1 List the signals that will automatically isolate the charging and letdown systems.

A better way to state the question is:

- 3.1(a) List three signals that will isolate the letdown system.
- (b) List two signals that will both isolate the letdown system and trip the charging (makeup) pumps.

19. The examination should be verified to see if it satisfies the requirements of Standards ES-201 through ES-203 and a quality assurance review sheet, Attachment 1 ES-107 shall be completed.
20. The examination should be read by another examiner for clarity and response.



21. The examination should be submitted to the appropriate regional section chief at least 5 working days before the examination date for review and comment.
22. All equations required to answer parts of the examination should appear in the equation sheet or as part of the question.
23. Diagrams or sketches should be used as attachments to written examinations. Questions that request candidates to identify components and other items on these attachments should be asked. The use of these attachments is preferred over the alternative that requires candidates to construct time-consuming, single-line diagrams and sketches.



STRUCTURE OF WRITTEN EXAMINATION ADMINISTERED TO  
REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard specifies the format, category weights and depth of knowledge for reactor operator written examinations.

B. General Structure

Each written examination shall be divided into four categories in accordance with Standard ES-202.

C. Cover Sheet

A cover sheet, with the format shown in Attachment 1 of this standard, shall be used on all written examinations. This sheet will provide for ready identification of the structure of the examination and, subsequently, of the relative strengths and weaknesses of the candidate.

All items in the upper corner of the cover sheet, except the name of the candidate (and sometimes the date administered), should be filled out when the examination is prepared and reproduced. The reactor type assists headquarters in comparing examinations of similar facilities and should be as descriptive as possible (e.g., BWR and PWR-W). The "Examiner" block should contain the name of the author(s). The first two columns on the cover sheet should be filled out at the time of the initial preparation.

D. Weighting of Categories

The relative weight of each category in the examination, as a percentile of total worth, shall be  $25\% \pm 3\%$  for each category. Category 1 shall be weighted so that  $15\% \pm 1\%$  ( $60\% \pm 4\%$  of the category) consists of principles of nuclear power plant operations and  $10\% \pm 1\%$  ( $40\% \pm 4\%$  of the category) consists of principles of thermodynamics, heat transfer, and fluid flow.

E. Value of Questions

The general structure of the examination shall be such that a safe operator will score above 80% on the entire test and above 70% in each category. The percentage attained in each category will be used, in conjunction with oral and operating test results, to identify strengths and deficiencies of the candidate.

The examiner shall assign a point value to each question and indicate this value in parentheses after the question. The value of a question is a judgment factor based on the combination of the following factors:

significance of the knowledge to the operator, difficulty of the question, amount of time required to answer the question, depth of knowledge required to answer the question, and the content areas addressed in the question.

#### F. Depth of Knowledge

For depth of knowledge, the written questions can be divided into five categories:

1. Knowledge and recall (Example - Define natural circulation.)
2. Comprehension and interpretation (Example - Give two examples of natural circulation; include sketches.)
3. Application of rules and principles (Example - Describe the natural circulation flow path for your reactor. List the primary indications you would monitor and give representative readings within 2 hours after shutdown assuming the reactor had been at 100% power for 30 days. List any assumptions.)
4. Analysis and deduction (Example - List primary indications and representative readings for natural circulation within 2 hours after shutdown (from 100% power for 30 days). How would these readings change (direction and magnitude) 2 weeks later?)
5. Synthesis and evaluation (Example - List primary indications and representative readings for natural circulation within 2 hours after shutdown (from 100% power for 30 days). How would these readings change if (a) the difference between the hot- and cold-leg temperature doubled? (b) the difference in height between the reactor core and the heat sink was halved?)

The content areas for questions have been addressed in Standard ES-202.

In all cases, the candidate shall receive a copy of his graded examination for his use in evaluation of weak areas and retraining.

Attachment 1

U.S. NUCLEAR REGULATORY COMMISSION  
 REACTOR OPERATOR LICENSE EXAMINATION

Facility: \_\_\_\_\_  
 Reactor Type: \_\_\_\_\_  
 Date Administered: \_\_\_\_\_  
 Examiner: \_\_\_\_\_  
 Candidate: \_\_\_\_\_

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Category Value	Category
_____	_____	_____	_____	1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
_____	_____	_____	_____	2. Plant Design Including Safety and Emergency Systems
_____	_____	_____	_____	3. Instruments and Controls
_____	_____	_____	_____	4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
_____	_____	_____	_____	TOTALS
			Final Grade _____%	

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

\_\_\_\_\_  
 Candidate's Signature

ADMINISTRATION AND PREPARATION OF WRITTEN EXAMINATIONS FOR REACTOR  
OPERATOR CANDIDATES - NON-POWER REACTORS

A. Purpose

This standard specifies the difference in preparation and administration of non-power reactor operator written examinations and power reactor operator examinations. The specifications in Standard ES-201, 202 and 203 apply when no difference exists for non-power reactors. Sections of ES-201, ES-202, or ES-203 which are different for non-power reactors are indicated in parenthesis after each paragraph heading.

B. Examination Administration

The administration of the written examination will be consistent with that for power reactors as specified in ES-201 with the following exceptions:

1. Provision of Literature (ES-201, paragraph D)

The reference material available from a non-power reactor facility may be significantly more limited than the list indicated in Attachment 1 to ES-201. Reference material which is unavailable should be deleted from the list on a case basis. Additionally, the letter sent to the reactor facility formalizing the examination arrangements should be addressed to the facility director or equivalent. If the letter to the facility director cannot be mailed in the time specified in ES-201, Paragraph D., due to scheduling conflict, the letter formalizing the examination should be sent immediately after an informal schedule is agreed upon by the region and the facility.

2. Administration of Examination (ES-201, paragraph G.5 and G.6 and paragraph J)

- i) The examiner should inform the candidates that to pass the examination they must achieve at least 70% in each category.
- ii) The examiner should inform the candidates that there is a time limit of 6 hours for completion of the examination. For candidates taking one or more sections of a written examination, each section should be limited to 1 hour.

C. Examination Preparation (ES 201, paragraph E)

The examiner shall prepare the examination and answers using Standards ES-202 and ES-203 as guidance, except as modified by this standard. The examiner should use Attachments ES-107-1, ES-108-1, and ES-201-6 for quality assurance checks of the examination, the examination grading, and the administration of the examination. The passing

grade for non power written examinations is at least 70% in each category. A copy of the examination and answer key should be forwarded to the appropriate regional Section Chief for review. Attachments ES-107-1, ES-108-1, and ES-201-6 should be filed with the master copy of the examination.

D. Examination Scope (ES-202, paragraph B.)

The required scope of the written examination is set forth in 10 CFR 55. To implement this scope and to provide for identification and documentation of strengths and weaknesses within certain areas of knowledge, the written examination shall be divided into seven categories:

Category A. - Principles of Reactor Operation

This category contains questions relating to basic nuclear reactor behavior, elementary nuclear reactor theory, technical terminology and an appreciation of processes taking place in a reactor. Answering these questions does not require mathematical ability in excess of ordinary algebra or detailed and advanced knowledge in reactor physics. Questions in this category relate to reactors in general or to reactors of the appropriate class.

Category B - Features of Facility Design

This category contains questions about the design features of the particular facility, with emphasis on the reactor, auxiliary systems and experimental facilities, as applicable. It generally requires the candidate to reproduce, from memory, fairly detailed diagrammatic sketches or descriptions of various hydraulic, pneumatic or power distribution systems or reactor vessel and core components. It also inquires into design intent and the more important design parameters. Generally, parameters expressed as limits (e.g., maximum flow, maximum excess reactivity, maximum step reactivity insertion, maximum pressure) or fixed numerical values for fabrication (e.g., enrichment, dimensions) are investigated. Elements of design and operation of the experimental facilities associated with the reactor should also be explored in this category.

Category C - General Operating Characteristics

This category contains questions on controlled and variable parameters of the reactor and auxiliary systems. Values which are expressed as normal or operating parameters (e.g. purification flow rate, reactor tank temperature, fuel temperature, storage tank level) or values which are measured as resultant characteristics (e.g., temperature coefficient, reactivity worth, pressure drop) are investigated. Questions relating to the manner in which power, reactivity, rod worths, or other parameters of this facility would change in response to rod manipulations, heatup, core burn up, experiment insertion or other stimuli are in this category. Questions relating to the traces that one would see on recorders, in



response to these changes should also be included. The questions should emphasize facility behavior rather than instrument characteristics.

#### Category D - Instruments and Control

This category contains questions on the characteristics and interrelationships of the nuclear and process instrumentation and control systems. These questions will inquire into the principles of operation of detectors, location and settings of instruments, diagrammatic representation of instrument and control systems and details of control rod drives design operation. It is not intended that a candidate must display the knowledge of an instrument technician (unless it is part of his licensed responsibilities at a particular facility), but his answers should indicate the ability to recognize the indications and consequences of improper instrument performance (e.g., over-compensation, power failure, air supply failure, signal failure) including the traces that recorders would show. He should also be able to use all available instruments to provide checks or verification of observed readings.

#### Category E - Safety and Emergency Systems

This category contains questions on the design, construction, operation and interrelationships of the systems most directly associated with reactor safety, such as scram and other power reduction systems, pressure relief, spray systems, emergency power systems, and annunciated malfunctions. The candidate should demonstrate thorough knowledge of detailed design, characteristics, and operating methods for these systems. He should also be familiar with the conditions which require the use of such systems, and the reasons why such protection is required.

#### Category F - Standard and Emergency Operating Procedures

This category contains questions on the procedures for the operation of the reactor and auxiliary systems, including administrative controls. In general, a candidate must demonstrate complete understanding of the immediate action steps specified by abnormal or emergency procedures and to describe generally, the normal, abnormal and emergency operating procedures. If he is given several steps in a normal operating procedure, he should be able to put them in proper sequence. Operating restrictions in the facility license may be included herein, to the extent they are directly applicable to an operator.

#### Category G - Radiation Control and Safety

This category contains questions on terminology, radiation hazards, radiological safety practices and fixed and portable radiation monitoring equipment. The candidate should demonstrate knowledge of the type and magnitude of radiation hazards which might be expected to be present and knowledge of the methods to cope with them. He should know facility regulations and the general provisions and precautionary procedures of 10 CFR Part 20. The candidate should be able to understand and



utilize portable equipment and describe type, location, approximate range and alarms associated with fixed equipment. He should know the limitations as well as the applications of this equipment.

E. Facility Management Control (ES-202, paragraph C)

The scope of the written examination is influenced, to a certain extent, by aspects of the management philosophy as set forth in facility documents. Since the examination and license are applicable only at the facility under application, the examiner shall consider the administrative controls in effect. This aspect is usually reflected in the examination areas of operating procedures and health physics. Procedures which clearly and comprehensively elicit the required operator action and require that even minor irregularities be immediately referred to senior operators necessitate less analysis and judgment by the operator. The continuous availability of health physics personnel for routine and emergency monitoring and investigation reduces the need of an operator for proficiency with portable monitoring equipment. The converse of each of these examples is also valid. However, in order for management controls to be considered as sufficiently established, they should be reflected in the facility license or literature in a form binding on the operating staff. In all cases, the examination shall reflect (1) the level of knowledge necessary for the safe operation of the facility; and (2) the responsibility delegated by the facility to the operator.

F. General Guidance (ES-201, paragraph E)

The general guidance contained in Standard ES-201, is also applicable to written examinations for non-power reactors. Attachment 1 is a results summary sheet for non-power license examinations.

G. Examination Structure (ES-203, paragraph B, C, D, E)

1. Each written examination shall be divided into seven categories in accordance with Section D of this standard. A cover sheet, with the format shown in Attachment 2, ES-204-1, shall be used on all written examinations.
2. The relative weight of each category in the examination, as a percentile of total worth, should be  $14\% \pm 3\%$  for each category, whenever possible. However the relative importance of safety and emergency systems vary significantly over the range of sizes and types of Research Reactors. Therefore, in order to comply with the 10 CFR 55 criteria "...to the extent applicable to the facility..." the weighting of the examination categories should be based on the professional judgement of examiners experienced in the operation and examination of non-power reactor facilities and approved by supervision. The general structure of the examination shall be such that a safe operator will score 70% or greater in each category. In addition, the length of the examination shall be such

that a candidate would complete the examination within five hours,  
thus leaving one hour for review.



Attachment 2

U.S. NUCLEAR REGULATORY COMMISSION  
 REACTOR OPERATOR LICENSE EXAMINATION

Facility: \_\_\_\_\_  
 Reactor Type: \_\_\_\_\_  
 Date Administered: \_\_\_\_\_  
 Examiner: \_\_\_\_\_  
 Candidate: \_\_\_\_\_

INSTRUCTIONS TO CANDIDATE

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category. Examination papers will be picked up six (6) hours after the examination starts.

<u>Category Value</u>	<u>% of Total</u>	<u>Candidate's Score</u>	<u>% of Cat. Value</u>	
_____	_____	_____	_____	A. Principles of Reactor Operation
_____	_____	_____	_____	B. Features of Facility Design
_____	_____	_____	_____	C. General Operating Characteristics
_____	_____	_____	_____	D. Instruments and Controls
_____	_____	_____	_____	E. Safety and Emergency Systems
_____	_____	_____	_____	F. Standard and Emergency Operating Procedures
_____	_____	_____	_____	G. Radiation Control and Safety

Final Grade \_\_\_\_\_%

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

\_\_\_\_\_  
 Candidate's Signature

ADMINISTRATION OF OPERATING AND ORAL EXAMINATIONS TO  
REACTOR OPERATORS AND SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard specifically pertains to the administration of the operating and oral examinations to applicants for reactor operator and senior reactor operator licenses at power reactor facilities. Generally, senior reactor operator "upgrade" examinations will only be administered to those operators who have held a valid license for at least 1 year. Specific exceptions may be made for those individuals who by virtue of education and experience possess the credentials to apply for an "instant" senior reactor operator (SRO) license. Guidance for granting the waiver of the 1-year reactor operator (RO) requirement is contained in Standard ES-110.

B. Examination Requirements

The scope of the operating and oral examinations is covered in Standard ES-302 for reactor operators and senior reactor operators. However, for clarification it is necessary to specify the control manipulations that are required for each category of the operating and oral examinations. For those facilities that have a plant-referenced simulator, a simulator examination will be required for reactor operator and senior reactor operator (instant and upgrade) examinations. The in-plant portion of the oral examination can be shortened by including some of the required coverage in the simulator part of the examination. This is described more fully in the ES-500 Series Standards. For candidates at plants without a plant-referenced simulator, reactor operators and instant senior reactor operators must perform a reactivity manipulation on their plant (usually a reactor startup) or obtain a certification from an NRC-approved simulator training program in accordance with the requirements of Appendix F of NUREG-0094. Upgrade SRO candidates, by virtue of holding a valid RO license, will not be required to perform a reactivity manipulation as part of their operating and oral examinations for those plants without a plant-specific simulator. The remainder of these standards (ES-300 Series) generally will apply only to the in-plant portion of the operating and oral examination. Specific reference will be made when necessary to simulator examination requirements.

C. Assignment

Assignment of the task of administering the operating and oral examinations is made on the Request To Administer the Examination as set forth in Standard ES-103. The examinations should be arranged on a time schedule mutually satisfactory to the candidates, facility licensee, and examiners and should cover the scope set forth in Standard ES-302.



#### D. Scheduling

As a general rule, operating and oral examinations should be given after the written examinations are complete; however, if a difficult scheduling problem can only be solved by another sequence, this is permissible.

Examinations should be scheduled so that in the case of a simulator examination and an oral walkthrough examination at the plant, the same examiner can administer both examinations. If this is not possible because of schedule conflicts, the examiner's notes should be very complete so that the last reviewer has sufficient information to make the final evaluation.

Examinations normally will be administered on regular work days although extensive working time may be required. It is desirable, whenever possible, to complete the examination of a candidate once it is started, but if completion of the examination is not feasible, a logical stopping point must be reached. At an operating reactor where the candidates have not been certified at a simulator, it may be necessary to administer all of the actual reactor startup portions of the operating tests in one specified period of time to accommodate the utility load demands. In cases where a simulator is used for the administration of the operating test and the plant is used for the oral portion of the examination, special arrangements may be necessary to make the most efficient use of the simulator time. On occasion, examinations may involve weekend or shift work, but in these cases this will have been prearranged by the examiner (or chief examiner) and the facility licensee.

When large groups of applicants are to be examined at power facilities, the chief examiner should schedule the operating and oral examinations so that each examiner will administer two examinations each day with a maximum of four examinations for each examiner. Under no circumstances should an examiner be required to administer more than five examinations in any one week.

There are no time restrictions on the minimum or maximum length of operating and oral examinations. However, for scheduling purposes, the normal length of the exams is as follows:

1. RO - 3½ to 4 hours
2. upgrade SRO - 2½ to 3 hours
3. instant SRO - 4 to 5 hours

#### E. Orientation of Examiners

Each examiner should become as familiar as possible with the specific facility through previous visits and the information supplied by the facility in preparation for the examinations. As a minimum, the chief examiner should arrange for a tour of the facility by each examiner accompanied by a facility staff member. This tour is usually made the day before oral examinations are scheduled to begin, should concentrate



on the control room, and should not be conducted by one of the candidates. For examiners visiting the facility for the first time or who have not made a site visit in a considerable length of time, a more extensive orientation is necessary. Suitable arrangements should be made by the chief examiner for more extended or additional orientation visits.

