

PACIFIC GAS AND ELECTRIC COMPANY  
DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
HUMBOLDT BAY POWER PLANT ADMINISTRATIVE PROCEDURE NO. B-155

TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

SCOPE

This administrative procedure describes the basic training program for qualification of selected plant personnel to take the NRC Reactor Operator's or Senior Operator's license examination. The programs outlined in this procedure are for individuals with no prior training or experience. Training courses and durations may vary based on the person's experience and prior training. This procedure describes the general material to be covered, references to be used, testing requirements, supervisory responsibilities, recordkeeping requirements, and training program reviews.

RESPONSIBILITIES

1. Training Manager/Coordinator

Responsible for the organization and coordination of the training programs and for assuring that required records are maintained and up-to-date. Also responsible for ensuring the training programs are kept up-to-date to reflect plant modifications, changes in procedures, industry-wide operating experience, and regulatory changes.

2. Plant Superintendent/Manager

Responsible for assuring that an annual review of the training programs is conducted.

3. Plant Staff

Provide assistance as necessary in preparing for and conducting lectures, practice examinations, and on-the-job training.

PROCEDURE

1. Candidates for operator and senior operator licenses shall have had operating experience and be qualified as required by Nuclear Plant Administrative Procedure B-1. The training conducted shall be related to the plant for which the examinations are to be requested. The program shall include training in the following areas: (A typical schedule is contained in Table I.)
  - a. NUCLEAR POWER PLANT FUNDAMENTALS. A fundamentals course shall cover the theory of nuclear fission process and reactor operation.

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

The course shall contain instruction in:

- 1) Principles of reactor operation
  - a) Atomic structure and radioactivity
  - b) Nuclear reaction and the fission process
  - c) Neutron behavior and control of the fission process
  - d) Core thermal-hydraulic design
- 2) Design features of the nuclear power plant
- 3) General operating characteristics of the nuclear power plant
- 4) Reactor instrumentation and control systems
- 5) Radiation control and safety provisions
- 6) Fundamentals of heat transfer, thermodynamics, and fluid flow related to transient analysis.
- 7) Training in the use of installed plant systems to control or mitigate an accident in which the reactor core is severely damaged.

The course shall contain instruction in mathematics, electricity, mechanics, and other subjects of a theoretical or engineering nature in support of the above. Portions of the program may be applied to meet the education requirements of the position to be filled by the license candidate.

- b. PLANT SYSTEMS. Systems instruction for license candidates shall include both observation and classroom work. This instruction shall be plant specific.

- 1) CLASSROOM INSTRUCTION. Instruction covering nuclear power plant systems shall include the following:
  - a) Plant instrumentation and control systems
  - b) Safety, fire, and emergency systems
  - c) Primary and secondary mechanical systems
  - d) Electrical systems
  - e) Plant auxiliary and support systems
  - f) Plant protection systems
  - g) Fuel handling systems
  - h) Waste processing systems
  - i) Integrated plant operation and casualty response

This instruction shall also include system and component malfunctions.

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

- 2) PLANT OBSERVATION. Planned systematic observation training of license candidates shall be performed on accessible plant equipment. At least four weeks of the observation time shall be done with the plant at power (20% or greater). Emphasis shall be on understanding system operation, local plant control, system interactions and indication. Student/instructor ratio shall be no greater than 6 to 1. Documentation of this training shall be maintained by system study check-offs.
- c. OPERATING PRACTICE. Training in operating practices shall take place both in the control room for which the candidate will license and at a simulator (if available).
  - 1) Instruction during this period shall include:
    - a) Standard and emergency operating procedures
    - b) Plant transients
    - c) Accident identification and analysis
    - d) Controlling the plant from a central control room during normal, abnormal, and emergency situations
    - e) Operating philosophy, use of procedures, shift and relief turnover, and verification of system status.
  - 2) CONTROL ROOM OPERATING EXPERIENCE. Candidates shall observe the operating practices and the operation of a nuclear power plant from a central control room. Hot license candidates shall manipulate the controls under the direct supervision of a licensed operator at the individual's duty station for a variety of plant operations. Senior Operator candidates shall have three (3) months of shift training as an extra man on shift and control room operator candidates shall have three (3) months training as an extra person in the control room.<sup>1</sup> Cold license candidates shall participate in the plant preoperational testing program. A check-off list of minimum operations to perform, observe, or simulate shall be established.
  - 3) SIMULATOR TRAINING. Candidates shall practice manipulating the controls of a plant as represented by a simulator which has similar operating characteristics to the operator's own plant. As a minimum, the license candidate shall participate in training sessions that include applicable plant manipulations from the following list, where available;

