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☐ QA PROGRAM RELATED ☒ QA IMPLEMENTING ☐ NON QA

TITLE NUCLEAR PLANT OPERATOR TRAINING PROGRAM

(FORMERLY PROCEDURE NO. 2.2.5)

PROCEDURE NO. 0202.05 **PROGRAM** NUCLEAR TRAINING

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DIVISION OF NUCLEAR POWER

REVISION LOG

REVISION DATE	PAGES AFFECTED	DESCRIPTION OF CHANGE
OCT 0 7 1984	Page 28 Pages 29 thru 87	To elaborate on System Familiarization Program for fourth period students. For page integrity. JUSTIFICATION: This is in response to OQA CH-8400-07-02 which states that all operations training should be included in one procedure. As a result of OQA CH-8400-07-02 this procedure should be issued.
MAR 1 5 1985	ALL	General Revision JUSTIFICATION: In response to NRC's letter dated May 11, 1984, to all Operating Power Reactor Licenses "Replacement and Requalification Training Program (Generic Letter No. 84-14)." Also to satisfy NCO85-005-004.

Title: NUCLEAR PLANT OPERATOR TRAINING PROGRAMS
(Formerly Procedure No. 2.2.5)

PROCEDURE NO. 0202.05

KEYWORDS: Operator Training Programs
Training Programs

I. PURPOSE

The purpose of this procedure is to describe the Nuclear Plant Operator Training Programs. This document summarizes and consolidates training requirements for all nuclear operating personnel.

II. SCOPE

This document prescribes the training requirements and methods used by the Tennessee Valley Authority (TVA) to provide its operations personnel with the knowledge and skill required for the safe and efficient operation of its nuclear power plants. It describes TVA policy concerning training program approval, operator selection, methods of training, operator evaluation, instructor qualifications, and the requirements for advancement through the four operator classifications comprising the shift operations crew at TVA's nuclear plants.

A program description of all TVA nuclear plant operator training for nonlicensed and licensed operators is included in this document beginning with the newly hired student operator and concluding with shift engineer.

The objective of these operator training programs is to ensure that a fully qualified operations staff is maintained for the safe operation of TVA's nuclear plants. In achieving this objective, TVA complies with NRC regulations.

III. PROCEDURE FORMAT

The manual is organized in the following manner:

I. Abbreviations and Definitions
II. References
III. Summary of Operator Training

This is an overview of the entire operator training program beginning with nuclear student operator training and describing the training requirements for each operator position at the nuclear plants.

IV. Nonlicense Training Programs
V. License Training Programs
VI. Review of Nuclear Operator Training Programs and Related Materials
VII. Documentation of Training Records

General Revision

IV. DISTRIBUTION

In addition to the standard program manual distribution list, this procedure is distributed as follows:

Browns Ferry Nuclear Plant (BFN) (10)

Sequoyah Nuclear Plant (SQN) (8)

Watts Bar Nuclear Plant (WBN) (10)

Bellefonte Nuclear Plant (BLN) (3)

Power Operations Training Center (POTC) (6)

Additional copies may be obtained upon request from the Supervisor, Records/Manual Control Unit.

Attachments

General Revision

NUCLEAR PLANT OPERATOR TRAINING PROGRAMS

CONTENTS

NUCLEAR PLANT OPERATOR TRAINING PROGRAMS

CONTENTS
(Concluded)

I. ABBREVIATIONS AND DEFINITIONS

A. Abbreviations

ASE - Assistant Shift Engineer

AUO - Assistant Unit Operator

BWR - Boiling Water Reactor

NCO - Nuclear Central Office

NOTP - Nuclear Operator Training Program

NTB - Nuclear Training Branch

NPPFC - Nuclear Power Plant Fundamentals Course

OJT - On-the-job training

ONP - Office of Nuclear Power

POTC - Power Operations Training Center

PWR - Pressurized Water Reactor

QA - Quality Assurance

RL - Reactor License (same as RO)

RO - Reactor Operator

SE - Shift Engineer

SRO - Senior Reactor Operator

UO - Unit Operator

B. Definitions

1. Definition of terms

Academic Training--Successfully completed college-level work which may lead to a recognized degree in a discipline related to the position in question.

Academic Probation--A two-week probationary period into which a student operator is placed when an academic subject is failed or insufficient progress is made.