#### F. Candidates

All candidates for licenses at the facility under application are listed on the Request To Administer the Examination and normally should be administered both the written examination and operating and oral tests. One exception is at facilities with a large number of applicants where the written examination often will be given a few weeks before the operating and oral examinations. In these cases, where the written examinations under 10 CFR 55.21 and 55.22 have been graded and the facility licensee has been informed of the candidates who have failed, the persons who have failed will not be given operating and oral examinations.

Candidates sometimes will withdraw from the examination at the last moment. If the examiner encounters this situation when he arrives on site, he should request a letter withdrawing the application of the individual(s) from the facility staff. This letter should be forwarded to the appropriate regional administrator.

In rare instances, candidates may withdraw after the examination has begun. The examiner will inform such candidates that this is cause for automatic denial of application and request the candidate to sign a voluntary withdrawal statement.

#### G. Personnel Present

The number of persons present during an examination should be minimal both to ensure the integrity of the examination and to minimize distractions to the candidates. If an actual reactor startup or other reactivity manipulation is performed as part of the examination, a licensed operator or senior operator must be present in accordance with 10 CFR 55.9(b). During control room discussions, additional shift crew personnel will be present as required by NRC regulations. If the examiner believes that the number of persons or the noise level in the control room is excessive, he should request the shift supervisor or other facility staff personnel to take appropriate action.

In no case shall a member of the facility training staff or other candidate be allowed to witness an oral examination. Examinations are not to be used as training vehicles for future candidates.

Another examiner may be present either to witness the examination as part of his training or to audit the performance of the examiner administering the oral examination. Other observers, such as resident inspectors,

regional personnel, researchers, or NRC supervisors, may be allowed to observe oral examinations if (1) the chief examiner has approved the request to observe before the examination, (2) the candidate does not object to the observer's presence, and (3) the facility representative has approved the request to observe.

#### H. Use of Documents and Materials

During the administration of the operating and oral examinations, the candidate should be allowed and encouraged to make use of any of the information that normally would be available to a licensed operator at that facility, including calibration curves, previous log entries, piping and instrumentation diagrams, calculation sheets, and procedures. The examiner shall inform each candidate of this fact before the examination. The candidate also shall be informed that he will be held responsible for knowing from memory the immediate actions of emergency procedures.

#### I. Reports of Examinations

A separate Examination Report has been developed for each type of examination: Form 157A for reactor operators, (Attachment 1), Form 157B for upgrade senior operators (Attachment 2), and Form 157C for instant senior operators (Attachment 3). The front page of the appropriate report form will be filled out for each candidate. If only a portion of the examination is administered by an examiner, the front page of the form will be completed for the portion completed.

The examiner should only make comments on the front page that are relevant to determining a pass or fail conclusion. He should expect such comments to be seen by the candidate and facility training personnel because each candidate is sent a copy of his examination. He should recommend passing or failing the candidate on the portions he administered in the appropriate blocks(s) at the top of the 157. The chief examiner should approve or not approve for license at the bottom of the page.

The examiner must recommend approval or disapproval of the application based on the results of the entire examination. If the candidate fails any or all parts (written, operating, or simulator), the examiner must recommend denial.

The responsible regional official will review the examination results and sign the appropriate block to issue or deny a license. If he does not agree with the recommendation, the examiner or chief examiner shall be conferred with before the recommendation is overturned. Although such disagreements are not common, they usually arise because of inadequate justifications in a denial recommendation. It is therefore very important for an examiner to be complete and accurate in his grading and comments.

An Operating and Oral Examination Summary Report (Form 157 A, B, or C, page 2) will be prepared for each candidate upon completion of the operating oral examination. On this report, the examiner shall summarize

his evaluation of the candidate's performance and his knowledge and understanding of and competence in the systems discussed. The examiner should use a designation of "S" for satisfactory, "M" for marginal, and "U" for unsatisfactory.

The summary report is based on the examiners operating and oral examination notes, the use of which is explained in Standards ES-303, ES-304, and ES-305.

The summary report contains a column for indicating the page number of the notes where information justifying the evaluation for that subject can be found. This column must be completed when the evaluation is unsatisfactory. This is necessary to indicate to the reviewing technical and legal personnel at headquarters or the regional office the specific reasons for the unsatisfactory determinations. The examiner should use his judgment in completing this column for marginal evaluations, particularly when the overall result is a recommendation to deny the application.

J. Reference

1. U.S. Nuclear Regulatory Commission, NUREG-0094, "A Guide for the Licensing of Facility Operators, Including Senior Operators," July 1976.
2. Title 10, Code of Federal Regulations part 55.23 and 55.25.



NRC Form 157A, Page 2 (9-84)		REACTOR OPERATOR OPERATING AND ORAL EXAMINATION SUMMARY REPORT	
		EVALUATION	
*For each unsatisfactory ("U"), list the page number(s) of the operating oral examination notes on which the unsatisfactory responses are explained.		RO	*Page Number for "U"
1. OPERATING	<input type="checkbox"/> DISCUSSION <input type="checkbox"/> DEMONSTRATION		
1.1	Pre-startup or Instrument Checks		
1.2	Console Operations		
	a. Manipulations		
	b. Understanding		
2. FACILITY EQUIPMENT			
	a. Major		
	b. Auxiliary		
	c. Engineered Safeguards Systems		
	d. Electrical		
3. INSTRUMENTATION			
	a. Nuclear		
	b. Process		
4. PLANT PROTECTION			
5. PROCEDURES			
	a. Normal		
	b. Offnormal/Abnormal		
	c. Emergency		
6. a.	REACTIVITY EFFECTS (Except Console Operation)		
	b. THERMODYNAMICS AND HYDRAULICS		
7.	ADMINISTRATIVE REQUIREMENTS		
8.	EMERGENCY PLAN		
9.	RADIATION PROTECTION AND SAFETY		
10.	RESPONSIBILITIES		
COMMENTS			

NRC Form 157A, Page 3 (9-84)			OPERATING AND ORAL EXAMINATION NOTES		
A OPERATING DEMONSTRATION					EVALUATION
<i>CHECK ONE</i>					
REACTOR START-UP	START-UP SPECIFICATIONS	SIMULATOR DEMONSTRATION			
1.1 Pre-startup or Instrument Checks					
Type of checkout: <i>(specify)</i>					
1.1.1 Familiarity with check sheet					
1.1.2 Accuracy when reading instruments					
1.1.3 Understanding of what is being checked					
1.1.4 Understanding of reasons for checkout					
1.1.5 Effects of malfunctions					
1.1.6 Knowledge of Control Room reference data					
1.1.7 Plant parameter verification (ECP, heat balance, etc.)					
1.2 Console Operation					
a. Initial conditions					
b. Program					
UNDERSTANDING					
1.2.1 Ability to predict response for specified program					
1.2.2 Understanding of instrument response					
1.2.3 Knowledge of reactivity effects					
MANIPULATIONS					
1.2.4 Follows procedures					
1.2.5 Observes and checks instrumentation					
1.2.6 Ability to follow specified program accurately					
1.2.7 Dexterity and "feel" for console controls					
COMMENTS <i>(Required for "U")</i>					



ES-303

NRC Form 157A, Page 4 (9-84)		SYSTEMS							
		A	B	C	D	E	F	G	H
<b>B. CONTROL ROOM</b> <i>(Major, Auxiliary and Engineered Safeguards Systems)</i>									
2.0	<b>EQUIPMENT</b>								
2.1	Purpose								
2.2	Flow Path								
2.3	Normal Parameters								
2.4	Components								
2.5	System Behavior and Response								
3.0	<b>INSTRUMENTATION</b>								
3.1	Detector								
3.2	Misfunction								
3.3	Control Room Indication								
4.0	<b>PLANT PROTECTION</b>								
4.1	Alarms/Setpoints								
4.2	Safety System Input								
4.3	Interlocks								
5.0	<b>PROCEDURES</b>								
5.1	Normal Procedures								
5.2	Offnormal/Abnormal Procedures								
5.3	Emergency Procedures								
6.0A.	<b>REACTIVITY EFFECTS</b>								
	<b>B. THERMODYNAMIC ANALYSIS/THERMAL EFFECTS</b>								
7.0	<b>ADMINISTRATIVE REQUIREMENTS</b>								
7.1	Technical Specifications								
7.2	Facility Requirements								
COMMENTS: <i>(Required for "U")</i>									

CONTINUED ON REVERSE

Page 4

COMMENTS (continued)

[Empty rectangular box for comments]

NRC Form 157A, Page 6 (9-84)		SYSTEMS				
		A	B	C	D	E
B. CONTROL ROOM <i>(Nuclear and Radiation Instruments)</i>						
3.0	INSTRUMENTATION					
3.1	Detectors					
3.2	Malfunctions					
3.3	Control Room Indications					
3.4	Channel Components					
3.5	Compensation/Discriminator					
3.6	Input to Control System					
4.0	PLANT PROTECTION					
4.1	Alarms/Setpoints					
4.2	Safety System Input					
4.3	Interlocks					
5.0	PROCEDURES					
5.1	Normal Procedures					
5.2	Offnormal/Abnormal Procedures					
5.3	Emergency Procedure					
7.0	ADMINISTRATIVE REQUIREMENTS					
7.1	Technical Specifications					
7.2	Facility Requirements					
COMMENTS <i>(Required for "U")</i>						

NRC Form 157A, Page 7 (9-84)		SYSTEMS			
		A	B	C	D
B CONTROL ROOM <i>(Electrical)</i>					
2.0	EQUIPMENT				
2.1	Purpose				
2.2	Flow Path				
2.3	Normal Parameters				
2.4	Components				
2.5	System Behavior or Response				
3.0	INSTRUMENTATION				
3.2	Interlocks				
3.4	Control Room indication				
5.0	PROCEDURES				
5.1	Normal Procedures				
5.2	Offnormal/Abnormal Procedures				
5.3	Emergency Procedures				
7.0	ADMINISTRATIVE REQUIREMENTS				
7.1	Technical Specifications				
7.2	Facility Requirements				
COMMENTS: <i>(Required for "U")</i>					

NRC Form 157A, Page 8 (9-84)		SYSTEMS					
		A	B	C	D	E	F
C. REACTOR AND AUXILIARY BUILDINGS (Power Reactors) (Major, Auxiliary, Electrical Safeguards, Fuel Handling, Rad Waste) FACILITY WALK THROUGH (Non-Power Reactors)							
2.0	EQUIPMENT						
2.2	Flow Paths						
2.3	Normal Parameters						
2.4	Equipment Location						
2.5	System Behavior and Response						
3.0	INSTRUMENTATION						
3.8	Local Instrumentation						
5.0	PROCEDURES						
5.1	Normal procedures (Local)						
5.2	Offnormal/Abnormal Procedures (Local)						
5.3	Emergency Procedures (Local)						
6.0A	REACTIVITY EFFECTS						
	B. THERMODYNAMIC ANALYSIS/THERMAL EFFECTS						
7.0	ADMINISTRATIVE REQUIREMENTS						
7.1	Technical Specifications						
7.2	Facility Requirements						
8.0	EMERGENCY PLAN						
8.1	Action Levels						
8.2	Response and Duties						
8.3	Other Emergencies (fire, security, etc.)						
9.0	RADIATION PROTECTION AND SAFETY						
9.1	Radiation Sources and Hazards						
9.2	Radiation Protection Procedures						
9.3	Knowledge and Use of Portable Instruments						
9.4	Waste Disposal Procedures						
10.0	RESPONSIBILITY						
COMMENTS:							

ES-303

NRC Form 157A, Page 9 (9-84)		SYSTEMS			
		A	B	C	D
D. DISCUSSIONS (Integrated Plant Response)					
2.0	EQUIPMENT				
	2.6 Components Response				
3.0	INSTRUMENTATION				
	3.4 Control Room Indications				
	3.8 Automatic Control				
	3.9 Ability to Manipulate Manual Control				
4.0	PLANT PROTECTION				
	4.1 Automatic Actions				
	4.2 Alarm/Setpoints				
5.0	PROCEDURES				
	5.1 Normal Procedures				
	5.2 Off-normal/Abnormal Procedures				
	5.3 Emergency Procedures				
6.0	REACTIVITY EFFECTS AND THERMODYNAMIC ANALYSIS				
	6.3 Coefficient Effects/Reactivity Effects				
	6.6 Transient Analysis/Thermal Effects				
7.0	ADMINISTRATIVE REQUIREMENTS				
	7.1 Technical Specifications				
	7.2 Facility Requirements				
COMMENTS (Required for "U")					



ES-303

NRC Form 157A, Page 10 (9-84)	EVALUATION
D. DISCUSSION	
6.0 PRINCIPLES OF NUCLEAR POWER PLANT OR NON POWER REACTOR FACILITY OPERATION	
A. REACTIVITY EFFECTS ( <i>Nuclear Theory</i> )	
6.1 Subcritical Multiplication	
6.2 Delayed Neutrons Effect	
6.3 Coefficients	
6.4 Poison Effects	
6.5 Long Term Exposure Effects	
B. THERMODYNAMICS AND HYDRAULICS	
6.6 Steam Tables	
6.7 Pump Characteristics	
6.8 Instrumentation	
6.9 Inadequate Core Cooling/Core Cooling	



SENIOR OPERATOR UPGRADE OPERATING AND ORAL EXAMINATION SUMMARY REPORT			
DESCRIPTION		EVALUATION	
		SRO	PAGE NUMBER
POWER REACTORS	NON-POWER REACTORS		
1. CONTROL ROOM	1. FACILITY ADMINISTRATION		
1.1 Shift Turnover	1.1 Facility Controls		
1.1.1 Logs and Records	1.2 Facility Reference Material		
1.2 Control Room Data			
1.2.1 Technical Specifications	1.3 Emergency Plan		
1.2.2 Procedures	1.4 Plant Operations		
1.2.3 Radiation Protection			
1.2.4 Piping and Instrumentation Drawings			
1.2.5 Computer			
1.2.6 Estimated Critical Position Determination			
2. RESPONSIBILITY AND AUTHORITY	2. FACILITY WALK THROUGH		
2.1 Emergency Plans	2.1 Plant Systems		
2.2 Plant Operation	2.2 Core Alterations		
2.3 Fuel Loading	2.3 Radiation Protection		
2.4 Surveillance	2.4 Security		
2.5 Security			
3. DISCUSSIONS	3. DISCUSSION		
3.1 Transients	3.1 Transients		
3.2 Reactivity Effects	3.2 Reactivity Effects		
3.3 Thermodynamics	3.3 Thermal Effects		
COMMENTS			

OPERATING AND ORAL EXAMINATION NOTES		
POWER REACTORS	NON-POWER REACTORS	EVALUATION
1. CONTROL ROOM	1. FACILITY ADMINISTRATION	
1.1 Shift Turnover	1.1 Facility Controls	
1.1.1 Logs and Records	a. Logs and Records	
a. Shift Supervisor	b. Equipment Out of Service	
b. Operating	c. Experimental Facilities	
c. Jumper and Lifted Leads	d. Key Control	
d. Surveillance	e. Surveillances	
e. Tagging	f. Other (Specify)	
f. Key Control	g. Other (Specify)	
g. Maintenance		
1.2 Control Room Reference Data	1.2 Facility Reference Material	
1.2.1 Technical Specifications	a. Technical Specifications	
a. Changes	b. Procedures	
b. Reporting Requirements	c. Piping and Instrumentation Drawings	
c.	d. Facility Curves	
d.	e. Core Loading	
1.2.2 Procedures	f. Other (Specify)	
1.2.3 Radiation Protection	1.3 Emergency Plan (Leave evaluation blank)	
a. Release Rates	a. Duties/Personal Assignments	
b. Exposure Limits	b. Evaluation Criteria/Types of Emergencies	
c. Radiation Work Permits	1.4 Plant Operations (Leave evaluation blank)	
1.2.4 Piping and Instrumentation Drawings	a. Startup/Shutdown	
1.2.5 Computer	b. Experiments	
1.2.6 Plant Parameter Verification (ECP, Heat Balance, etc.)	c. Steady State Operation	
COMMENTS		
COMMENTS CONTINUED ON THE REVERSE		



3 DISCUSSION	TRANSIENTS			
	A	B	C	D
3.1 Transients				
3.1.1 Components				
3.1.2 Instruments				
a. Control Room Indications				
b. Automatic Control				
3.1.3 Reactor Protection				
a. Automatic Actions				
b. Alarm Setpoints				
3.1.4 Analysis				
a. Coefficient Effects				
b. Safety System Interactions				
3.1.5 Procedures				
a. Specify				
b. Specify				
3.1.6 Physics Effects				
a. Reactivity Effects				
b. Thermal Effects				
COMMENTS				
<input type="checkbox"/> COMMENTS CONTINUED ON THE REVERSE				







SENIOR OPERATOR OPERATING AND ORAL EXAMINATION SUMMARY REPORT		EVALUATION	
*For each unsatisfactory ("U"), list the page number(s) of the operating oral examination notes on which the unsatisfactory responses are explained.		SRO	PAGE NUMBER FOR "U"
1. OPERATING <span style="float: right;"><input type="checkbox"/> DISCUSSION    <input type="checkbox"/> DEMONSTRATION</span>			
1.1 Pre-startup and Instrument Checks			
1.2 Console Operation			
a. Manipulations			
b. Understanding			
1.3 Plant Direction and Control			
2. FACILITY EQUIPMENT			
a. Major			
b. Auxiliary			
c. Engineered Safeguards Systems			
d. Electrical			
3. INSTRUMENTATION			
a. Nuclear			
b. Process			
4. PLANT PROTECTION			
5. PROCEDURES			
a. Normal			
b. Offnormal/Abnormal			
c. Emergency			
6. a. REACTIVITY EFFECTS (Except Console Operation)			
b. THERMODYNAMICS AND HYDRAULICS			
7. ADMINISTRATIVE REQUIREMENTS			
8. RESPONSIBILITIES AND AUTHORITIES			
a. Radiation Protection and Control			
b. Emergency Plan			
c. Other Duties and Responsibilities			
COMMENTS:			