Note 1: For all applications after 8/1/80

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

PWR/BWR

- a) Plant or reactor startups to include a range that reactivity feedback from nuclear heat addition is noticeable and heatup rate is established.
- b) Plant shutdown
- c) Manual control of steam generators and/or feedwater during startup and shutdown
- d) Boration and/or dilution during power generation
- e) Any significant ( $\geq 10\%$ ) power changes in manual rod control.
- f) Loss of coolant
  - (1) including 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)
- g) Loss of instrument air (if simulated plant specific)
- h) Loss of electrical power (and/or degraded power sources)
- i) Loss of core coolant flow/natural circulation
- j) Loss of condenser vacuum
- k) Loss of service water if required for safety
- l) Loss of shutdown cooling
- m) Loss of component cooling system or cooling to an individual component
- n) Loss of normal feedwater or normal feedwater system failure
- o) Loss of all feedwater (normal and emergency)
- p) Loss of protective system channel
- q) Mispositioned control rod or rods (or rod drops)
- r) Inability to drive control rods

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAM

- s) Conditions requiring use of emergency boration or standby liquid control system
- t) Fuel cladding failure or high activity in reactor coolant or off gas
- u) Turbine or generator trip
- v) Malfunction of automatic control system(s) which affect reactivity
- w) Malfunction of reactor coolant pressure/volume control system
- x) Reactor trip
- y) Main steam line break (inside or outside containment)
- z) Nuclear instrumentation failure(s)

Participation shall be in groups of no more than four people manipulating the controls or directing the activities of individuals during plant exercises. Cold license candidates shall perform at least ten startups on a simulator which has similar characteristics to the reactor for which the license is being obtained or as part of a laboratory course at a test, research or power reactor.

2. Senior Reactor Operator Instruction

Senior reactor operator license candidates shall have additional instruction in subjects relating to their duties. Instruction shall include:

- a. Reactor theory
- b. Handling and disposal of, and hazards associated with, radioactive materials
- c. Specific operating characteristics of the nuclear power plant
- d. Fuel handling and core parameters
- e. Administrative procedures, conditions, and limitations of facility license
- f. Chemistry
- g. Operating philosophy, use of procedures, shift and relief turnover, and verification of system status
- h. Fundamentals of heat transfer, thermodynamics, fluid flow and dynamics as related to transient analysis.



DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

1. Responsibilities during emergency conditions

Instruction in these subjects may be conducted throughout the training program.

Portions of this program may be applied to fulfilling the educational requirements of the position to be filled by the senior operator license candidate. The primary emphasis throughout the senior operator training should be on the practical application of the theory rather on the memorization of technical facts. The basis behind and reasons for the limits, etc., should be stressed.

3. Practical Work Assignments for Cold License Candidates

Training in the form of practical work assignments for the site shall be provided. Work assignments may include plant operating procedure preparation and verification, preoperational testing of plant systems, participation in hot functional testing program, providing instruction on plant systems to the remainder of the group. Emphasis shall be on the license candidate gaining thorough knowledge of his own plant. Some of this training shall be done in the central control room of the plant involved. A check-off list of minimum operations to perform or observe shall be established.

4. References

The following list of references shall be used to guide the candidates and/or the instructor through the program. Additional material or references may be used for clarification, but those listed below shall be used as much as possible as they are the references used by the Commission in making up the NRC license exams. The operator license candidates need only to be familiar with the administrative requirements that are associated with the following, but they are required knowledge for the senior licensed candidate.

- a. Plant Manual - All sections generally applicable to operations of the plant, but exclusive of those sections specifically assigned to other departments.
- b. Equipment Description and Operation Manual (if not included as part of the Plant Manual).
- c. Introduction to Nuclear Power - All portions applicable to general theory and to the type of reactor plant at the facility.
- d. Radiation Protection Training Manual.
- e. Final Safety Analysis Report (selected applicable portions).