Academic Subject--In the NOTP, the academic subjects are as follows: algebra and trigonometry, water chemistry, physics, thermodynamics, calculus, report writing, English composition, industrial psychology, oral communications, and solid-state principles.

Accreditation Examination--An examination administered by an examining board which normally consists of two or three examiners. Used for the purpose of upgrade prior to promotion.

Accredited--Certified as being complete in all the TVA requirements necessary for an employee to hold a particular operating position.

Accrediting Subcommittee for Operator Training--This committee consists of the following membership:

a. One representative of the Office of Nuclear Power

b. One representative of the International Brotherhood of Electrical Workers

c. A representative of the Office of Nuclear Power, Personnel Services Staff will serve as chairman-secretary.

Boiling Water Reactor (BWR)--A reactor in which water, used as both coolant and moderator, is allowed to boil in the core. The resulting steam is used to drive a turbine.

Central Committee for Operator Training--This committee consists of the following membership:

a. One representative of the Division of Fossil and Hydro Power, one representative of the Office of Nuclear Power, and one representative of the Division of Power System Operations.

b. One representative of labor from the International Brotherhood of Electrical Workers.

c. A representative of the Office of Nuclear Power, Personnel Services Staff will serve as chairman-secretary.

Certification Examination--A performance examination conducted on a simulator by an examiner (simulator instructor or other qualified person) which shall demonstrate the candidate's ability to:[1]

(1) Manipulate the controls in a safe and competent manner,

(2) predict instrument response and use instrumentation available,

(3) follow applicable procedures,

(4) understand alarms and annunciators and take proper action, and

(5) communicate promptly and effectively

This examination is one method of determining whether or not an operator trainee is certified to take the NRC license examination.

Cold License--NRC reactor operator (RO) or senior reactor operator (SRO) licenses obtained prior to initial criticality of the subject reactor are termed "cold licenses."

Fossil Plant--An electric generating station using heat produced from fossil fuels as the primary energy source.

High School Diploma Equivalence--Successful completion of the General Education Development (GED) test is the only acceptable equivalence.

Hot License--NRC RO or SRO licenses obt ined subsequent to the initial criticality of the reactor are termed "hot licenses."

Joint Committee for Operator Training--This committee consists of the following membership:

a. Manager, Office of Nuclear Power or a designated representative

b. One representative of the International Brotherhood of Electrical Workers

c. A representative of the Office of Nuclear Power, Personnel Services Staff will serve as chairman-secretary.

[1]ANS 3.1, 1981, Section 5.2.1.3.2.

General Revision

Licensed Reactor Operator--Any individual who possesses an operator's license pursuant to Title 10, Code of Federal Regulations, Part 55, "Operators' Licenses."

Licensed Senior Reactor Operator--Any individual who possesses a senior reactor operator's license pursuant to Title 10, Code of Federal Regulations, Part 55, "Operators' Licenses."

Local Subcommittees for Operator Training--These subcommittees consist of the following membership:

a. One representative of the Office of Nuclear Power

b. One representative of labor--a member of the International Brotherhood of Electrical Workers--for each subcommittee at each nuclear plant and the POTC

c. A representative of the Office of Nuclear Power, Personnel Services Staff will serve as chairman-secretary.

Nuclear Plant--An electric generating station using heat produced in a nuclear reactor as the primary energy source.

Nuclear Power Plant Experience--Experience acquired in the preoperational and startup testing activities or operation of nuclear power plants. Experience in design, construction, and operational training may be considered applicable nuclear power plant experience and should be evaluated on a case-by-case basis. (Two years of such experience equals one year nuclear power plant experience.)

a. Experience acquired at military, nonstationary, propulsion, or production nuclear plants may qualify as equivalent on a two-for-one basis up to a maximum of three years.

b. Training may qualify as nuclear power plant experience if acquired in reactor simulator training programs to a maximum of three months' credit.

c. On-the-job training may qualify as equivalent to nuclear plant experience on a one-for-one basis up to a maximum of two year's credit.[2]

Nuclear Peactor--Any assembly of fissionable material which is designed to achieve a controlled, self-sustaining neutron chain reaction.

[2]ANS 3.1, 1981, Section 2.