OPERATING AND ORAL EXAMINATION NOTES	
A. OPERATING DEMONSTRATION	EVALUATION
CHECK ONE	
<input type="checkbox"/> REACTOR STARTUP <input checked="" type="checkbox"/> <b>STARTUP CERTIFICATION</b> <input type="checkbox"/> SIMULATOR DEMONSTRATION	
1.1 Pre-Startup or Instrument Checks, Type of Checkout (specify) _____	
1.1.1 Familiarity with checksheet	
1.1.2 Accuracy when reading instruments	
1.1.3 Understanding of what is being checked	
1.1.4 Understanding of reasons for checkout	
1.2 Console Operation	
a. Initial conditions	
b. Program	
c. Understanding	
1.2.1 Ability to predict response for specific program	
1.2.2 Understanding of instrument response	
1.2.3 Knowledge of reactivity effects	
d. Manipulations	
1.2.4 Follows procedures	
1.2.5 Observes and checks instrumentation	
1.2.6 Ability to follow specified program accurately	
1.2.7 Dexterity and "feel" for console controls	
1.3 Plant/Facility Direction and Control	
1.3.1 Ability to direct plant operation	
1.3.2 Plant parameter verification (ECP, heat balance, etc.)	
1.3.3 Technical specification requirements	
1.3.4 Equipment OOS requirements	
1.3.5 Experimental Facilities (Non-Power Reactors only)	
COMMENTS	

	SYSTEMS							
	A	B	C	D	E	F	G	H
<b>B. CONTROL ROOM</b> <i>(Major, Auxiliary and Engineered Safeguards Systems)</i>								
2.0 EQUIPMENT								
2.1 Purpose								
2.2 Flow Path								
2.3 Normal Parameters								
2.4 Components								
2.5 System Behavior and Response								
3.0 INSTRUMENTATION								
3.1 Detector								
3.2 Malfunction								
3.3 Control Room Indication								
4.0 PLANT PROTECTION								
4.1 Alarms/Setpoints								
4.2 Safety System Input								
4.3 Interlocks								
5.0 PROCEDURES								
5.1 Normal Procedures								
5.2 Offnormal/Abnormal Procedures								
5.3 Emergency Procedures								
6.0 A. Reactivity Effects								
B. Thermodynamic Analysis: Thermal Effects								
7.0 ADMINISTRATIVE REQUIREMENTS								
7.1 Technical Specifications								
7.2 Facility Requirements								
COMMENTS (Required for "U")								
<input type="checkbox"/> CONTINUED ON REVERSE								

COMMENTS *(Continued)*

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	SYSTEMS				
	A	B	C	D	E
<b>B. CONTROL ROOM</b> <i>(Nuclear and Radiation Instruments)</i>					
<b>3.0 INSTRUMENTS</b>					
3.1 Detectors					
3.2 Malfunctions					
3.3 Control Room Indications					
3.4 Channel Components					
3.5 Compensation/Discriminator					
3.6 Input to Control System					
<b>4.0 PLANT PROTECTION</b>					
4.1 Alarms/Setpoints					
4.2 Safety System Input					
4.3 Interlocks					
<b>5.0 PROCEDURES</b>					
5.1 Normal Procedures					
5.2 Offnormal/Abnormal Procedures					
5.3 Emergency Procedure					
<b>7.0 ADMINISTRATIVE REQUIREMENTS</b>					
7.1 Technical Specifications					
7.2 Facility Requirements					
<b>COMMENTS: (Required for "U")</b>					





	SYSTEMS			
	A	B	C	D
D. DISCUSSIONS ( <i>Integrated Plant Response</i> )				
2.0 EQUIPMENT				
2.6 Components Response				
3.0 INSTRUMENTS				
3.4 Control Room Indications				
3.8 Automatic Control				
3.9 Ability to Manipulate Manual Control				
4.0 PLANT PROTECTION				
4.1 Automatic Actions				
4.2 Alarm/Setpoints				
5.0 PROCEDURES				
5.1 Normal Procedures				
5.2 Offnormal/Abnormal Procedures				
5.3 Emergency Procedures				
6.0 REACTIVITY EFFECTS AND THERMODYNAMIC ANALYSIS				
6.3 Coefficient Effects/Reactivity Effects				
6.6 Transient Analysis/Thermal Analysis				
7.0 ADMINISTRATIVE REQUIREMENTS				
7.1 Technical Specifications				
7.2 Facility Requirements				
COMMENTS ( <i>Required for "U"</i> )				

D. DISCUSSION (Power Reactors)	EVALUATION
6.0 THEORY OF NUCLEAR POWER PLANT OPERATION	6.0
A. REACTIVITY EFFECT (Nuclear Theory)	A
6.A.1 Subcritical Multiplication	
6.A.2 Delayed Neutrons Effect	
6.A.3 Coefficients	
6.A.4 Poison Effects	
6.A.5 Long Term Exposure Effects	
6.A.6 Axial and Radial Limits	
6.A.7 Shutdown Margin	
6.A.7 Safety Limits	
B. THERMODYNAMICS AND HYDRAULICS	
6.B.1 Steam Tables	
6.B.2 Instrumentation	
6.B.3 Pump Characteristics	
6.B.4 Inadequate Core Cooling	
6.B.5 DNBR, MCPR, etc.	
6.B.6 Operational Analysis	
8.0 RESPONSIBILITY AND AUTHORITY	
A. RADIATION PROTECTION CONTROL	
8.A.1 Source and Hazards of Radiation	
8.A.2 Exposure Limits (10 CFR 20, Facility)	
8.A.3 Portable Instrumentation (Knowledge and Use)	
8.A.4 Procedures (RWP, containment entry, etc.)	
8.A.5 Release Permits (gaseous, liquid, purge)	
B. EMERGENCY PLAN IMPLEMENTING PROCEDURES	
8.B.1 Duties	
8.B.2 Classification	
8.B.3 Evaluation Criteria	
8.B.4 Personnel Assignments	
C. ADDITIONAL DUTIES AND RESPONSIBILITIES	
8.C.1 Surveillance Testing	
a. Instrumentation and Control	
b. Other (Specify)	
8.C.2 Security	
8.C.3 Shift Turnover	

COMMENTS (Required for "U" use reversal)

D. DISCUSSION (Non Power Reactors)	EVALUATION
6.0 THEORY OF NON-POWER REACTOR FACILITY OPERATION	
6.1 Reactivity Effects	
a. Subcritical Multiplication	
b. Dropped Rod/Stock Rod	
c. Coefficients	
d. Experiment Effects	
e. Long Term Exposure Effects	
f. Rod Worth	
g. Shutdown Margin- Excess Reactivity	
h. Power Increases and Decreases	
6.2 Thermal Effects	
a. Core Cooling	
b. Heat Balance	
c. Instrumentation	
8.1 Radiation Protection Control	
a. Source and Hazards of Radiation	
b. Exposure Limits (10 CFR 20, Facility)	
c. Portable Instrumentation (Knowledge and Use)	
d. Procedures (RWP, Contamination Control, etc.)	
e. Release Permits (gaseous, liquid, purge)	
8.2 Emergency Plan Implementing Procedures	
a. Duties	
b. Classification	
c. Evaluation Criteria	
d. Personnel Assignments	
8.3 Additional Duties and Responsibilities	
a. Surveillance Testing	
b. Core Alterations	
1. Refueling procedures	
2. Fuel Component Handling	
3. Fuel Component Storage	
c. Security	
d. Shift Turnover	



NRC FORM 157C, Page 11  
(9-94)

ES-306

COMMENTS (Continued)

Page 11

SCOPE OF OPERATING EXAMINATIONS ADMINISTERED TO  
REACTOR OPERATORS AND SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard lists the general scope and objectives of the operating examination. The operating examination is an oral examination and also includes a simulator examination for those facilities that have a plant reference simulator. The wide variations in concepts, design, and operation of licensed facilities make it impossible to delineate precise procedures applicable to all facilities. The scope of the examinations, as described below, should be applied, as appropriate, to allow the examiner to make judgments in accordance with Standard ES-301.

B. Examination Requirements

All candidates for reactor operator (RO) and senior reactor operator (SRO) licenses are required to be administered operating and oral examinations except in cases where a waiver has been granted in accordance with 10 CFR 55.24. The scope and content of the examinations will depend on the type of license applied for (RO, instant SRO, upgrade SRO) and the availability of a plant reference simulator. When the operating examination includes a simulator examination, the oral portion of the examination should be reduced by the material satisfactorily covered on the simulator portion such that the total operating examination is equivalent to an operating examination at a facility that does not have a plant reference simulator. The clarification of reactivity manipulations is detailed in Standard ES-301, Paragraph B. Simulator examination requirements are contained in the ES-500 Series Standards. This standard explains the scope of the operating examination, as required by 10 CFR 55.23.

C. Rules of Practice

Each examiner must understand and observe certain ground rules during the conduct of operating examination.

1. For those examinations that require an actual reactor startup or other manipulation of controls and/or instrumentation of the facility
  - a. The examiner should inform the candidate and the licensed operator present and/or the responsible supervisor that he (the examiner) will never intentionally ask the candidate to perform an act that violates facility regulations or procedures or which places the facility in a hazardous situation. If a requested act falls in these categories, then the candidate, operator, or supervisor should indicate this immediately.

If the examiner's intent is to determine whether the candidate would perform such an act, the question can be phrased in some manner other than requesting the act to be performed.

- b. The examiner should ensure that it is understood that his presence does not alter the normal chain of command and that the candidate, during the examination, should make all reports and obtain all permissions that normally would be required. All directions to the candidate shall come from the responsible supervisor in accordance with the facility administrative procedures. The examiner shall only question and make requests of the candidate. The examiner should avoid asking distracting questions during the manipulation of controls.
  - c. The examiner shall not alter the set points or calibrations of any instrument or manipulate any control.
  - d. The licensed operator on duty should be informed that he should step in and take over control of the reactor any time there is an unsafe condition or there is reasonable assurance, in his opinion, that the reactor will shut down if conditions are not corrected.
2. For all operating examinations, the examiner should brief the candidate on, or ensure that the candidate is aware of,
- a. the general conduct, scope, and length of the examination and any other pertinent information
  - b. the fact that the examiner is a visitor at the facility and is to be so treated according to facility procedures
  - c. his right to seek clarification of the examiner's questions when necessary
  - d. the fact that the examiner cannot reveal the results at the conclusion of the examination
  - e. the candidate's obligation for demonstrating a responsible, safe attitude to facility operation during conduct of the examination

#### D. Conduct of Examinations

Various phases of the operating examinations are listed below. Normally all examinations will include all four phases; although for "cold" examinations not performed at a simulator or for "hot" examinations where the candidates have been certified at a simulator, the manipulative portion of Phase A is not required. Where a simulator is available, all of Phase A and portions of Phases B and D will be performed at the simulator. The nature and extent of the questions for the reactor operator and senior reactor operator candidates will vary.

1. The four phases of the examination for the reactor operator candidate generally include:

Phase A, Operating Demonstration

Manipulation of controls through a reactor startup or other reactivity manipulation (see Standard ES-303, Section E, for the methods for accomplishing this phase).

Phase B, Control Room (Major, Auxiliary, Engineered Safeguards, Nuclear and Radiation Instruments, Electrical)

Discussions, performance of checkouts, and use of procedures at supplementary instrument panels in the control room.

Phase C, Reactor and Auxiliary Buildings

Discussions, performance of checkouts, and use of procedures at selected portions of the facility outside the control room. This should also include discussions concerning radiation protection (procedures, instrumentation, hazards, and so forth).

Phase D, Discussion (Integrated Plant Response, Reactor Theory, Thermodynamics, and Hydraulics)

Discussions of a specific nature concerning overall plant behavior including response to transients based on nuclear theory and thermodynamics.

2. For the upgrade senior reactor operator candidate, the following substitutions, additions, or deletions should be made in each of the phases:

Phase A, Operating Demonstration

Simulator examination, if applicable. If not, a discussion of plant operations to include a startup or shutdown.

Phase B, Control Room

Administrative requirements to include shift turnover, surveillances, planned waste releases, and emergency plan implementation.

Phase C, Reactor and Auxiliary Buildings

Fuel handling, shutdown outside control room, and other procedures.

Phase D, Discussion

Similar to that for a reactor operator; however, topics shall be explored in more depth consistent with a senior reactor operator's responsibility and authority.

3. The operating examination for an instant senior reactor operator must be an appropriate blend of the examination requirements for a reactor operator and for an upgrade senior reactor operator. The examiner must determine that the instant senior reactor operator candidate has the requisite knowledge and ability as a reactor operator and also can function in a supervisory capacity as a senior reactor operator. The senior reactor operator candidate, whether upgrade or instant, must be aware that he is being examined for the highest position for which the senior reactor operator's license is applicable on each shift. For example, if the senior reactor operator candidate is to be given a shift foreman's (or assistant shift supervisor's) position when he receives an SRO license, the examination must be conducted assuming the candidate will function as the shift supervisor.

#### E. Scope of Examination

The operating tests administered to candidates for reactor operator and senior reactor operator licenses must include, to the extent applicable, the following items as required by 10 CFR 55.23:

1. The candidate should perform prestartup checks on the reactor or any other checks (e.g., daily, recovery from scram) that a licensed operator would normally perform. When complete performance of all applicable checks requires a prohibitive amount of time, the examiner may select portions of the checklists and spot check items or use other methods he deems suitable to determine competence within a reasonable time.
2. The candidate should start up the reactor from a substantially subcritical condition and raise power to a preselected value that is sufficient to use all nuclear instrumentation channels and introduce effects on reactivity (e.g., temperature increase and void formation) as may be appropriate. In the case of examinations administered at a nuclear power plant simulator (see Standards ES-501 and ES-502), the examiner may use other programs (i.e., malfunctions and/or abnormal conditions) to determine the candidate's understanding of, and ability to perform, manipulations at the control console.
3. The candidate should describe his actions and responses to each alarm and annunciator signal and indicate the probable causes and significance thereof. The candidate should show a high degree of familiarization with procedures of this nature and should distinguish between actions or checks that he must take immediately and those actions that are logical followups depending on the circumstances.
4. The candidate should predict the approximate readings of all pertinent instrumentation for the conditions at which he will be operating and verify that his predictions are accurate.

5. The candidate should describe the response of the system to control changes and verify that his description is correct. Normally, the candidate should make one or more changes of power level on a period or startup rate indicated by the examiner and permitted by the regulations of the facility.
6. The candidate should demonstrate familiarity with auxiliary and emergency systems at the facility and particularly indicate the interrelationships and interconnections between them and the reactor or reactor control system.
7. The candidate should perform such standard calculations (e.g., burnout, rod position, estimated critical position (ECP), and heat balance) as are consistent with an operator's responsibility at the facility.
8. The candidate should align and start, or describe the procedure for, several of the pertinent auxiliary and emergency systems.
9. The candidate should describe the operation and pertinent design and construction features of the reactor and auxiliary systems and indicate satisfactory familiarity with the overall facility, including the ability to locate and identify significant components and instrumentation.
10. The candidate should demonstrate the use of, and interpret, the readings of the portable monitoring equipment that is usually available.
11. The candidate should demonstrate his actions in the event of emergencies that may occur. He should possess a high degree of familiarity with duties required in the emergency procedures and be able to distinguish between those actions he must take immediately as an operator, those which are followup actions, and those that affect persons at the facility for whom he has a safety responsibility.
12. The candidate should observe all rules and procedures regarding radiation safety and equipment and required radiation work permits and permissions and demonstrate a logical safe approach to questions involving radiological safety, including hypothesized situations.
13. The candidate should demonstrate familiarity with, and follow all, operating procedures and standards of the facility including all notifications to supervision and other facility personnel. He should also demonstrate that he knows when permission from other facility personnel is required before performing some actions.

#### F. Systems and Subjects

Generic lists of systems and subjects have been developed for both pressurized-water reactors and boiling-water reactors (Attachments 1 and 2 to this standard). The examiners may select from these lists, or



a list specific to the vendor type and model of the nuclear steam supply system, those areas that they wish to cover during the operating and oral examinations. The examiners should diversify their coverage and discuss as many of the systems and subjects as feasible during a specific assignment.

In preparing the program for the operating examination, examiners should avoid true/false-type questions or questions with only two possible answers. Questions of this type increase the difficulty of determining satisfactory or unsatisfactory responses, particularly if the candidate "changes his mind" because of prompting by the examiner. For example, instead of asking, "If the steam generator safety failed open with rod control in automatic, would rods move in or out?", the examiner should ask, "If a steam generator safety failed open, what would be the primary effect on reactivity initially?" Then he should discuss rod control response and protective system response or reactivity principles in more depth depending on the candidate's answer. In general, the examiner should try to avoid situations that could result in the candidate claiming to have given the correct answer even though he had to correct himself when the examiner felt that the basic understanding was not evident.