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

- f. Selected special reports or correspondence between the Company and the NRC.
- g. Selected proposed changes and amendments to the License or Technical Specifications as necessary for background information.

5. Testing in Lieu of Training

Extensive operating experience at a reactor facility which is generally classified as comparable in complexity and operating characteristics to the plant at which examinations are to be requested may substitute for some of the training described above. Examinations verifying that the level of knowledge of the individual is comparable to the knowledge of an individual completing the training segment shall be required prior to excusing this individual from the training. In all cases, the Training Manager/Coordinator shall ensure that sufficient plant specific instruction is provided.

6. Testing Requirements

- a. Periodic tests, quizzes, or oral exams shall be given to determine the candidates' progress and the areas where the review or more intensive study are required. The plant manuals, training manuals, and reference materials contain much more information than is required for passing the NRC exam or for operating the plant safely and reliably. It is important that the instructor direct his test questions toward the required material and not toward the background material.
  - 1) Written examinations may be periodic quizzes or segment completion examinations or both. Tests, quizzes, or examinations should be given no less frequently than once per month. Attendance for all examinations shall be documented and shall include retention of examination grades and the examination grading key.
  - 2) Oral examinations shall be documented. Examination questions and the overall grade of satisfactory/unsatisfactory assigned to each examination shall be included in this documentation.
  - 3) A comprehensive examination similar to the NRC license examination shall be administered prior to certification of competency of this individual to the NRC. A brief simulator training program emphasizing overall plant operation shall be included for cold license candidates. Oral and written examinations are encouraged. An intensive period of instruction prior to the NRC license examination should be provided. Operating features of the facility design and experience at similar plants shall be included.

DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

- b. Examinations using the simulator shall be provided, and contain an examination while operating at power with plant malfunctions, and while starting up the reactor. The certification examination shall demonstrate the candidate's ability to:
- a) manipulate the controls in a safe and competent manner,
  - b) predict instrument response and use the instrumentation available,
  - c) follow the facility procedures, and
  - d) understand alarms and annunciators and take proper action.

If a simulator with similar operating characteristics to the operator's own plant is not available, the license candidate should perform as many manipulations from the above list as possible on the actual plant. The candidate shall perform at least two actual reactor startups. All manipulations not actually performed shall be simulated. Completion of these manipulations or simulations shall be documented by use of a check-off list.

7. Training of Licensed Supervisors

Personnel selected for supervisory positions requiring an NRC Senior Operators License shall receive training in the following supervisory skills:

- a. Leadership
- b. Interpersonnel communication
- c. Command responsibilities and limits
- d. Motivation of personnel
- e. Problem and decisional analysis
- f. Administrative requirements for the particular supervisory position.

8. Records and Reviews

- a. Adequate records shall be retained so that a periodic review and evaluation of the overall program can be conducted. A log or record should be maintained on each training group or individual so that the following information is retained.
- 1) Subject Material
  - 2) Instructor
  - 3) Trainees Present
  - 4) Lecture Time (approximate)
  - 5) Test Scores
  - 6) Results of NRC License Exam
  - 7) Other items of interest in the training program



DEPARTMENT OF NUCLEAR PLANT OPERATIONS  
NUCLEAR PLANT ADMINISTRATIVE PROCEDURE NO. B-155  
TITLE: LICENSED OPERATOR AND SENIOR OPERATOR TRAINING PROGRAMS

- b. Record reviews shall be conducted periodically, at least once during the program and at its conclusion by the Plant Superintendent or his delegate. A record of this review shall be maintained with the other records associated with the specific trainee group.
- c. The training records for each individual shall be retained throughout his assignment to the plant organization or for five years, whichever is longer.

REFEPENCES

- 1. ANS 3.1/ANSI N18.1- "Standard for Qualification and Training of Personnel for Nuclear Power Plants" - Draft Revision 12/6/79.
- 2. Title 10, Code of Federal Regulations, Part 55, "Operators' Licenses"
- 3. PG&E, "Quality Assurance Manual for Operating Nuclear Power Plants"
- 4. NUREG-0094-1976, "NRC Operator Licensing Guide"
- 5. March 28, 1980 letter from Harold Denton of the NRC, "Qualifications of Reactor Operators"

ATTACHMENTS

Table I, "Typical NRC Approved Licensed Candidate Training Program"