General Revision

Nuclear Training Branch--A branch within the Division of Nuclear Services which is directly responsible for the development, administration, and evaluation of all plant-specific or generic training and requalification of operational, engineering, technical, and maintenance personnel in the Office of Nuclear Power.

On-the-Job Training (OJT)--Participation in nuclear power plant startup, operation, maintenance, or technical services as a trainee under the direction of experienced personnel.

Operator--An employee who is accredited for some power plant operating position other than student I, II, III, or IV and who is currently performing duties in that classification.

Period Exam--The final written or oral examination which is administered at the conclusion of each period of the NOTP.

Power Operations Training Center (POTC)--A centralized educational facility to provide plant-specific or generic training and requalification of operational, engineering, technical, and maintenance personnel in the Office of Nuclear Power.

Pressurized Water Reactor (PWR)--A power reactor in which heat is transferred from the core to a heat exchanger by water kept under high pressure to achieve high temperature without boiling. Steam is generated in the secondary system.

Productive Work--Work performed by a student or operator who is assigned to and actually performs the work of a regular operating position as a part of OJT for a position.

Related Technical Training--Formal training beyond the high school level in technical subjects associated with the position in question, such as acquired in training schools or programs conducted by the military, industry, utilities, universities, vocational schools, or others. Such training programs shall be of a scheduled and planned length and include text material, lectures, and frequent examinations. This includes training obtained through completion of lesson assignments on technical material and through study of any manufacturers' bulletins, diagrams, and related material used for instructional purposes.

Remedial Period--(A) For student operators--(1) the additional time served in training because of failure of a step written or oral examination, or (2) specific time of evaluation due to a student's failure to satisfactorily progress within a step or period of training. Additional training time is not required. (B) For operators--a period of ineligibility for formal training or reexamination.

Shall, Should, and May--The word "shall" is used to denote a requirement; the word "should" to denote a recommendation; and the word "may" to denote permission--neither a requirement nor a recommendation.

Special Training--The time in which operators are removed from regular duties and assigned to another plant or another location in a plant for training.

Step Exam--The written and oral examination which is conducted at the conclusion of each step of the NOTP.

Student Operator--An employee, classified as a student operator I, II, III, or IV, who is training for an operating position.

Training Phases--Phase I--The portion of the NOTP conducted at the POTC.
Phase II--The portion of the NOTP conducted at the assigned plant.

Training Review Board--A board (committee) which is composed of the plant manager, the operations and engineering superintendent, plant operations supervisor, and training shift engineer or plant training section supervisor.

Upgrade Training--The training which an accredited operator enters to become qualified for another operating position on the same or a higher level than his/her present classification.

2. Definition of positions

Shift Engineer (SE)--The SE on duty is in direct control of the plant, including the startup, operation, and shutdown of the reactors, turbogenerators, and their auxiliaries. The SE has direct supervision over the operating personnel on his shift and has control over the actions of other personnel while they are involved with plant systems or components.

Assistant Shift Engineer (ASE)--The ASE is under the immediate supervision of the SE. He supervises the work of operators and others assigned to him and performs manipulative operation of equipment as required.

Unit Operator (UO)--The UO is under the immediate supervision of the ASE and the general supervision of the SE. He supervises one or more assistant unit operators and others assigned to him. He is responsible for the safe and efficient operation of one unit and appurtenant equipment which he normally operates from the main control room. He may perform work outside the main control room as assigned.

Assistant Unit Operator (AUO)--The AUO is under the immediate supervision of the UO and the general supervision of the ASE. He may supervise the work of laborers or others assigned to him. He performs work requirements and assists in the operation of equipment within well-defined areas throughout the plant.

II. REFERENCES

A. Source Documents

10 CFR Part 55, January 1984 - Operators' Licenses.

Letter from Darrell G. Eisenhut, Director, Division of Licensing, NRC, to all Power Reactor Licensees and Applicants for Operating Licenses, December 16, 1981.

NUREG-0737, Clarification of TMI Action Plan Requirements, October 31, 1980. (Letter from Darrell G. Eisenhut, Director, Division of Licensing, NRC, to all Licensees of Operating Plants and Applicants for Operating Licenses and Holders of Construction Permits, October 31, 1980 (A02 801110 008).

NUREG-1021, Operator Licensing Examiner Standards, October, 1983.