## ATTACHMENT 1

## LIST OF TOPICS FOR ORAL EXAMINATIONS - BOILING-WATER REACTORS

## A. CONTROL ROOM SYSTEMS

## 1. MAJOR

- Turbine Generator
- Reactor Level Control
- Recirculation
- Control Rods and Control Rod Drives
- Electrohydraulic Control
- Turbine Bypass
- Main Condenser
- Circulating Water
- Condensate and Feedwater
- Mechanical Design (Fuel Assembly)
- Reactor Vessel

## 2. AUXILIARY

- Reactor Building Closed Cooling Water
- Turbine Building Closed Cooling Water
- Control, Instrument, and Service Air
- Fire Protection
- Service Water
- Equipment and Floor Drainage
- Condensate Storage and Transfer
- Radioactive Waste (Solid and Liquid)
- Fuel Pooling Cooling and Cleanup
- Demineralized Water
- Augmented Off Gas
- Condenser Circulating Water
- Process Sampling
- Heating, Ventilation, and Air Conditioning
- Reactor Water Cleanup
- Shutdown Cooling
- Head Cooling
- Containment Inerting
- Gland Seal and Exhaust
- Turbine - Generator Lube Oil
- Steam Jet Air Ejectors

## 3. ENGINEERED SAFETY FEATURES

- Residual Heat Removal
- High-Pressure Coolant Injection
- Low-Pressure Coolant Injection
- Standby Gas Treatment

## 4. ENGINEERED SAFETY FEATURES (Continued)

- Reactor Core Isolation Cooling
- Isolation Condenser
- Primary Containment
- Containment Spray
- Core Spray
- Core Flooding
- Auto - Depressurization
- Standby Coolant Supply
- Main Steam Line Restrictors
- Control Rod Velocity Limiter
- Main Steam Line Isolation Valves
- Standby Liquid Control
- Pressure Relief
- Secondary Containment

## 5. NUCLEAR AND RADIATION INSTRUMENTS

- Source Range Monitors
- Intermediate Range Monitors
- Average Power Range Monitors
- Local Power Range Monitors
- Rod Worth Minimizer
- Rod Block Monitor
- Traveling Incore Probe
- Process Computer
- Rod Sequence Control
- Liquid Effluent
- Area Radiation Monitors
- Gaseous Effluent
- Stack Gas
- Main Steam Line Radiation
- Off Gas System

## 6. ELECTRICAL

- Diesels
- Normal AC Supply
- Emergency AC Supply
- Normal DC Supply
- Emergency DC Supply
- Reactor Protection System
- Uninterruptible Power Supply

## B. REACTOR AND AUXILIARY BUILDING SYSTEMS

Any system listed above including systems covered during the control room portion of the examination may also be covered during the walkthrough. The systems listed below are also convenient for coverage during the plant walkthrough.

Fuel Handling and Storage  
Rad Waste

C. INTEGRATED PLANT RESPONSE TRANSIENTS

Turbine Trip  
Loss of Generator Load  
Emergency Shutdown From Full Power  
Scram - Cold Restart  
Scram - Hot Restart  
Load Change (at least 20%)  
Subcritical to Critical  
Normal Shutdown From Full Power  
Maneuver to Hot Standby  
Recirculation Pump Trip  
Feedwater Pump Trip  
Steam Pipe Break  
Recirculation Line Break  
Loss of Reactor Building Closed Cooling Water  
Loss of Instrument Air

## ATTACHMENT 2

## LIST OF TOPICS FOR ORAL EXAMINATIONS - PRESSURIZED-WATER REACTORS

## A. CONTROL ROOM SYSTEMS

## 1. MAJOR

- Reactor
- Pressurizer
- Reactor Coolant Pumps
- Primary System
- Steam Generators
- Control Rod Drive Systems
- Chemical and Volume Control Systems (CVCS)
- Steam, Feed, and Condensate System
- Turbine Generator
- Reactor Protective System (RPS)

## 2. AUXILIARY

- CVCS - Makeup/Letdown
- CVCS - Boration/Deboration
- Component Cooling Water
- Shutdown Cooling System (RHR, Decay Heat Removal)
- Spent Fuel Pit Cooling
- Sampling System
- Fire Protection System
- Containment Air Recirculation and Cooling System
- Condensate
- Condenser Circulating Water
- Quench Tank
- Service Water
- Compressed Air System
- Auxiliary Feedwater System

## 3. ENGINEERED SAFETY FEATURES

- High-Pressure Safety Injection System
- Low-Pressure Safety Injection System
- Safety Injection Tanks (Accumulators, Core Flood Tanks)
- Containment Spray System
- Reactor Building Isolation
- Refueling Water Tank (Refueling Water Storage Tank, Borated Water Storage Tank)
- Containment Iodine Removal System
- Hydrogen Removal System
- Actuation Signals

## 4. NUCLEAR AND RADIATION INSTRUMENT

Startup Channels  
 Intermediate Channels  
 Power Range Channels  
 In-Core Instrumentation  
 Process Radiation Monitors  
 Area Radiation Monitor

## 5. ELECTRICAL

230-kV Systems  
 6900-V Systems  
 4160-V Systems  
 A80-V Systems  
 120-V Systems  
 DC Power Supplies  
 Batteries  
 Emergency Generator or Diesel Generators  
 Lighting

## B. REACTOR AND AUXILIARY BUILDING SYSTEMS

Any system listed above including systems covered during the control room portion of the examination may also be covered during the walkthrough. The systems listed below are also convenient for coverage during the plant walkthrough.

Sampling System  
 Fuel Handling and Storage (Cold Plant)  
 Liquid Waste Handling and Disposal  
 Gaseous Waste Handling  
 Solid Waste Handling and Disposal  
 Diesel Generators  
 Shutdown Outside Control Room - Charging System  
 Shutdown Outside Control Room - Feedwater Station  
 Shutdown Outside Control Room - Control Panel  
 Shutdown Outside Control Room - Boration  
 Chemical Addition  
 Hydrogen Recombiners  
 Station Gas (N<sub>2</sub>H<sub>2</sub>) Supplies  
 Intermediate Cooling Systems  
 Main Condenser Level Control System  
 Auxiliary Feedwater Systems

## C. INTEGRATED PLANT RESPONSE TRANSIENTS

Load Increase/Decrease - Auto Control  
 Load Increase/Decrease - Manual Control  
 Load Rejection



## INTEGRATED PLANT RESPONSE TRANSIENTS (Continued)

Turbine Trip  
Feedwater Pump Trip  
Rod Malfunction  
Primary System Leak  
Steam Leak  
Reactor Coolant Pump Trip  
Control Instrument Malfunction  
Steam Generator Tube Failure  
Fuel Cladding Failure  
Loss of Feedwater  
Loss of Component Cooling

INSTRUCTIONS ON USE OF FORMS FOR OPERATING EXAMINATIONS  
ADMINISTERED TO REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard provides guidance to the examiner on the use of the examination forms during the course of the reactor operator operating examinations. Form 157A has been designed to minimize the amount of note taking and to make best use of the time necessary for the examinations. Separate forms have been developed for the reactor operator (RO) examinations (Form 157A), the upgrade senior reactor (SRO) examination (Form 157B), and the instant SRO examination (Form 157C) (Attachments 1 through 3 of ES-301).

B. General

The examiner is ultimately responsible for making a professional, subjective judgment on whether a candidate should pass or fail this segment of the examination. The forms pertaining to the oral portion of the operating examination should only be used as an aid to the examiner in conducting the examination and as a means of documenting the bases for the examiner's pass or fail determination. This determination is based on an audit of the levels of knowledge and abilities of the candidate, and, as such, all of the applicable areas defined in Standard ES-302 should be explored in varying degrees of depth.

The examiner will specify his evaluation of the candidate's observed performance and knowledge and understanding of and competence in the subjects and systems discussed by placing an "S" for satisfactory, an "M" for marginal, and a "U" for unsatisfactory in the appropriate space. The following criteria are to be used for the evaluation.

S - Excellent to Good Working Knowledge and Understanding of the Subject or Systems

The candidate may have some slight or minor difficulty relating to system interactions. Competence in the operation of equipment associated with system is very good although there may be some hesitation while performing some tasks. The candidate, however, appears to be familiar with the equipment and procedures.

M - Fair Working Knowledge and Understanding of Subject or Systems

Candidate may have difficulty answering questions in depth and in relating the interactions of systems. Competence in operation of equipment is generally good. The candidate, however, shows some lack of familiarity with the equipment and procedures.

U - Poor Working Knowledge and Understanding of Subject or System

Answers given by the candidate are incorrect and incomplete and/or he is unable to provide an answer. The candidate shows obvious unfamiliarity with subject and/or system as evidenced by hesitant answers, need to search for information, inability to locate control board indications and/or controls, and lack of knowledge of procedural steps to operate systems.

An example of a marginal evaluation is one where a candidate initially provides a wrong answer then later recognizes the mistake with little prompting and corrects the answer. If the candidate gives a wrong answer to a question with only two possible answers (e.g., rods go in or rods go out) and then corrects the answer, the examiner should expand the questioning to ensure that the candidate understands the system or event and is not guessing. If this happens several times in the same area, the marginal evaluation should be changed to an unsatisfactory. All unsatisfactory evaluations shall be supported by detailed notes stating the particular action or response that resulted in the unsatisfactory evaluation. The supporting notes should be as specific as possible; use of general statements such as "did not know decay heat removal system" should be avoided.

Use of statements such as "gave correct answer only after prompting" is not acceptable documentation of an unsatisfactory rating. Additional justification is required because the examiner admits that the correct answer was given.

The use of marginal evaluations should be minimized. Areas where a candidate's knowledge is marginal should be explored further in an attempt to determine if an "S" or a "U" rating is warranted. If the marginal evaluation stands, supporting notes should be included although they are not mandatory.

The examiner should allow, and in fact encourage, the candidate to draw diagrams, flow paths, or other visual representations. This serves two purposes:

1. It allows the candidate to better express himself when providing an answer or explanation to the examiner.
2. It provides additional documentation to support a pass or fail determination.

These visual representations may be made on the reverse pages of the forms pertaining to the oral examination or other paper which the examiner should attach to the examination notes.

### C. Rules of Practice

The rules of practice set forth in Standard ES-302 apply to the R0 operating examinations. When actual plant manipulations are to be performed, these rules should be explained to, and understood by, each candidate.

### D. Conduct of Examination

The procedure for conduct of the examination, as specified in Standard ES-302, is most applicable for reactor operator candidates. The most common method of examination (nonplant-specific simulator) is a "sit-down" period of discussion with the candidate, followed by the control room discussion and startup, if applicable, and a plant walkthrough. Typical time requirements for this examination are as follows:

1. discussion - 3/4 to 1 hour
2. control room - 2 to 2-1/2 hours
3. walkthrough - 1/2 to 3/4 hour

If reactor startups are required for a group of candidates, they generally will all be performed in 1 day to minimize plant downtime. In such cases, the "Discussion" and "Control Room," phases of the oral examination can be shortened if some of the required items are covered during the startup. If a plant-specific simulator examination is administered, items covered at the simulator should not be covered again during the oral portion, thus further shortening the oral part of the examination. It is necessary, however, that the examiner give a complete examination as is explained in Section E, "Detailed Instructions," of this standard.

The operating examinations are audits of selected areas that each candidate is responsible for knowing or in which he must demonstrate competence. As such, the examiner must make a complete audit of each candidate to justify granting a license. It is often necessary to go significantly beyond the average oral examination time periods to complete the audit. In a relatively few cases, where a candidate has clearly shown deficiencies and there is no doubt of a denial, the examiner may omit some required coverage. In such cases he should attempt to include as much coverage of the subject area as possible within the "average" oral examination period.

### E. Detailed Instructions

1. Operating Demonstration (Form 157A, page 3)

This phase of the examination may be completed by one of three methods:

- a. actual reactor startup or other reactivity manipulation on the plant

- b. startup certification on a simulator as part of an approved NRC program
- c. simulator examination

For an actual reactor startup or other reactivity manipulation, the examiner shall evaluate the candidate's knowledge and/or performance for every subject on page 3 of Form 157A.

The type of prestartup performed should be specified, including the procedure number if applicable.

During the manipulation portion of the examination, the candidate will be evaluated on both his understanding and his ability to safely and competently manipulate the controls.

In lieu of an actual plant startup, the candidate may have successfully completed a certification program using a simulator. The examiner is not required to evaluate the candidate on the "Operating Demonstration" phase of the examination. It is recommended that one or more candidates per assignment be audited on this phase. This audit may be performed by a "talk-through" of a startup with a candidate. In this instance, Items 1.2.4 through 1.2.7 pertaining to manipulation should be marked "Not Applicable (N/A)." Items 1.1.1 through 1.1.7 of the examiner notes should be completed. This may be accomplished by using a routine functional or other surveillance checklist for which the operators are responsible.

If a simulator examination is conducted, NRC FORM 309 (ES 303 Attachment 1) should be completed instead of page 3 of NRC form 157A and a note on page 3 should direct attention to NRC form 309 attached.

## 2. Control Room (Form 157A, B, or C)

The portion of the Examination Report pertaining to the control room consists of three pages, and the format in Forms 157A and C is a matrix type that allows the examiner to select with ease the systems and subjects he wishes to discuss. A generic list of systems and subjects for pressurized-water reactors and boiling-water reactors is included in Standard ES-302.

The systems are selected from the applicable generic list. The system selected will be listed at the top of the columns. The subjects that can be discussed are arranged on the left-hand side of the page.

To make best use of the time required for the administration of the examination and provide a uniform and reasonable basis for the issuance of a license or denial of an application, the examiner shall use the following procedure for each applicant.



- a. The "Control Room" section dealing with major, auxiliary, and engineered safeguards systems shall contain a minimum of two systems from each category. All six systems should be evaluated in at least six subject areas.
- b. For the "Nuclear and Radiation Instrument" section, the examiner should select two nuclear and one installed radiation system, as a minimum, and at least six subjects in each system should be explored.
- c. For the "Electrical" section, the examiner should select a minimum of one normal and one emergency supply system. In this case five subjects for each system should be adequate for a determination of the knowledge and/or competence of the candidate.

During the course of the discussions on the control room, the examiner should require the candidate to demonstrate his understanding and familiarity by locating and explaining

- a. control board instrumentation
- b. control board controls
- c. piping and instrument diagrams
- d. procedures
- e. other related reference data (such as logs, tag outs, and Technical Specifications)

The candidate's response to at least three abnormal and/or emergency procedures should be evaluated during the control room phase of the examination.

### 3. Reactor and Auxiliary Buildings

The control room licensed personnel are responsible for directing the activities of all facility personnel in areas that could affect the safety of the plant and as such should be familiar with plant layout, design, local procedures, and radiological and safety conditions. The examiner may evaluate the candidate's knowledge in this phase by a variety of methods:

- a. He may select at least two systems from the list of items for the reactor type and discuss a minimum of five subjects for each system.
- b. From control room discussions, he (or the candidate) may generate a list of items that require local monitoring, verification, or manipulation.
- c. He may select at least two procedures with actions that are performed in the plant.



These or alternate methods should be used for the plant walkthrough part of the examination with the following guidelines:

- a. The response to at least one local emergency procedure should be evaluated.
- b. One entry into a radiation-controlled area should be made.
- c. The examiner should diversify his coverage of the plant for a group of candidates.

The examiner should evaluate the candidate's knowledge of the facility's Emergency Plan as it pertains to the job responsibilities of a reactor operator. Although the senior operator in charge is usually responsible for classifying and implementing the appropriate action levels, the RO should know those levels and his response and duties for each one. In addition, the operator must be able to respond to other emergencies such as fire and security intrusion.

The portion pertaining to radiation protection and safety will be completed by the examiner exploring those areas that are within the candidate's responsibility for personnel protection and for the control and discharge of radioactive wastes.

During the control room and plant walkthrough, the examiner will evaluate the candidate's responsibility associated with personnel safety, security, and the safe operation of the facility. This evaluation need not be performed by direct questioning of the candidate but may be accomplished by observing his response to unexpected or incorrect existing plant conditions.

#### 4. Discussion

The final section of the examination is the "Discussion" and is divided into two parts, both of which shall be used by the examiner:

- a. Integrated Plant Response
- b. Principles and/or Theory of Nuclear Power Plant Operation

During the nonsimulator oral phase, the examiner is required to explore in detail the candidate's knowledge of the integrated plant response including applicable procedures for at least two plant transients. The back of the examination notes may be used for sketches, or additional sheets may be attached. This portion of the examination need not be a separate discussion. In fact, it may be more useful and efficient to combine this phase during other portions of the examination. For example, by postulating a plant upset condition such as a reactor scram, the examiner may include in the discussion one or more of the plant systems required to be covered in the control room discussion.

If a simulator demonstration is involved, NRC Form 309 (Attachment 1 to this standard) should be completed instead of page 8 of NRC Form 157A and a note on page 8 should direct attention to NRC Form 309.

The "Principles of Nuclear Power Plant Operation" portion of the notes must be completely filled in with evaluations for each candidate in every subject. Again this discussion may be combined with other areas for examination continuity and efficiency. It is important for the candidate to use and explain existing plant information for this phase of the examination. Examples include reactivity data used in estimated critical position (ECP), computer-generated core data, pump head curves, and so forth.



INSTRUCTIONS ON USE OF FORMS FOR OPERATING EXAMINATIONS  
ADMINISTERED TO UPGRADE SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard provides guidance to the examiner on the use of Examination Form 157B during the course of operating and oral examinations for upgrade senior operator candidates.

B. General

A letter from H. Denton (NRC), dated March 28, 1980 required that operating examinations be administered to upgrade senior operator candidates. Previous policy to waive this portion of the examination and administer only a written examination was superseded by this new requirement.

C. Rules of Practice

The rules of practice set forth in Standard ES-302, Section C, also apply during this type of examination and should be discussed with the candidate as indicated in Standard ES-302. The candidate should be informed that he will be examined at the highest onshift level that he can occupy with a senior reactor operator (SRO) license, for example, shift supervisor.

D. Conduct of Examination

The conduct of an upgrade senior reactor operator examination is also specified in Standard ES-302. Generally, this examination is administrative in nature and aimed at evaluating the candidate's knowledge of his responsibilities as a shift supervisor. The candidate should display the ability and attitude of responsibility for safe operation and especially to assume a management role during plant transient and upset conditions.

Differences in administrative controls and facility design will affect the senior operator's responsibilities, but in general the following items should be used as guides for the scope of the senior operator examination.

1. The senior operator, in directing licensed activities, must evaluate plant performance, particularly during nonroutine events, and make operational judgments accordingly. He should therefore have a higher degree of knowledge in areas such as operating characteristics, reactor behavior, and instrument interpretation than a reactor operator.

2. The senior operator, in directing licensed activities, must have a wider and more thorough knowledge of facility administration controls and methods, including limitations imposed by regulations, particularly the limitations set forth in the Technical Specifications and the bases for each of the specifications, than a reactor operator.
3. The senior operator often will be assigned comprehensive actions during facility emergencies and abnormal conditions and should demonstrate knowledge of these assignments.
4. The senior operator often will be assigned responsibilities for auxiliary systems that are outside the control room and are not normally operated by licensed operators. The most common example is a waste disposal and handling system for which the licensed operator's responsibility ends when the fluid passes the last instrument that has console display. Usually, the senior operator has additional responsibilities. In such a case the senior operator candidate must demonstrate knowledge of system design concerning maximum permissible concentration, effluent release rates, and other aspects if appropriate.

Examination Report Form 157B has been prepared for use by the examiner when administering the upgrade senior reactor operator examination. This form has been designed to ensure uniformity in the administration of the examination, minimize the amount of note taking, and make best use of the time required for the examination. The notes will provide the basis for recommending the issuance of a license or the denial of the application. Refer to Section B of Standard ES-303 for an explanation concerning the method of determining pass and fail criteria and awarding "S", "M", or "U" ratings.

#### E. Detailed Instructions

1. The "Control Room" section (page 3) is divided into two major subsections, "(1.1) Shift Turnover" and "(1.2) Control Room Reference Data." The examiner shall evaluate the candidate's knowledge for each of the subjects listed on this page.

For Section 1.1, the examiner should use at least one piece of existing or out-of-service equipment (or hypothesize one) and follow through with the required procedural and administrative requirements pertaining to it, including its restoration to service.

For Section 1.2.3, the examiner should discuss at least one type of planned radioactive waste release (gaseous, liquid, containment purge) with the candidate.



## 2. Responsibility and Authority

The portion pertaining to the senior operator's responsibility and authority (page 4) is divided into five major subsections: "(2.1) Emergency Plans", "(2.2) Plant Operations", "(2.3) Fuel Handling", "(2.4) Surveillance Testing", and "(2.5) Security." Each of the subjects listed under the major subsection must be evaluated to the extent necessary to determine the senior candidate's knowledge of these areas.

The shift supervisor is generally designated as the emergency coordinator during implementation of an emergency plan action level and remains in that capacity until appropriately relieved. Each candidate will be evaluated in this regard during discussions concerning the emergency plan. All parts of Section 2.1 should be completed by the examiner.

For Section 2.2, the candidate should be evaluated on at least one aspect of plant operations, for example, startup or shutdown. This discussion should emphasize the supervisory responsibilities.

Discussions concerning fuel handling should be conducted at the appropriate location (e.g., fuel-handling bridge and spent fuel pool), if at all feasible.

## 3. Discussion

The "Discussion" section (pages 5 and 6) consists of three major subsections: "(3.1) Transients," "(3.2) Reactivity Effects," and "(3.3) Thermodynamics and Hydraulics."

For Section 3.1, the examiner should explore the candidate's knowledge and understanding of at least two plant transients. Each of the subject areas on this page should be evaluated. The simulator examination should be substituted in lieu of this discussion phase if appropriate. The examiner should complete the evaluation of at least six of the eight topics listed under Sections 3.2 and 3.3.

## F. References

Letter from H. Denton (NRC) to All Power Reactor Applicants, Subject: Qualification of Reactor Operators and Licensees, Mar. 28, 1980.



INSTRUCTIONS ON USE OF FORMS FOR OPERATING EXAMINATIONS  
ADMINISTERED TO INSTANT SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard provides guidance to the examiner on the use of the Examination Form 157C during the course of operating examinations for instant senior reactor operator candidates.

B. General

Operators are required to hold a reactor operator (RO) license for 1 year before they are eligible to apply for a senior reactor operator (SRO) license. Exceptions are allowed, however, for those candidates who possess the necessary education, experience, and training to assume a supervisory role immediately.

Standard ES-109 covers eligibility requirements to obtain RO and SRO licenses.

C. Rules of Practice

The rules of practice set forth in Standard ES-302, Section C, also apply during this type of examination and should be discussed with the candidate as indicated in Standard ES-302. The candidate should be informed that his examination will cover the knowledges, skills, and abilities from the licensed operator level to the highest on shift level of a licensed senior operator at his facility (shift supervisor, for example). The license or denial evaluation based on this examination shall be made on an overall basis at the senior license level and no separate evaluation at the operator level shall be made.

D. Conduct of Examination

The conduct of an instant senior reactor operator examination is also specified in Standard ES-302. This examination is the most difficult and time consuming to administer because the candidate must be evaluated for two different levels of responsibility. The examiner must assure himself that the candidate has the necessary skills and abilities as a reactor operator and has the required knowledge and supervisory capabilities to function as a senior reactor operator. Therefore, the instant senior reactor operator examination must be a balanced combination of the reactor operator (ES-303) and the upgrade senior reactor operator (ES-304) operating examinations. Examination Report 157C has been developed for this purpose.

## E. Detailed Instructions

## 1. Operating Demonstration (Form 157C, page 3)

This phase of the examination is to be conducted in a manner similar to that specified in Standard ES-302, Section E. If a reactor startup demonstration is performed, all of Sections 1.1, 1.2, and 1.3 must be completed. If a simulator examination is a part of the operating examination NRC form 309 (ES 303 attachment 1) should be completed instead of sections 1.1 and 1.3 form 157C and a note on page 3 should direct attention to the NRC form 309 attached. If the candidates have completed a startup certification, these sections should be audited on at least one candidate (Items 1.2.4 through 1.2.7 are not applicable).

Section 1.3 should be completed for all candidates. In the case of a startup certification, this section may be combined with other control room discussions, and in the case where a simulator examination is involved these knowledges and abilities may be tested during the simulator examination.

## 2. Control Room (Form 157C, pages 4, 6, and 7)

The portion of the examination pertaining to the control room should be conducted similarly to that of the reactor operator examination (see Standard ES-303) in accordance with the following minimum requirements.

<u>Page</u>	<u>Systems</u>	<u>Subject areas</u>
4	Two major	6
4	Two auxiliary	6
4	Two engineered safeguards	6
6	Two nuclear instruments	6
6	One radiation monitoring	6
7	One normal electrical	5
7	One emergency electrical	5

The scope of coverage in this phase of the examination for the instant senior reactor operator candidates shall be more thorough than that for the reactor operator candidates. For the senior reactor operator, more emphasis should be placed on the procedural and administrative requirements sections than for the reactor operator. The line of questioning for a reactor operator should be from a systems standpoint (e.g., hardware, instruments, and numerical values) for all systems covered; for an instant senior reactor operator, the examiner should also explore these areas from a functional viewpoint.

Two examples of completed page 4s, one for a reactor operator, the other for an instant senior reactor operator, are attached to this

standard. Several facts should be noted concerning these two examples. Although the minimum number of required subject areas is six, the examples show seven and more. This is indicative of a more comprehensive examination. Also, for the instant senior reactor operator, the subjects in Items 5.0 through 7.0 are emphasized more than those in Items 2.0 through 4.0.

3. Reactor and Auxiliary Buildings (Form 157C, page 8)

This phase of the examination is similar in conduct to that of the reactor operator (see appropriate section in Standard ES-302 for required coverage). The examiner must, however, broaden the scope of questioning to include the responsible areas of senior reactor operator knowledge and competence. Fuel-handling operations should be included if practical.

4. Discussion (Form 157C, pages 9, 10 and 11)

The "Discussion" portion concerning responsibility and authority should be completely filled out for all candidates. Section 8.A. should be approached from both the reactor operator and senior reactor operator levels; the remaining subjects are primarily at the senior reactor operator level (see Standard ES-304 for further explanation).

During the nonsimulator operating examination, the examiner is required to explore in detail the candidate's knowledge of the integrated plant response, including applicable procedures for at least two plant transients. For examination continuity and efficiency, it may be useful to combine this phase with the discussion on control room systems.

If a simulator demonstration is involved, Form 309 (Attachment 1 in Standard ES-303) should be completed instead of page 9 of NRC Form 157C. During plant transient for which the applicant is the senior reactor operator (SRO) it is important for the examiner to evaluate the candidate's ability to maintain a perspective directed toward total plant coordination. The candidate should step back and maintain a "big picture" outlook regarding the transient. This is much easier to accomplish during a simulator demonstration, but it shall be evaluated during a plant oral examination if no simulator examination is involved.

SAMPLE REACTOR OPERATOR EXAMINATION REPORT

Reactor Operator

NRC FORM 157C, Page 4  
(12-82)

B. CONTROL ROOM (Major, Auxiliary and Engineered Safeguards Systems)		SYSTEMS							
		Pressurizer	Reactor coolant system		Chemical volume and control system	Component cooling		High pressure safety injection	Containment spray
		A	B	C	D	E	F	G	H
2.0	EQUIPMENT								
2.1	Purpose	S			S			S	S
2.2	Flow Path		S		S			S	
2.3	Normal Parameters	S	S			S			
2.4	Components		S		S				S
2.5	System Behavior and Response	S				S		S	S
3.0	INSTRUMENTATION								
3.1	Detector	S	S			S			
3.2	Malfunction	S				S			
3.3	Control Room Indication		S		S			S	S
4.0	PLANT PROTECTION								
4.1	Alarms/Setpoints	S			S			S	S
4.2	Safety System Input	S						S	
4.3	Interlocks		S		S	S		S	
5.0	PROCEDURES								
5.1	Normal Procedures	S	S			S			S
5.2	Abnormal Procedures		S		S				
5.3	Emergency Procedures				S			S	
6.0	A. Reactivity Effects				S				
	B. Thermodynamic Analysis				S				
7.0	ADMINISTRATIVE REQUIREMENTS								
7.1	Technical Specifications				S				
7.2	Facility Requirements	S							
COMMENTS (Required for "U")									

CONTINUED ON REVERSE

SAMPLE INSTANT SENIOR REACTOR OPERATOR EXAMINATION REPORT

Instant Senior Reactor Operator

NRC FORM 157C, Page 4  
(12-82)

B. CONTROL ROOM (Major, Auxiliary and Engineered Safeguards Systems)		SYSTEMS							
		Pressurizer	Reactor coolant system	Chemical volume and control system	Component cooling	High pressure safety injection	Containment Spray		
		A	B	C	D	E	F	G	H
2.0	EQUIPMENT								
2.1	Purpose			S					S
2.2	Flow Path			S				S	
2.3	Normal Parameters	S			S			S	
2.4	Components								S
2.5	System Behavior and Response	S	S		S				
3.0	INSTRUMENTATION								
3.1	Detector	S							
3.2	Malfunction	S							
3.3	Control Room Indication		S		S				S
4.0	PLANT PROTECTION								
4.1	Alarms/Setpoints							S	S
4.2	Safety System Input		S		S			S	
4.3	Interlocks		S			S			
5.0	PROCEDURES								
5.1	Normal Procedures	S			S			S	
5.2	Abnormal Procedures	S	S			S			S
5.3	Emergency Procedures		S			S			S
6.0	A. Reactivity Effects	S			S			S	
	B. Thermodynamic Analysis	S			S			S	
7.0	ADMINISTRATIVE REQUIREMENTS								
7.1	Technical Specifications	S			S	S		S	
7.2	Facility Requirements		S			S			
COMMENTS (Required for "U")									

CONTINUED ON REVERSE



SCOPE AND INSTRUCTIONS FOR OPERATING EXAMINATIONS  
ADMINISTERED AT NON-POWER REACTORS

A. Purpose

This standard specifies the difference in the scope of the operating examinations administered at non-power reactors from those administered at power reactors. Instructions specifically for operating examinations at non-power reactors are included. The specifications in Standards ES-301 through ES-305 apply when no differences exist for non-power reactors. Sections of ES-301 through ES-305 which are different for non-power reactors are indicated in parenthesis after each paragraph heading. Where no differences exist, the specifications are not repeated in this standard, therefore, a knowledge of ES-301 through ES-305 is necessary when using this standard.

B. Examination Requirements (ES-301, paragraph B)

Non-power reactor facilities do not have plant-referenced simulators. References throughout standards ES-301 through ES-305 to the situation where a plant-reference simulator exists are not applicable to non-power reactor facilities. However, non-power reactor operator and instant senior operator candidates will normally be required to perform actual reactor startup and shutdown demonstrations.

C. Scheduling (ES-301, paragraph D)

The nominal length of operating and oral examinations are shorter for non-power reactors than for power reactors due to the limited size and complexity of non-power reactors. There is no minimum or maximum length of operating examinations; however, for scheduling purposes, the normal length of exams is as follows:

1. RO - 2 $\frac{1}{4}$  to 3 $\frac{1}{4}$  hours
2. upgrade SRO - 1 $\frac{1}{2}$  to 2 hours
3. instant SRO- 3 to 4 hours

D. Reports of Examinations (ES-301, paragraph I)

The Examination Reports described in Standard 301 (ES 301, Attachments 1 through 3) are designed to be used for non-power reactor examinations also. Those portions of the report which are only applicable to power reactor candidates are shaded or included as a separate column on the Examination Report form. The general guidance contained in Standards 301 through 305 is also applicable to non-power reactor examinations. Detailed instructions for completing Examination Reports for non-power reactors are contained in paragraph I of this standard.



#### E. Rules of Practice (ES-302, paragraph C)

The rules of practice specified in paragraph C of ES-302 are applicable to non-power reactor examinations also. Note that most non-power reactor operating demonstrations will involve actual reactor startups.

#### F. Conduct of Examinations (ES-302, paragraph D)

The guidelines provided in this paragraph of ES-302 for reactor operators and instant senior operators are also applicable to reactor operator and instant senior operators at non-power reactors (except that Phase C, Reactor and Auxiliary Building should read Facility Walk-through). The upgrade senior operator will generally include the following phases:

##### Phase A, Facility Administration

Administrative requirements to include facility controls, facility reference materials and emergency plan implementation.

##### Phase B, Facility Walk Through

Walk through of systems and procedures from outside control room, to include plant operations, core alterations and radiation protection.

##### Phase C, Discussion

Discussions of a specific nature concerning overall plant behavior including response to transients.

#### G. Scope of Examination (ES-302, paragraph E)

The scope of the non-power reactor operating examination must include those areas specified in Standard 302.

#### H. Systems and Subjects

Generic list of systems and subjects has been developed (Attachement 4 to this standard). The examiner may select from this list, or a list specific to the vendor type and model of the reactor to be examined on, those areas which he desires to cover during the operating-oral examination. The examiner should diversify his coverage and discuss as many of the systems and subjects as feasible during a specific assignment.

#### I. Instructions for Completing Notes (ES-303, paragraphs B, C, and D)

##### 1. General

General guidance for completing the Examination Report is contained in Standard 303, paragraph B, and is fully applicable to the completion of notes for a non-power reactor operating examination. An operating test

administered to a reactor operator or instant senior operator candidate at non-power reactor facilities will nearly always require actual reactor startups by the candidates. Upgrade senior operator candidates will not normally be required to startup the reactor. If a malfunction should prevent actual operation of the reactor after the examiners have arrived at the facility, the reactor startup may be "walked-through". If the malfunction occurs prior to the examiners departure for the facility, the examinations should be delayed until the malfunction is corrected.

The most common method of examination for reactor operators and instant senior operators is to have a "sit-down" period during which discussion items are covered, and a typical reactor startup checklist is discussed, followed by a facility tour. The examination is then completed with a reactor startup demonstration. Typical time requirements for this examination are:

1. discussion - 1/2 to 3/4 hour
2. walk through - 3/4 to 1 hour
3. control room - 1 to 1½ hours

If possible, examinations should be scheduled so that reactor startup demonstrations coincide with predicted or scheduled facility down times.