Letter from Darrell G. Eisenhut, Director, Division of Licensing, NRC, to all Power and non-Power Reactor Licensees, Applicants for an Operating License and Holders of a Construction Permit (Generic Letter 83-17), April 8, 1983.

NQAM, Part III, Sections 4.1, Quality Assurance Records, and 6.1, Selection and Training of Personnel for Nuclear Power Plants

B. Reference Documents

ANSI/ANS-3.1 - Selection and Training of Nuclear Power Plant Personnel, December 17, 1981.

Program Manual Procedure No. 0201.09, Applications for NRC License Examination or Renewals

Program Manual Procedure No. 0202.01, Training Development and Utilization.

Program Manual Procedure No. 0202.03, Instructor Certification Program.

III. SUMMARY OF OPERATOR TRAINING

The TVA operator training process begins with candidate selection for enrollment into the Nuclear Operator Training Program for initial operator training. Successful completion of this program results in accreditation as an Assistant Unit Operator, at which time the candidate is permanently employed on the TVA Operations Staff. Subsequent to accreditation, an AUO may attempt to promote to Unit Operator, then to Assistant Shift Engineer, and finally to Shift Engineer. To be eligible for accreditation and tenure in these positions, the candidate must meet all applicable requirements for training, experience, and NRC licensure.

Instructors who are employed by TVA for operator training must meet applicable requirements for instructor certification and competence in their fields of learning. In addition, instructors who are operators must meet certain requirements as to operating position and NRC licensure.

A. Candidate Selection

The minimum qualifying requirements for candidates entering the NOTP are as follows:

1. Age: must have reached 18th birthday.

2. Education: must have completed high school or present authentic records of satisfactory completion of the equivalent.

3. Test: candidates must have taken and scored high on the power plant operation section of the U.S. Employment and Test Services General Aptitude Test Battery (GATB).

The final selection of candidates will be made in accordance with the certification policy of the Office of Nuclear Power (ONP) Personnel Services Staff. TVA's employment selection is subject to satisfactory conformance to general employment policies of TVA. Nothing in this selection shall be construed to modify the legal requirements imposed upon TVA with regard to the employment of personnel.

Candidates who have been selected for interviews must take and satisfactorily pass the following:

1. Psychological examinations

2. Security test battery

3. Medical examinations

During the interview, candidates will be given the following:

1. Training program orientation

2. Nuclear plant tour (insofar as reasonably possible)

3. Personal interviews

B. Nuclear (Nonlicensed) Operator Training Program (NOTP) Summary

The Nuclear Operator Training Program (NOTP), formerly titled as the Nuclear Student Generating Plant Operator (NSGPO) Training Program, was developed by joint management-labor committees consisting of TVA management and representatives of the International Brotherhood of Electrical Workers (IBEW) Union. The training is administered and conducted by the local management-labor committees in accordance with the policies and procedures established by the Central Committee for Operator Training.

The NOTP is a comprehensive 113-week training program which is designed to give the student operator a good fundamental background in all facets of nuclear power plant operation. The program is divided into four periods of training and each period must be successfully completed before the student may advance to the next period.

The NOTP is a recognized program by an accredited institution leading to a two-year Associate of Science Degree in Mechanical Engineering Technology (Nuclear Power Operations Option).

The following outline, listing the various facets of the program, describes the training requirements of the student candidate after placement in the training program and prior to assignment as a permanent AUO:

Period I	Mathematics, physics, chemistry, plant secondary systems
Period II	Electrical theory, turbines
Period III	Reactor theory and technology, Plant Mechanical and Electrical Systems
Period IV	AUO Break-In, and On-the-Job Training (OJT)

Any student who resigns or is dropped from the NOTP is ineligible for reenrollment in this program.

During the training program, weekly written examinations should be administered to the students. These examinations will be available for review by the local and accrediting subcommittees to aid in determining the progress of all students in [illegible]. All step and period final examinations for Periods I, II, and III should be conducted prior to the completion date for that step and period. The Period IV final examination shall be scheduled as soon as possible after the date of completion of Student IV.

Examinations--Only written examinations where appropriate will be administered for each academic subject. Final written and oral examinations will be administered for Student I, Step 2; Student II, Steps 1 and 2; and Student III, Steps 1B and 2. (A final written examination will be administered at the end of Student III, Step 1A.) The oral examination for Student III, Step 1A will be included with the Student III, Step 1B oral examination. A final oral examination will be administered in Student IV.