The upgrade senior operator examination typically will have a "sit-down" period during which administrative and supervisory items are covered and a facility tour which will stress administrative aspects of radiation safety and details of fuel handling. Typical time requirements for this examination are:

1. discussion - 1/2 to 3/4 hour
  2. walkthrough - 3/4 to 1¼ hour
2. Detailed Instructions (ES-302, paragraph E)
    - a. Operating Demonstration (Form 157 A or C, page 3)

This phase of the examination for the reactor operator and instant senior operator will normally be completed by having the candidate perform an actual reactor startup or other reactivity manipulation on the reactor. Instant senior operator candidates are required to perform the actual manipulations of a startup and should be placed in the position of a reactor operator for the demonstration. The examiner shall evaluate the candidate's knowledge and/or performance for every subject on this page. In general, the operating demonstration should require the candidate to manipulate the controls to achieve criticality, attain a specified period during a power increase, steady the reactor at a predetermined power level and place the reactor controls in automatic. The candidate should also demonstrate the ability to conduct a normal reactor shutdown or manual reactor scram.

The type of pre-startup check performed should be specified, including the procedure number if applicable. Similarly, a description of the console operations should be specified, including the initial conditions of the reactor.

If a reactor malfunction prevents actual reactivity manipulations after the examination process has begun, the operating demonstration may be performed as a "walk-through". This will be indicated on page 2 of the report by checking the "Discussion" block. An appropriate explanation of the circumstances resulting in a walk-through demonstration should be included on the cover sheet of the report.

b. Control Room (Form 157A or C, pages 4, 6 and 7)

The portion of the Examination Report pertaining to the control room consists of three pages, and the format in Forms 157A and C is a matrix type that allows the examiner to select with ease the systems and subjects he wishes to discuss. A generic list of systems and subjects which can be used as general guidance in selecting systems at a specific facility is included as Attachment 4.

The systems may be selected from this generic list. The system selected will be listed at the top of the columns. The subjects that can be discussed are arranged on the left-hand side of the page. Attachment 4 is not meant to be an all inclusive list. Consideration must be given to the unique features of each facility.

To make best use of the time required for the administration of the examination and provide a uniform and reasonable basis for the issuance of a license or denial of an application, based upon the facility design, the examiner should use to the extent possible the following procedure for each applicant:

NOTE: Variations to the procedure are permitted where the design of the non-power reactor facility limits the areas and the extent of questions that can be addressed during the oral examination.

1. For reactor operator candidates, the "Control Room" section dealing with major, auxiliary and engineered safeguards systems will contain a minimum of two major systems, one auxiliary and one engineered safeguards system. All four systems should be evaluated in a least six subject areas.
2. For instant senior operator candidates, the "Control Room" section dealing with major, auxiliary, and engineered safeguards systems will contain a minimum of two systems from each category. All six systems should be evaluated in at least six subject areas.
3. For the "Nuclear and Radiation Instrument" section, the examiner should select one nuclear and one installed radiation system, as a minimum, and at least six subjects in each system should be explored.

4. For the "Electrical" section, the examiner should select at least one electrical system for evaluation. The system selected should also be evaluated in at least six subject areas.

During the course of the discussions on the control room, the examiner should require the candidate to demonstrate his understanding and familiarity by locating and explaining:

- a. control board instrumentation
- b. control board controls
- c. piping and instrument diagrams
- d. procedures
- e. other related reference data (such as logs, tag outs, and Technical Specifications)

A reactor operator candidate's response to at least two abnormal and/or emergency procedures should be evaluated during the control room phase of the examination. A instant senior operator candidate's response to at least four abnormal and/or emergency procedures should be evaluated during this phase. For those non power reactor facilities that do not have sufficient abnormal and/or emergency procedures in use, the examiner should evaluate abnormal and/or emergency procedures to the extent possible at that facility.

- c. Facility Administration (Form 157B, page 3)

This phase of the examination for the upgrade senior operator will normally be completed in the control room and consists of "talk-throughs" of various administrative controls necessary for the safe operation of the reactor. Portions of this phase may also be completed concurrently with the facility walk-through and discussion phases. At least one facility control procedure and one facility reference in addition to the specified topics listed on page 3 shall be evaluated. The plant operations discussion should emphasize supervisory responsibilities.

- d. Facility Walk Through
  1. Reactor Operator and instant senior operator (Form 157A page 8 or Form 157C, pages 8 and 10.)

The control room licensed personnel are responsible for directing the activities of all facility personnel in areas which could affect the safety of the plant and as such should be familiar with plant layout, design, local procedures, and radiological and safety conditions. The examiner may evaluate the candidate's knowledge in this phase by a variety of methods:

- a. He may select at least four systems from the list of items and discuss a minimum of five subjects for each system.

- b. From control room discussions, the examiners may generate a list of items which require local monitoring, verification or manipulation.
- c. The examiner may select at least two procedures whose actions must be performed in the plant.

These or alternate methods should be used for the plant "walk-through" phase of the examination with the following guidelines:

- a. The response to at least one local emergency procedure should be evaluated.
- b. One entry into a radiation controlled area should be made. As an alternate a discussion of handling radioactive materials may be conducted.
- c. The examiner should diversify his coverage of the plant for a group of candidates.
- d. For these non-power reactors having associated experimental facilities the examiner should include discussions related to insertion, removal and hauling of experiments including administrative controls, to the extent the operator or senior operator is responsible.

The examiner should evaluate the candidate's knowledge of the facility's Emergency Plan as it pertains to the job responsibilities of a reactor operator. Although the senior operator in charge is usually responsible for classifying and implementing the appropriate Action Levels, the RO should know those levels and his response and duties for each one. In addition, the operator must be able to respond to other emergencies such as fire and security intrusion.

The Radiation Protection and Safety portion will be completed by the examiner exploring those areas within the candidate's responsibility for personnel protection and for the control and discharge of radioactive wastes.

During the course of the control room and plant walk-through the examiner will evaluate the candidate's responsibility associated with the safe operation of the facility. This evaluation need not be performed by direct questioning of the candidate but may be accomplished by observing his response to unexpected or incorrect existing plant conditions.

Senior Operator candidates should also be evaluated on their knowledge of fuel-handling operations and equipment.



## 2. Upgrade Senior Operator (Form 157B, Page 4)

Since an upgrade senior operator has previously passed an operating test, the facility walk-through for these candidates is limited primarily to aspects of reactor facility operations for which a senior operator is solely responsible or for which a senior operator's responsibilities are significantly different than that of an operator. The following guidelines apply to the facility walk-through for upgrade senior operators:

- a. Each item on page 4 of Form 157B should be evaluated.
- b. Candidates knowledge of fuel handling should be evaluated at an appropriate location outside the control room from which core alterations are performed.
- c. One entry into a radiation controlled area should be made if feasible. As an alternate, a discussion of handling radioactive materials may be conducted.

In the area of facility operations, the candidates knowledge and use of local procedures or experiment facilities shall be evaluated. Additionally, a brief check of the candidates systems and operational knowledge should be made. If a candidate appears to be weak in these areas, more extensive coverage in these areas should be performed and documented in the comments section.

- e. Discussion (Form 157A, pages 9 & 10, Form 157B, pages 5 & 6, Form 157C, pages 9 & 10)

The initial section of the examination is the Discussion portion and is divided into two parts, both of which must be used by the examiner:

- a. Integrated Plant Response
- b.
  1. Principles of Nuclear Non Power Reactor Facility Operation (Form 157A)
  2. Theory of Nuclear Non Power Reactor Facility Operation (Forms 157B and C)

During the oral phase the examiner shall examine in detail the candidate's knowledge of the reactor transient response including applicable procedures for at least one transient. The back of the examination notes may be used for sketches or additional sheets may be attached. This portion of the examination need not be a separate discussion. In fact, it may be more useful and efficient to combine this phase during other portions of the examination. For example, by postulating a plant upset condition such as a reactor scram, the examiner may include in the discussion one or more of the plant systems required to be covered in the Control Room discussion.



The Principles of the Nuclear Non Power Reactor Facility Operation (Theory of Nuclear Facility Operations for senior operators) portion of the notes must be completely filled in with evaluations for each candidate in every subject. Again this discussion may be combined with other areas for exam continuity and efficiency. It is important for the candidate to use and explain existing plant information for this phase of the examination. Examples include reactivity data used in ECP's and reactivity changes due to approved experiments.

## ATTACHMENT 1

## TOPICS FOR OPERATING EXAMINATIONS - NON-POWER

MAJOR SYSTEMS:

reactor  
reactor power level control  
control rods  
control rod drives  
primary system  
secondary system  
mechanical design (fuel assembly)  
reactor vessel - pool - tank  
core construction

AUXILIARY SYSTEMS:

reactor building cooling water  
control, instrument, service air (compressed air system)  
sampling system  
fire protection system  
service water system  
equipment and floor drainage  
containment air recirculation  
radioactive waste (solid and liquid)  
demineralized water  
heating ventilation and air conditioning  
reactor water clean-up/make-up  
beam tubes  
thermal columns  
pneumatic tube systems  
incore experiment tubes  
chemical additions

Engineered Safety Features:

decay heat removal  
core spray  
core flooding  
control rod velocity limiter  
containment/reactor building isolation  
reactor building isolation  
reactor protective system

Nuclear and Radiation Systems:

startup channels  
log N channels  
safety channels

Nuclear and Radiation Systems: (continued)

incore instrumentation/incore probe  
liquid effluent monitors  
process radiation monitors  
area radiation monitors  
gaseous effluent  
stack gas

Electrical

normal AC supply  
emergency AC supply  
normal DC supply  
emergency DC supply  
reactor protection electrical power system  
batteries

Reactor Facilities

fuel handling and storage  
exposure rooms  
beam tubes  
thermal columns  
pneumatic tube facilities  
liquid waste handling and disposal  
gaseous waste handling  
solid waste handling and disposal

Reactor Transient Response

Power increase/decrease - auto control  
Power increase/decrease - manual control  
emergency shutdown from full power  
scram - hot restart  
sub critical to critical  
normal shutdown from full power  
rod malfunction  
primary system leak  
control instrument malfunction  
fuel clad failure

ADMINISTRATION OF WRITTEN EXAMINATIONS TO  
SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard specifies the difference in preparation of senior reactor operator written examinations and reactor operator examinations.

B. Preparation of Examination

The examiner shall prepare the examination questions and answers using Standards ES-402 and ES-403 for guidance. One copy of the examination and one copy of the answers should be forwarded to the appropriate regional section chief for review. The "Written Examination Quality Assurance checkoff sheet", attachment 1, ES 107, should be filed with the master copy of the examination. The examiner should conduct a detailed review of his examination using attachment 1, ES-107.

C. Administration and Grading

Administration and grading of the senior reactor operator written examination is the same as for the reactor operator written examination as specified in ES 201. ES 104 describes the post examination activities and reports. ES 107 and ES 108 describe the quality assurance programs for review of the examination and the grading.

STRUCTURE OF WRITTEN EXAMINATIONS ADMINISTERED TO  
SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard specifies the format, category weights, and depth of knowledge for senior reactor operator written examinations.

B. General Structure

Each written examination shall be divided into four categories in accordance with Standard ES-402.

C. Cover Sheet

A cover sheet, with the format shown in attachment 1 ES-403-1, shall be used on all written examinations. This sheet will provide for ready identification of the structure of the examination and, subsequently, of the relative strengths and weaknesses of the candidate after the examination has been graded.

All items in the upper corner of the cover sheet, except the name of the candidate (and sometimes the date administered), should be filled out when the examination is prepared and reproduced. The reactor type aids headquarters in readily correlating the examinations of similar facilities and should be as descriptive as possible (e.g., BWR and PWR-W). The "Examiner" line shall contain the name of the examination author. The first two columns on the cover sheet should be filled out at the time of the initial preparation.

D. Weighting of Categories

The relative weight of each category in the examination, as a percentile of total worth, shall be  $25\% \pm 3\%$  for each section. Category 5 shall be weighted so that  $15\% \pm 1\%$  ( $60\% \pm 4\%$  of the category) consists of theory of nuclear plant operations and  $10\% \pm 1\%$  ( $40\% \pm 4\%$  of the category) consists of theory of fluids and thermodynamics.

E. Value of Questions

The examiner shall assign a point value to each question and indicate this value in parentheses after the question. The point value of a question is a judgment factor based on the combination of the following factors: significance of the knowledge to the senior reactor operator, difficulty of the question, amount of time required to answer the question, depth of knowledge required to answer the question, and the content of the question.

The general structure of the examination should be such that a safe and competent operator will score above 80% on the entire test and above 70% in each

category. The percentage attained in each category will be used, in conjunction with operating test results, to identify strengths and deficiencies of the candidate.

When the candidate is sent the results of his examination, a copy of the graded examination shall be forwarded to the candidate. If a candidate failed the written examination, a copy of the final approved answer key shall also be forwarded to the candidate.

A copy of the "Examination Results Summary Sheet" (Attachment 5 ES 201) will also be sent by the appropriate section leader to plant management for their use in developing retraining and requalification programs.



Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION  
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

Facility: \_\_\_\_\_  
 Reactor Type: \_\_\_\_\_  
 Date Administered: \_\_\_\_\_  
 Examiner: \_\_\_\_\_  
 Candidate: \_\_\_\_\_

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

<u>Category Value</u>	<u>% of Total</u>	<u>Candidate's Score</u>	<u>% of Category Value</u>	<u>Category</u>
_____	_____	_____	_____	5. Theory of Nuclear Power Plant Operation, Fluids, and Thermodynamics
_____	_____	_____	_____	6. Plant Systems Design, Control, and Instrumentation
_____	_____	_____	_____	7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
_____	_____	_____	_____	8. Administrative Procedures, Conditions, and Limitations
_____	_____	_____	_____	Totals
_____	_____	_____	_____	Final Grade

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

\_\_\_\_\_  
Candidate's Signature

SCOPE AND STRUCTURE OF WRITTEN EXAMINATIONS FOR  
SENIOR OPERATOR CANDIDATES - NON-POWER REACTORS

A. Purpose

This standard specifies the difference in preparation of senior reactor operator written examinations and reactor operator examinations.

In general, the provisions contained in Standard ES-204 apply equally to the Senior Reactor Operator examination.

B. Preparation of Examination (ES-410, paragraph B)

The examiner shall prepare the examination questions and answers using guidance contained in paragraphs C, D and E below. The examiner should conduct a detailed review of his examination using Attachment ES-107-1. A copy of the examination and answer key should be forwarded to the appropriate regional section chief for review. Attachment ES-107-1, ES-108-1, and ES-201-6 should be filed with the master copy of the examination.

C. Scope

The required scope of the examination is set forth in 10 CFR 55. To implement this scope and to provide for identification and documentation of strengths and weaknesses within certain areas of knowledge, the written examination is divided into five categories. These five categories are listed below with a description of the content of each. They are designated by the letters H through L to differentiate them from categories A through G in the operator exam as set forth in ES-204.

1. Category H - Reactor Theory

This category contains questions on principles of reactor theory including details of the fission process, neutron multiplication, source and control rod effects and criticality indications. It has more advanced content than the operator category A but is not advanced to the level of a nuclear physicist or engineer. The candidate should be able to demonstrate quantitative as well as qualitative knowledge of reactor behavior. He should be able to understand and utilize mathematical expressions regarding reactor behavior; however, these expressions (or formulae) and nuclear constants (fission factors, half lives, etc.) usually need not be committed to memory and will be supplied in the examination when questions requiring them are included. Further, this category may contain questions applicable to the facility, concerning some aspects of basic reactor engineering, e.g., heat transfer and fluid flow which affect the safety of the reactor.

The primary emphasis throughout will be on understanding and practical application of the theory rather than mere memorization of technical facts.

## 2. Category I - Radioactive Material Handling, Disposal and Hazards

This category contains questions on radiation hazards which may arise during operation or the performance of experiments, shielding alterations or maintenance activities. Close familiarity with the provisions of 10 CFR Part 20 and supplementary facility regulations is required as well as a good common sense approach to radiological safety situations. Questions may include calculations involving inverse square law, activation, decay rates, half-value or tenth value thicknesses and conversions of measured radiation intensities to rem, as well as other calculations of a similar nature. Hence, operational "Rules of thumb" methods of calculation are acceptable wherever applicable.

Also included are questions relating to procedures and equipment (processing and monitoring) available for handling and disposal of radioactive materials and effluents. Although an operator's knowledge of this aspect is generally limited to discharge from the reactor proper, the senior operator should have familiarity with the radioactive processing and disposal systems of the facility and the hazards associated therewith.

In special situations, such as facilities which produce and ship isotopes or irradiated experiments, the senior operator may need some knowledge of packaging and shipping regulations for radioactive materials, if the scope of his activities at that facility encompasses such responsibilities.

## 3. Category J - Specific Operating Characteristics

This category contains questions on specific operating characteristics of the reactor and auxiliary systems, including nuclear, hydraulic, thermal, pneumatic, electrical and coolant chemistry. Questions regarding quantitative as well as qualitative explanations of causes, limitations, effects and consequence of changes are included. Questions addressing behavior during normal, abnormal and transient operations are also included in this section.

The category includes questions on the understanding and use of curves depicting reactor behavior which may be beyond the scope of knowledge needed by operators for routine operation. These may include, as applicable, differential and integral control rod worth curves (single or group), period vs. reactivity curves, temperature and power coefficient curves, and poison (e.g., Xenon, Samarium and Boron) worth curves. Whenever possible, actual sample curves of the facility will be utilized; otherwise, applicable sample illustrative curves will be prepared.

## 4. Category K - Fuel Handling and Core Parameters

This category contains questions regarding fuel, fuel handling and core loading and alteration, fuel transfer and storage, and detection and prevention of criticality. Questions relating to fuel element characteristics and limitations include consideration of reactivity worths, burnup, hot spots, leakage/rupture detection, and effects of core geometry changes.

Curves and mathematical expressions may be utilized to the extent described in category H. Knowledge of special equipment, procedures and personnel requirements regarding fuel handling and core loading is expected.

#### 5. Category L - Administrative Procedures, Conditions and Limitations

This category contains questions on administrative, procedural and regulatory items which affect operation of the facility. Included are questions on design and operating considerations and limitations as specified in the facility license, including technical specifications, the procedures required to obtain authority for design changes, the procedures regarding formation and approval of operating procedures, and the authority to approve deviations from operating procedures on either a permanent or temporary basis. Questions may also cover the requirements for certain personnel to be present at certain times, the types of records that must be maintained and pertinent provisions of 10 CFR Parts 50 or 115 and 10 CFR Part 55.

#### D. Facility Management Controls and Accident Questions

These areas are applicable to the SRO exam as described under the RO section in ES-204. In all cases, the examination should, to the extent possible, reflect the level of knowledge necessary for the safe operation of the facility and responsibility delegated by the facility to the senior operator by virtue of the senior operator holding an NRC license.

#### E. Structure of Written Exam

1. Each written examination should be divided into five categories in accordance with section B of this standard. A cover sheet, with the format shown in Attachment 1, shall be used on all written examinations. This sheet will provide for ready identification of the structure of the examination and, subsequently, of the relative strengths and weaknesses of the candidate.
2. The relative weight of each category in the examination, as the percentile of total worth should be  $20\% \pm 3\%$  for each category whenever possible. However the relative importance of safety and emergency systems vary significantly over the range of size and the type of Research Reactors. Therefore in order to comply with the 10 CFR criteria "... to the extent applicable to the facility..." the weighting of the examination categories should be based on the professional judgement of examiners experienced in the operation and examination of non-power reactor facilities and approved by supervision. The general structure of the examination shall be such that a safe operator will score above 70% in each category. In addition, the length of the examination shall be such that a candidate would complete the examination within five hours, thus leaving one hour for review.

U.S. NUCLEAR REGULATORY COMMISSION  
 SENIOR REACTOR OPERATOR LICENSE EXAMINATION

Facility: \_\_\_\_\_  
 Reactor Type: \_\_\_\_\_  
 Date Administered: \_\_\_\_\_  
 Examiner: \_\_\_\_\_  
 Candidate: \_\_\_\_\_

INSTRUCTIONS TO CANDIDATE

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category. Examination papers will be picked up six (6) hours after the examination starts.

<u>Category Value</u>	<u>% of Total</u>	<u>Applicant's Score</u>	<u>% of Cat. Value</u>	<u>Category</u>
_____	_____	_____	_____	H. Reactor Theory
_____	_____	_____	_____	I. Radioactive Materials Handling Disposal and Hazards
_____	_____	_____	_____	J. Specific Operating Characteristics
_____	_____	_____	_____	K. Fuel Handling and Core Parameters
_____	_____	_____	_____	L. Administrative Procedures, Conditions and Limitations
_____	_____	_____	_____	Totals
				Final Grade _____%

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

\_\_\_\_\_  
 Candidate's Signature



ADMINISTRATION OF SIMULATOR EXAMINATIONS TO REACTOR OPERATORS  
AND SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard pertains to the administration of simulator examinations as a part of the operating examination to candidates for either reactor operator or senior reactor operator licenses. This standard is applicable to examinations at simulators that are designed to be specific for the plant for which the candidate is applying for a license. Examination scheduling and details may vary depending on such factors as (1) the geographical distance between the simulator and the plant, (2) whether the same or a different examiner will conduct both the simulator examination and the oral examination, and (3) the status of plant construction.

B. Assignment

Assignment of the task of administering the simulator examination is made on the Request To Administer the Examination, as set forth in Standard ES-103. The examinations should preferably be arranged on a time schedule mutually satisfactory to the candidates, facility licensee, and the examiners and should cover the scope as set forth in Standard ES-502. In general, the examiner who administers the simulator examination to a specific candidate will administer the oral part of the examination to the same candidate. Exceptions to this general rule may be necessary and should be approved by the appropriate section chief or branch chief.

Normally, each examiner shall complete up to four complete operating examinations (including simulator exams) per visit and only in exceptional cases five complete operating examinations per visit.

C. Scheduling

The simulator examinations should be scheduled reasonably close to the administration of both the oral part of the operating examinations and the written examinations in order to use the examiner resources efficiently and to minimize the length of time between the start and finish of the entire examination process. The following guidelines should be followed unless special conditions exist:

1. Cold Examinations

- a. The written examinations should be administered 1 to 2 months before the operating examinations so that the written examinations can be graded before the operating examinations. Normally, operating examinations will not be given to a candidate who has failed the written examination until he has reapplied for a second examination.



- b. The simulator examinations should be scheduled so that the same examiner can complete both the simulator and oral parts of the operating examination for a specific candidate during the same week. The examiner should reduce the oral part of the operating examination by the material satisfactorily covered on the simulator part of the examination such that the total operating examination is equivalent to an operating examination at a facility that does not have a plant reference simulator. Exceptions to this preferred arrangement will occasionally be necessary. An example of an exception would be when the simulator is not located on the plant site.

## 2. Hot Examinations

Normally the operating and written examinations shall be scheduled to be completed during one visit by a group of examiners at facilities when the simulator is located on the plant site. Special scheduling arrangements shall be negotiated with the facility when the simulator is remote from the plant site. In this case, the written examination may be conducted at the plant site or the simulator site.

## 3. General

Several alternate methods can be used to complete the combination simulator and oral parts of the operating examination when the simulator and plant are located on the same site. When this situation exists, every effort should be made to complete the simulator and oral parts of the examinations on the same day. The ideal situation is three examiners examining one senior and two operator candidates or other combinations of three candidates. The alternates shown below are examples of schemes that can be used if less than the ideal situation exists. It is recognized that other schemes can be used and the details should be discussed with the chief examiner.

### a. Alternate 1

Day 1 - Two examiners work as a team on the simulator. Examiner A administers the examination to Candidates 1, 2, and 3, while Examiner B administers the examination to Candidates 4, 5, and 6. The candidates are paired off so that two examiners and two candidates are in the simulator control room simultaneously. Each examination lasts about 2.5 hours.

Day 2 - Examiner A administers the oral part of the operating examination to his three candidates as does Examiner B. Each oral part of the examination shall last about 1.5 hours.

### b. Alternate 2

Day 1 - Examiner A administers the simulator examination to candidate 1; simultaneously, examiner B administers the examination to candidate 2. Both examiners and candidates proceed to the plant to conduct the oral part of the operating examination thus completing the examinations

for candidates 1 and 2. Afternoon examinations are similar except that the oral part of the examinations are conducted first so that examiners do not have to reenter the plant security area. Each examiner completes two full combination simulator and oral examinations.

c. Alternate 3

Two examiners conduct examinations at simulators with candidates 1, 2, and 3. Examiner A observes and discusses manipulations of controls with candidates 1 and 2 who are designated as operators. Examiner B examines candidate 3 at the senior level, and candidate 3 is assigned the role of shift supervisor. The candidates rotate positions so that all candidates fill all positions. Questions are tailored to the appropriate level, senior operator or operator. Six or more candidates are examined on the simulator per 8-hour day. Adjustments can be made when an odd number of candidates are to be examined. Oral examinations are completed on subsequent days following the simulator examinations.

4. Senior operators and operators should be scheduled for an optimum mixture. A senior operator with one or two operators is preferred. If this is not possible, senior operators can be designated as operators on a rotating basis.

D. Orientation

Examiners shall request literature about the facility from the licensee training department personnel in the same manner and quantity as described in standards ES-301 and ES-201 to prepare for the written and oral examinations at the facility. In addition, the examiners should request specific literature on the simulator, such as initialization modes and malfunction capabilities, which is available for use on examinations. The procedures and technical specifications used for operation of the simulator should be those that are also used at the plant(s). For simulators with novel features or unusual concepts, it is likely that an orientation trip should be made in advance. In general, when the examiner is familiar with the facilities of the same type as the one where the examinations are to be conducted, sufficient orientation can be obtained by arriving at the simulator a day (or half day) in advance of the planned examinations. At least one member of the examining team preferably should have had previous experience in administering examinations at the specific simulator. Preplanned simulator examination programs may be tried out during the orientation period. To make certain that the candidates do not learn of the actual examination programs, the examiner should alter the programs used in the orientation periods and should not use the actual program when members of the facility staff are present.

E. Personnel Present

The number of persons present during an examination should be minimized both to ensure the integrity of the examination and to minimize distractions to the candidate. The persons present normally will be limited to the NRC examiners,

other examiners witnessing the examination for training or to audit the performance of the examiners administering the simulator examination, and facility staff required so that the examination can be given. Other observers such as resident inspectors, regional personnel, researchers, or NRC supervisors may be allowed to observe simulator examinations if (1) the chief examiner has approved the request in advance of the examination; (2) the candidates do not object to the observers' presence, and (3) the facility representative has approved the request to observe. Examinations are not to be used by the licensee as training vehicles for future candidates.

#### F. Use of Documents and Materials

During the administration of the simulator examination, the candidates should be allowed to make use of any of the information that would normally be available to a licensed operator at that facility, including calibration curves, piping and instrumentation diagrams, and calculation sheets. The candidates should be able to locate these items readily and be certain of which ones they need for each task.

#### G. Report of Examination

The appropriate sections of the Examination Report (Standard ES-301, Attachments 1 through 3) shall be prepared for each candidate.

The Operating Examination Summary Report (see Standard ES-301, page 4) shall be prepared for each candidate. This form shall be completed in accordance with Standards ES-303, ES-304, or ES-305. All grades (S, M, or U) will be awarded on the basis of the candidate's verbal or manipulation responses during the operating examinations either at the simulator or during the oral examination. Written comments can be used to provide background for the determination of grades and to ascertain whether the candidate's response was made during the simulator or oral portion of the examination. Written comments or notes are required to support an unsatisfactory grade. The Simulator Exam Report (ES-303, Attachment 1) will be completed by the examiner for each candidate who is administered a simulator examination and will be submitted with the Examination Report (Standard ES-301, Attachments 1 through 3).

Both attachment 1 to ES 303 and the appropriate attachment 1, 2 or 3 ES 301 shall be completed using the "S," "M," and "U" system to evaluate the candidate at the reactor operator or senior reactor operator level depending on the license level requested in his application.

Senior operator applicants, including instructor certifications, shall be examined at both the operator and senior operator level during the simulator portions of the operating examination. Applicants for a senior operator license limited to fuel handling may be granted a waiver of the simulator portion of the operating examination.

SCOPE OF SIMULATOR EXAMINATIONS ADMINISTERED TO REACTOR  
OPERATORS AND SENIOR REACTOR OPERATORS - POWER REACTORS

A. Purpose

This standard gives the general scope and objectives of the examination that is administered to candidates at simulators that are specific to the facility where the candidate has applied for a license. The precise requirements for the simulator examination can be varied because the simulator examination is considered to be a portion of the overall operating examination covered in Standards ES-301 through ES-305. These standards cover the administration and scope of the plant operating examinations. Certain topics, transients, and systems can be covered and discussed either during the simulator examination or during the oral examination.

B. Rules of Practice

Certain ground rules that the examiners shall observe are as follows:

1. The examiners should plan the examination program before the actual examinations. Preliminary planning can be done at the home office before the examiners travel to the simulator. The examiners should review and/or practice representative programs at the simulator with the simulator instructor during the orientation period before the administration of the first set of examinations. The examiners should plan the program taking into consideration (a) the number of examiners in the team, (b) the number of candidates to be examined, and (c) the number of reactor operators and/or senior reactor operators to be examined. Refer to Standard ES-501 for further information on methods of scheduling simulator examinations.
2. Each group of candidates should be asked, as a minimum, to (a) conduct two normal evolutions such as boration changes, power maneuvering with rods or core flow, or reactor startup, (b) respond to instrument failures such as nuclear or process instrumentation failure, (c) respond to two component failures where it is reasonable to expect that a scram may not result with prompt operator action, and (d) respond to a major plant transient such as a loss-of-coolant accident or loss of electrical power. Enclosure 4 to H. Denton's March 28, 1980 letter to power reactor applicants lists 27 control manipulations that can be used to plan examination programs. Enclosure 4 is Attachment 1 to this standard. Another reference is the list of malfunctions and initialization modes available in simulator specifications and literature.
3. The candidates should be allowed time to check the control boards and review the plant (simulator) status before the start of the examination. Equipment or controls may be placed in abnormal



positions to test the operator's ability to detect malpositioned controls or equipment out of service. The examiners should inform the candidates of this possibility when appropriate.

4. The examiners should explain that the candidates are to operate the simulator as they would the real plant. Discussions with examiners should be secondary to simulator operations and operator responses.
5. Procedures should be followed and referred to as required in the real plant.
6. The candidates should communicate with each other in such a way that the examiners can hear them. The candidates should "think out loud" so that examiners can monitor the thought process.
7. The candidates should communicate with the simulator instructor. This instructor normally assumes the roles of maintenance mechanics, auxiliary operators, load dispatcher, and other personnel. Candidates should be informed that all permission forms and reports should be received or written as at the actual plant. The simulator instructor should fill the role of any personnel not present.
8. The candidates should be informed that they should use all available information (e.g., procedures, Technical Specifications, and graphs), as they would in the real control room.
9. The examiners should give the candidates an opportunity to ask questions before the start of the examination.
10. The examiners should limit discussions with the candidates during the simulator examination so that candidates are not distracted from operating the simulator as the "real" plant. The questions ask by examiners during the simulator exercise should only be to determine the candidates analysis and response to the plant conditions and transients relevant to the simulator exercise in progress. Simulator freezes will disturb the "real" plant perception and flow of the exercise but may be used judiciously for question and answer periods that can not be completed during or after the exercise. If it is desirable to conduct part of the oral portion of the operating examination in the simulator facility, then this should be done before or after the simulator exercise or when the candidate is not responsible for operation of the simulator.
11. Before the examination a suitable communication system should be set up between the examiners and the simulator instructor to insert malfunctions without cuing the candidates. Many methods can be used depending on the simulator design. The malfunctions to be used should be selected by the examiners. These malfunctions and any limitations or expected response characteristics should be discussed with the instructor. Reasonable precautions should be taken so that the program is not revealed to the candidates before

the examination. One method is to assign predetermined times for the sequence of malfunctions so that both examiners and instructors are aware of what event is about to occur or is occurring.

12. Senior reactor operator candidates should be evaluated on their ability to direct operators and to diagnose and identify the cause of plant transients. Operator candidates should be evaluated on their ability to inform the senior operator of parameter changes, operator actions taken, and verification of automatic actions that take place during both normal evolutions and transient conditions. These ground rules should be explained to the candidates before the examination. Senior reactor operator and reactor operator candidates should be scheduled in examination groups for an optimum mix as discussed in Standard ES-501, Section C.3. If all candidates are operators in a particular group, they will be evaluated on their team work and communication ability rather than their ability to direct others. Senior reactor operator candidates also shall be required to manipulate any or all of the simulator controls and have a higher degree of ability to diagnose events than that expected of an operator candidate. The difference between satisfactory operator knowledge and senior operator knowledge, to a large extent, is the same on a simulator examination as that expected on the oral part of the operating examination.
13. The examiners are encouraged to request copies of logs, recorder charts, computer typewriter printouts, and other material to attach as supplements to their notes, if appropriate.
14. The examiners may make assignments to the operators so that they share the responsibility for actions. For example, one candidate can be assigned the balance of plant while the other operator is responsible for the reactor controls. Also, one operator can be assigned a specific task at the appropriate time, such as restarting a pump and establishing flow or placing the turbine generator on the line. Frequently, it is necessary to make definite assignments to a candidate who is less forceful than the candidate with whom he is teamed. However, normal shift responsibilities as used at the facility should be observed, if possible, to evaluate the candidates under realistic conditions.
15. The examiner may make cautious use of such features as backtrack, freeze, and other simulator capabilities if they contribute to the fair evaluation of the candidates. The examiner should be aware that the use of these feature may inhibit the ability of the candidates to view the simulator as the "real" plant for the examination exercises.
16. If the simulator should become inoperable, causing excessive delay of the examination, the chief examiner should discuss the situation with the responsible regional section chief so that a decision on whether or not to cancel simulator examinations.



C. References

Letter from H. Denton (NRC) to All Power Reactor Applicants and Licensees, Subject: Qualifications of Reactor Operators, Mar. 28, 1980.

## ATTACHMENT 1

CONTROL MANIPULATIONS<sup>1</sup>

The following control manipulations and plant evolutions where applicable to the plant design are acceptable for meeting the reactivity control manipulations required by Appendix A, Paragraph 3.a. of 10 CFR Part 55. The starred items shall be performed on an annual basis; all other items shall be performed on a two-year cycle. However, the requalification programs shall contain a commitment that each individual shall perform or participate in a combination of reactivity control manipulations based on the availability of plant equipment and systems. Those control manipulations which are not performed at the plant may be performed on a simulator. The use of the Technical Specifications should be maximized during the simulator control manipulations. Personnel with senior licenses are credited with these activities if they direct or evaluate control manipulations as they are performed.