Written Part--The written examinations, consisting of questions on the technical knowledge obtained through related training, will be scheduled and administered by the local subcommittee or designated representatives.

Oral Part--The oral examinations, which are administered in order to evaluate a student's understanding of the subjects presented during the specified training period, will be scheduled, administered, and graded by representatives of the local subcommittees in the cases of Students I, II, and III and by the accrediting subcommittee or its designated representative in the case of Student IV. The class instructor will not take part in these examinations. The examiners for student operators should be accredited unit operators or higher classifications (i.e., an ASE or SE).

General Revision

Upon satisfactory completion of all the requirements for any period of the NOTP, the student shall be reclassified as appropriate to the next higher classification beginning at the next pay period. However, the next period or step of training should begin on the Monday following the step examination.

The local subcommittee may recommend that a student be placed in a remedial period at any time the subcommittee determines that the student's progress is unsatisfactory. A student failing the written or oral examination for a training step will be placed in a remedial period and then reexamined upon recommendation of the local subcommittee and the accrediting subcommittee. A remedial period will not be granted if one has been granted previously during the same phase of training. If a remedial examination is failed, the local subcommittee will recommend that the student be removed from the training program.

The length of the remedial period for nuclear operators is two weeks for Phase I and only one remedial in Phase I is allowed. Phase I of the training program includes periods I, II, and III, steps 1A and 1B conducted at the POTC. A two-week remedial period is granted for student III step 2 of Phase II at the assigned plant.

A five-week remedial period is granted for student IV of Phase II at the assigned plant. Only one remedial is allowed in Phase II at the assigned plant.

A student may continue to participate in all training activities while on remedial.

For academic subjects at the POTC, the local subcommittee may recommend that a student be placed on academic probation. If a student operator fails to satisfactorily pass an academic course or fails to make satisfactory progress during the course, he/she will be placed on academic probation for a period of two weeks. Tutoring may be available for any student operator on probation. At the end of two weeks, a course challenge examination will be administered or, in the case of unsatisfactory progress, the student's weekly examination performance will be evaluated. Unsatisfactory progress or failure to obtain a passing grade in the course will result in the subcommittee's recommendation for removal from the training program.

A student operator will be allowed only one probation for a given academic course and a total of two while at the POTC (phase I). Failure of or unsatisfactory progress in a third academic course will result in a two-week remedial period.

C. Operator Training Organization and Instructors for Operator Training

1. Organization

a. The Operator Training Group (OTG) is that part of the Nuclear Training Branch which is responsible for the development and administration of all operator training conducted at both the nuclear plants and the POTC. The OTG is headed by a Group Supervisor who reports to the Chief, Nuclear Training Branch or his assistant. The OTG is divided into sections which are headed by section supervisors who report directly to the Group Supervisor. Sections may be subdivided into units for facility of administration. Unit supervisors report to their section supervisors. The instructors and other staff members employed by the OTG report to their unit or section supervisor.

b. Until such time as the Sequoyah training organization is brought within the Operator Training Group, operator training at Sequoyah is under the direction of the Training Shift Engineer who reports to the plant Operations Section Supervisor.

2. Qualification of Training Supervisors

Personnel selected for positions as Group Supervisor, Section Supervisor, Unit Supervisor or Training Shift Engineer shall have a broad degree of experience in training and administration, shall hold or have held an NRC SRO license or certificate on a TVA nuclear plant, should be an accredited Shift Engineer, and should be certified in the techniques of instruction. These supervisors shall also be enrolled in applicable requalification programs and meet all other conditions of their licenses if they presently hold a license. Supervisors assigned to precritical stations need not hold an NRC license nor attend requalification training.[3]

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[3]NRC requirement, NUREG-0737, Enclosure 3, Section I.A.2.1, Harold R. Denton letter, Enclosure 1, Section I.A.2.c. (footnote)

General Revision

3. Conduct of Business between OTG and the Nuclear Plants

In regard to training matters, the plant training section supervisor or training shift engineer serves as liaison between the Nuclear Training Branch and plant management. This does not prohibit any section or unit supervisor from communicating with plant management directly as long as the plant training section supervisor or training shift engineer is informed.

4. Instructors for Operator Training

a. Operator instructors

(1) Instructors for RO, SRO, and Requalification Training

Instructors for licensed operator training programs (cold or hot license or license requalification) shall hold or have held an NRC SRO license.

All licensed operator instructors shall be enrolled in appropriate requalification programs to ensure their cognizance of current operating history, problems, and changes to procedures and administrative limitations.[4]

Operator instructors at nuclear plants which are in a precritical situation may not be SRO licensed nor attend requalification training.[5]

All instructors for licensed operator training shall meet the requirements of Program Manual Procedure 0202.03, "Instructor Certification Program."

Instructors for licensed operator training programs should be selected from accredited ASEs, SEs, or others as approved by the Chief, Nuclear Training Branch.

(2) Instructors for Nonlicense Operator Training

All instructors for NOTP Nonlicensed Operator Training shall meet the requirements of Program Manual Procedure 0202.03, "Instructor Certification Program."

[4]NRC requirement, NUREG-0737, Enclosure 3, Section I.A.2.1, Harold R. Denton letter, Enclosure 1, Section I.A.2.e.
[5]Ibid., Section I.A.2.c (footnote)

Shift engineer instructors of nuclear plant operator classes at the plants or the POTC should be selected from accredited ASEs, SEs, or others as approved by the accrediting subcommittee.

Assistant shift engineer instructors of nuclear plant operator classes at the plants or the POTC should be selected from experienced ASEs or others as approved by the accrediting subcommittee.

Student Instructor--Nuclear RL instructors of nuclear plant student operator classes should be selected from experienced unit operators or others as approved by the accrediting subcommittee, and shall hold a current RO license on a TVA nuclear plant.

Student Instructor--Nuclear instructors of nuclear plant student operator classes should be selected from experienced unit operators or others as approved by the accrediting subcommittee.

Unit Operators and Assistant Unit Operators assigned to serve temporarily as instructors for nonlicensed training courses should be selected from experienced personnel in these classifications or others as approved by the accrediting subcommittee.

b. Professional educators

Contractual arrangements with outside groups, such as colleges, will be available to provide instruction for portions of the TVA operator training programs.

c. Vendor training instructors

Some specialized training may be provided for operators by vendors of major equipment such as reactors and turbogenerators.

d. Specialists

Some operator training programs include segments which may be taught by qualified individuals such as nuclear, electrical, instrument, safety, health physics, or chemical specialists.

D. Upgrade Training

An operator who does not meet all of the training requirements for an operating position of the next higher level is eligible for upgrade training, provided the operator is fully qualified for the current position and that the service time requirements for the position sought are either completed or will be completed by the date of the accrediting examination. Operators may be approved to participate in upgrade training to become qualified for additional operating positions on the same level when operating conditions permit. Successful completion of a preliminary examination may be required before a candidate enters any phase of upgrade training.

All placement into operating positions requiring an NRC license are made contingent upon the operator's ability to obtain the appropriate license. Should an operator fail to obtain that license, upon a second unsuccessful attempt, the operator will be returned to a former permanent classification or placed in a position not requiring a license.

The following requirements are listed to indicate the potential progress of an AUO to the highest onshift operating position--that of a nuclear plant SE.

1. Assistant unit operator (AUO) to unit operator (UO):

   a. Applicants for RO licenses shall have two years of power plant experience. One year of this shall be nuclear power experience.[6]

   b. Must have a minimum of six months at the site for which the license is sought.[7]

   c. Must be accredited as a nuclear plant AUO for a minimum of 12 months before entering Electrical Step 2B or RO license training.

   d. Must have successfully completed Step 2B, Electrical Upgrade Training.

   e. Must have successfully completed the Cold or Hot License Program, passed the RO certification, and the UO accreditation examination. A permanent UO position is contingent upon obtaining the NRC license required for performing the active duties of the position.

[6]NRC requirement, NUREG-1021, Standard ES-109, Section B.1.a
[7]Ibid., Section B.1.b.

f. An AUO may also become a UO by the transfer method for new plant staffing. The accrediting subcommittee may examine and accredit AUOs for transfer and promotion into the UO classification at new plants during the initial staffing process. Accreditation gained in this manner must be followed by transfer to the designated plant, completion of the license certification program, and obtaining the NRC license required for performing the active duties of the position. The transfer method is recognized for no other purpose.