## PWR/BWR/HTGR

- \* (1) Plant or reactor startups to include a range that reactivity feedback from nuclear heat addition is noticeable and heatup rate is established.
- (2) Plant shutdown.
- \* (3) Manual control of steam generators and/or feedwater during startup and shutdown.
- (4) Boration and or dilution during power operation.
- \* (5) Any significant (> 10%) power changes in manual rod control or recirculation flow.
- (6) Any reactor power change of 10% or greater where load change is performed with load limit control or where flux, temperature, or speed control is on manual (for HTGR).
- \* (7) Loss of coolant including:
  - 1. significant PWR steam generator leaks
  - 2. inside and outside primary containment
  - 3. large and small, including leak-rate determination
  - 4. saturated reactor coolant response (PWR).
- (8) Loss of instrument air (if simulated plant specific).

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<sup>1</sup>Source: Enclosure 4 of H. Denton's March 28, 1980 letter.

- (9) Loss of electrical power (and/or degraded power sources).
- \* (10) Loss of core coolant flow/natural circulation.
- (11) Loss of condenser vacuum.
- (12) Loss of service water if required for safety.
- (13) Loss of shutdown cooling.
- (14) Loss of component cooling system or cooling to an individual component.
- (15) Loss of normal feedwater or normal feedwater system failure.
- \* (16) Loss of all feedwater (normal and emergency).
- (17) Loss of protective system channel.
- (18) Mispositioned control rod or rods (or rod drops).
- (19) Inability to drive control rods.
- (20) Conditions requiring use of emergency boration or standby liquid control system.
- (21) Fuel cladding failure or high activity in reactor coolant or offgas.
- (22) Turbine or generator trip.
- (23) Malfunction of automatic control system(s) which affect reactivity.
- (24) Malfunction of reactor coolant pressure/volume control system.
- (25) Reactor trip.
- (26) Main steam line break (inside or outside containment).
- (27) Nuclear instrumentation failure(s).

## ADMINISTRATION OF NRC REQUALIFICATION PROGRAM EVALUATION

### A. Purpose

This standard establishes the procedures for administering the NRC evaluation of utility requalification programs. Included are methods of selecting utilities to be evaluated, methods of auditing, evaluation criteria, action guidelines, and required administrative forms and records.

### B. Program Description

The NRC regional staff will determine the schedule for facility audits based on the criteria described in Paragraph C below. During these audits, the staff shall evaluate the strengths and weaknesses of the facility requalification program. The methods to be used to conduct this evaluation are (1) to administer an NRC-developed written examination, and (2) to conduct NRC simulator-oral operating examinations.

The evaluation program will include as a minimum (1) simulator-oral operating examinations administered by NRC-certified examiners and (2) a complete NRC prepared written examination for each facility selected for audit. The examinations should emphasize operational knowledge rather than strictly theoretical information, and the length of the examination should be about 60% of that for a standard licensing examination. Review of facility grading of previously administered written requalification examinations also may be performed. This effort, together with an evaluation of actual operating experience, will provide an indication of the effectiveness of the licensee's overall operator requalification training program. The intent of this program is to conduct the full evaluation of 20% of the operators and senior operators at 50% of the facilities each year. Whenever resources are inadequate to conduct this level of effort, the number of facilities evaluated will be reduced.

### C. Selection Criteria

The regional administrator or his designee will establish the priority of facilities to be evaluated based on the following inputs:\*

1. licensee event report history and recent facility performance, which relates to licensed operator performance
2. previous ratings on Systematic Assessment of Licensee Performance (SALP), Criterion 7, Training Effectiveness and Qualification

\*These are not intended to be all inclusive. Other selection criteria may be appropriate as determined by the region.

3. recent operator licensing and NRC requalification examination results
4. training program accreditation (such as the Institute of Nuclear Power Operations' (INPO) Facility Training Accreditation Program)
5. recommendations by senior resident inspectors or NRC examiners
6. results of routine inspection of the facility licensed operator training program
7. number of shifts and number of licensed operators
8. size of plant training staff in relation to the number of licensed operators

For the above criteria, the following policies apply:

1. Any plant evaluated as SALP Category 3 in the area of licensed operator training effectiveness and qualifications or any plant with a large number of errors by licensed operators or that has had a particularly serious error committed by licensed operators should be assigned the highest priority.
2. Except as specified in (3) below, any plant that has not been evaluated in the previous 2 years shall be selected.
3. Any plant evaluated as SALP Category 1 in the area of licensed operator training or having an INPO-accredited Operator Requalification Program may be considered for a 50% extension of the nominal biennial evaluation (e.g., NRC participation every 3 years).

D. Examination Format

The following guidelines should be observed:

1. During every site visit to conduct requalification program evaluations, the NRC examiners shall administer an NRC prepared written examination and simulator-oral operating examinations to 20% of the operators and senior operators. NRC-administered oral examinations are permitted regardless of whether they are normally administered as part of the facility's NRC-approved requalification program.
2. In addition to the written examinations prepared by NRC examiners, copies of a previous facility-administered written examination may be graded by an NRC examiner. The examiner should compare NRC grading and facility grading as part of the requalification program evaluation.
3. For facilities with plant-referenced simulators, the requalification audit examination should include an evaluation of 20% of the operators and senior operators on the simulator.

## E. Program Administration

Program administration is the responsibility of the NRC regional offices. Each regional office should maintain a current facility requalification schedule for each facility in its region. NRC will request facility schedules annually when the generic letter requesting replacement and instructor certification examinations is issued and will provide these schedules to the regional offices. Facilities may adjust their program examination dates to even out NRC examiner workload, if agreed to by the facility and the regional staff. Once a schedule is mutually agreed upon by the NRC regional office and the facility, it should not be changed except for special circumstances (such as outages). Facilities should normally be contacted at least 3 months before the scheduled requalification examination dates. Tentative examiner assignment(s) should be made at this time (see Attachment 1). Following the guidelines of Paragraphs C and D above, the extent of the requalification program evaluation will be determined by the region. Reference material required from the facility to prepare for the requalification audit should be requested from the facility approximately 60 days before the scheduled visit, using the format of Attachment 2 as a guide. The assigned examiner(s) should prepare for the written and operating examinations to be conducted in accordance with the appropriate operator licensing standards for licensing examinations. Once at the site, the examiner(s) shall meet with facility management, review with them the schedule for NRC participation in their program, and arrange the details necessary to conduct the evaluation. The requalification examination conducted by the NRC examiner(s) should be operationally oriented and conducted in accordance with this and existing operator licensing standards for written and operating examinations. However, the length of the examinations should be about 60% of the standard licensing examinations. The NRC written examination should be reviewed with facility personnel in accordance with the review policy established in ES 201.H.

Required forms and reports are included as Attachments 3 and 4. The appropriate portions of NRC Form 157, "Operator Examination Report," shall be used for NRC-administered oral examinations and the appropriate portions of NRC Form 309, "Simulator Exam Report," shall be used for NRC administered simulator examinations. When the program evaluation is completed, an exit briefing should be conducted and any significant program deficiencies noted should be discussed. The examiner(s) shall not indicate whether the program is evaluated as satisfactory or unsatisfactory at the exit briefing.

After returning to the regional office, the examiner(s) shall grade the written examinations and review the results of his (their) evaluation. The examiner(s) shall then recommend an overall satisfactory or unsatisfactory evaluation of the licensee requalification program (Attachment 4) and forward the results for approval as established by regional directives. Included, as an attachment to the form, will be the names of those individuals with unsatisfactory results on some portion of the examination and for whom the facility should take corrective action as required by its approved requalification program.



## F. Program Evaluation

The overall evaluation of the program adequacy should fall into one of the following three categories: (1) programs evaluated as satisfactory, (2) programs evaluated as unsatisfactory, or (3) programs falling between a satisfactory and an unsatisfactory evaluation. The criteria for each of the categories follow.

1. To be evaluated as satisfactory a program should meet the following criteria:
  - a. NRC-Administered Examinations

More than 80% of the evaluated operators passed all portions of the examinations.
  - b. Facility-Administered Written Examinations
    - (1) Facility written examination grading results are not more than 10% higher than the results obtained by NRC examiners for the same examination or section of an examination.
    - (2) More than 80% of the final pass/fail evaluations made by both the facility and the NRC are in agreement.
    - (3) The facility-prepared written examinations adequately cover the technical subjects required by the requalification program and Appendix A to 10 CFR 55.
2. To be evaluated as unsatisfactory are those programs where:
  - a. NRC-Administered Examinations

Less than 60% of the evaluated operators passed all portions of the examinations.
  - b. Facility-Administered Written Examinations
    - (1) Significant deficiencies in the level of knowledge or competence is observed in the facility training staff, as evidenced by lack of sufficient coverage of material in written examinations and a lack of followup to identify weak areas.
    - (2) The facility-graded written examination results are higher than those of the examinations graded by NRC examiners by more than 20% per section (i.e., NRC grade + 20%).

- (3) There is less than 60% agreement between the final pass/fail evaluations made by the facility and the NRC.

When a program is evaluated as unsatisfactory, the regional administrator or his designee shall require the licensee to propose corrective actions and implementation schedules. Corrective actions, implementation schedules, and followup audits and reports shall be established by the regional administrator or his designee.

3. Programs falling between a satisfactory and an unsatisfactory evaluation include those where only 60 to 80% of the examinees passed all portions of examinations administered by NRC examiners.

For those programs falling between a satisfactory and an unsatisfactory evaluation, the regional administrator or his designee should request the licensee to identify proposed corrective actions and schedules for their implementation. Schedules for followup audits should be established by the regional administrator or his designee to ensure that effective corrective actions are implemented.

4. Because a small sample (20%) of licensed operators is tested, there is a risk of decision errors regarding the acceptability of the utility training program. Therefore, the regional staff should include consideration of other indications of the licensee's commitment to provide high quality training to the licensed operators. This may include:
- a. trends indicated by the evaluation of selection criteria in Paragraph C
  - b. facility management response in the exit briefing
  - c. facility proposals for corrective actions
  - d. ongoing efforts by the facility to upgrade the training
5. Performance on a second, subsequent requalification program audit in the marginal range shall result in an unsatisfactory rating.

#### G. Renewals

If a satisfactory evaluation is reached, requests for renewals will be made based on proper certification by facility officials until the next program evaluation. The facility certification shall include certification of accelerated retraining completion for individuals who have failed either an NRC or facility administered requalification examination.

If an evaluation clearly falls between a satisfactory and an unsatisfactory rating, renewals should be made if the corrective actions identified are being implemented to the extent and in accordance with the schedule established above.

If an evaluation is unsatisfactory, renewals will be issued only for those operators who pass an examination administered by the NRC until identified corrective actions have been implemented. The regional administrator or his designee may agree to accept facility certification and issue renewals based on this certification when they have determined that program quality has been upgraded to satisfactory as indicated by additional audits, inspections, or other reviews of the licensee's performance.

#### H. Records

1. A facility requalification file shall be maintained for each facility. All evaluation forms, records, assignment sheets, and correspondence relating to the requalification program audit for the latest two evaluations shall be retained. This file should also contain a copy of the NRC-approved requalification training program and any requested or approved amendments (such as the responses to Task Action Plan Items I.A.2.1 and II.B.4) and the associated approval letters or safety evaluation reports.
2. When the requalification evaluation has been completed by the Regional Office, a copy of all NRC administered written, oral and simulator examination results shall be supplied to the facility. The facilities are required to maintain these records for 2 years by Appendix A of Part 55 10 CFR.

## ATTACHMENT 1

## ASSIGNMENT TO EVALUATE LICENSED OPERATOR REQUALIFICATION PROGRAM

NRC Examiner(s):

Assignment To Evaluate Licensed Operator Requalification Program at  
\_\_\_\_\_.

You are assigned to evaluate the requalification program at the above named facility. Please make arrangements to perform the following aspects of the evaluation program:

- \_\_\_ Generate a complete written examination to replace the facility reactor operator (RO) examination.
- \_\_\_ Generate a complete written examination to replace the facility senior reactor operator (SRO) examination.
- \_\_\_ Administer plant oral examinations to \_\_\_\_\_ operators and \_\_\_\_\_ senior operators.
- \_\_\_ Administer simulator examinations to \_\_\_\_\_ operators and \_\_\_\_\_ senior operators.
- \_\_\_ Review grading of previous examinations.

Date(s) of Evaluation: \_\_\_\_\_

Facility Contact: \_\_\_\_\_

Simulator Location: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_

## ATTACHMENT 2

## FORM LETTER TO FACILITY VICE PRESIDENT - REFERENCE MATERIAL REQUIRED

Date:

To:

Subject: Requalification Program Evaluation

In a telephone conversation between Mr. \_\_\_\_\_ (title, i.e., training coordinator) and Mr. \_\_\_\_\_ (section chief), arrangements were made for an evaluation of the requalification program at the (facility name). The evaluation visit is scheduled for the week of (date).

For this visit, the NRC examiner will administer NRC prepared written, oral, and simulator examinations. When the NRC examiner arrives at the site, he will meet with the appropriate facility personnel to review the schedule for these examinations. For the examiner to adequately prepare for this visit, it will be necessary for the facility to furnish the approved reference material listed in Enclosure 1 "Reference Material Requirements for Requalification Program Evaluations," by (date). Mr. \_\_\_\_\_ has been advised of our reference material requirements and where they are to be sent.

This request for information was approved by the Office of Management and Budget under Clearance Number 3150-0101, which expires June 30, 1986. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports Management Room 3208, New Executive Office Building, Washington, D.C. 20503.

Thank you for your consideration in this matter. If you have any questions on the evaluation process, please contact \_\_\_\_\_ (regional section chief and telephone number).

Sincerely,

(Appropriate Regional Representative)

DISTRIBUTION:

Project Manager  
Resident Inspector  
Regional Section Leader  
Examiner(s)  
Facility Training Coordinator

## ENCLOSURE 1

## REFERENCE MATERIAL REQUIREMENTS FOR REQUALIFICATION PROGRAM EVALUATION

1. An index of administrative, operating, abnormal and emergency procedures.
2. All administrative procedures (as applicable to reactor operation or safety)
3. All integrated plant procedures (normal or general operating procedures)
4. Emergency procedures (emergency instructions, abnormal, or special procedures)
5. Standing orders (important orders which are safety related to and may supersede the regular procedures)
6. Fuel-handling and core-loading procedures (initial core-loading procedure, when appropriate)
7. Annunciator procedures (alarm procedures, including set points)
8. Radiation protection manual (radiation control manual or procedures)
9. Emergency plan
10. Technical Specifications
11. Plant technical data (curve) book
12. Lesson plans (training manuals, plant orientation manual, systems descriptions)
13. Systems operating procedures
14. Piping and instrumentation diagrams, electrical single-line diagrams, or flow diagrams
15. Copies of facility RO and SRO requalification examinations administered during the past 2 years
16. Simulator malfunction list with descriptive summary of malfunction effects.

All of the above referenced material should be approved, final issues and should be so marked. Uncontrolled, preliminary, or other such issues will not be acceptable. All procedures and reference material should be bound or in the form used by the control room operators, with appropriate indexes or tables of contents to ensure efficient use.





ATTACHMENT 4

REQUALIFICATION PROGRAM EVALUATION REPORT

Facility: \_\_\_\_\_  
Examiner: \_\_\_\_\_  
Date(s) of Evaluation: \_\_\_\_\_  
Areas Evaluated: \_\_\_\_\_ Written \_\_\_\_\_ Oral \_\_\_\_\_ Simulator

Written Examination

- 1. Overall evaluation of examination: \_\_\_\_\_
- 2. Evaluation of facility examination grading: \_\_\_\_\_

Oral Examination

- 1. Overall evaluation \_\_\_\_\_
- 2. Number conducted \_\_\_\_\_

Simulator Examination

- 1. Overall evaluation \_\_\_\_\_
- 2. Number conducted \_\_\_\_\_

Overall Program Evaluation

Satisfactory \_\_\_\_\_ Marginal \_\_\_\_\_ Unsatisfactory \_\_\_\_\_ (List major deficiency areas with brief descriptive comments)

Submitted: \_\_\_\_\_ Forwarded: \_\_\_\_\_ Approved: \_\_\_\_\_  
Examiner Section Chief Branch Chief

NRC FORM 335 (2-84) NRCM 1102 J-01, 3202 <b>BIBLIOGRAPHIC DATA SHEET</b> SEE INSTRUCTIONS ON THE REVERSE	U.S. NUCLEAR REGULATORY COMMISSION REPORT NUMBER (Assigned by TIDC add Vol. No., if any) NUREG-1021 Rev. 1
2 TITLE AND SUBTITLE  Operator Licensing Examiner Standards	3 LEAVE BLANK  4 DATE REPORT COMPLETED MONTH: October      YEAR: 1984
5 AUTHOR(S)	6 DATE REPORT ISSUED MONTH: February      YEAR: 1985
7 PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Z-p Code) Division of Human Factors Safety Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555	8 PROJECT/TASK WORK UNIT NUMBER  9 FIN OR GRANT NUMBER
10 SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Z-p Code)  Same as 7.	11a TYPE OF REPORT  b PERIOD COVERED (Inclusive dates)
12 SUPPLEMENTARY NOTES	
13 ABSTRACT (200 words or less)  <p>The Operator Licensing Examiner Standards provide policy and guidance to NRC examiners and establish the procedures and practices for examining and licensing of Title 10 of the Code of Federal Regulations (10 CFR 55). They are intended to assist NRC examiners and facility licensees to understand the examination process better and to provide for equitable and consistent administration of examinations to all applicants by NRC examiners. These standards are not a substitute for the operator licensing regulations and are subject to revision or other internal operator examination licensing policy changes.</p> <p>As appropriate, these standards will be revised periodically to accommodate comments and reflect new information or experience.</p>	
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