2. Unit operator (UO) to assistant shift engineer (ASE):

a. Must be accredited as a nuclear plant UO.

b. Must have served temporarily or permanently as a unit operator for at least 12 months prior to the administration of the ASE accrediting examination.

c. Must serve a minimum of 12 months as a UO with an RO license prior to entering SRO license training.[8]

d. Must complete electrical training (Step 3) and pass the qualifying examination given by the accrediting subcommittee at the completion of this training.

e. Applicants for senior operator licenses shall have 4 years of responsible power plant experience. Responsible power plant experience should be that obtained 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. A maximum of 2 years power plant experience may be fulfilled by academic or related technical training, on a one-for-one time basis. Two years shall be nuclear power plant experience. At least 6 months of the nuclear power plant experience shall be at the plant for which he seeks a license.[9]

f. All requests for ASE examinations shall be made in writing to the Chief, Nuclear Training Branch (attention: Supervisor, Operator Training Group). These requests must have the sanction of the plant manager.

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[8]NRC requirement, NUREG-0737, Enclosure 3, Section 1.A.2.1., Harold R. Denton letter, Enclosure 1, Section A.1.b.

[9]Ibid., Enclosure 1, Section A.1.a.

[10] and [11]--There are no footnotes 10 and 11 in this procedure. The next footnote is number 12.

General Revision

g. Must have completed the Cold or Hot License Program and passed the SRO certification and the ASE accreditation examination. A permanent ASE position is contingent upon obtaining the NRC license required for performing the active duties of the position.

h. An unlicensed ASE may perform work on a nuclear unit, provided the work is performed under the direction of the SRO in charge of the unit.

Note: Precritical applicants and/or fossil transferees will be required to meet unique qualifications.

3. Assistant shift engineer (ASE) to shift engineer (SE):

a. Must be accredited as a nuclear plant ASE and must have served 15 months as an ASE or have a combination of experience as an ASE or SE instructor for a minimum of 15 months, 7 months of which must have been as an ASE in a plant. Temporary time served prior to NRC license requirements shall count toward fulfilling this minimum time ingrade.

b. Shall have five years of power plant operating experience.

c. Shall have an NRC SRO license.

Note: Precritical applicants and/or fossil transferees will be required to meet unique qualifications.

d. All requests for SE examinations shall be made in writing to the Chief, Nuclear Training Branch (attention: Supervisor, Operator Training Group). These requests must have the sanction of the plant manager. All candidates for SE positions will be personally interviewed by the site director.

e. Must pass the TVA accrediting examination for SE.

IV. NONLICENSE TRAINING PROGRAMS

A. Nuclear Operator Training Program (NOTP)

1. Purpose

The NOTP offers formal training for promotion of nuclear student operators to AUOs.

2. Description

Students in the NOTP spend 71 weeks at the POTC, dividing their time between the classroom and plant observation training. The NOTP students spend an additional 42 weeks in classroom and OJT at a nuclear plant before promoting to AUO.

Note: Academic courses will be scheduled as required for the optimum training of each individual class.

3. Prerequisites

Basic requirements for selection of students include a high school education; 18 years of age or older; an aptitude for mathematics, science, mechanics, and electrical theory; and good physical and psychological health.

4. Evaluation and documentation

a. For academic subjects, the minimum acceptable grade for weekly written examinations and course average shall be 65 percent. The minimum acceptable grade for academic course challenge examinations shall be 80 percent.

b. For technical subjects, the minimum acceptable grade for weekly written examinations, step written examinations, and course average shall be 70 percent. The minimum acceptable grade for oral examinations shall be satisfactory as determined by the oral examination board.

c. The following will be sent to Administrative Services, Training Records, at the POTC:

(1) Each trainee's weekly examination score.
(2) The original weekly examination if scored unsatisfactory with another trainee's examination which is scored satisfactory.
(3) All final step written and oral examinations.

Refer to part VII of this procedure for QA record requirements.

General Revision

5. NOTP outline (113 weeks)

   a. Student I (28 weeks)

      (1) Step 1--Mathematics, physics, and chemistry (9 weeks)

         (a) Nuclear plant introduction
            1) Introduction to nuclear power
            2) Orientation
            3) Radiation safety

         (b) Academic subjects
            1) Algebra and trigonometry I and II
            2) Water chemistry
            3) Introduction to physics

      (2) Step 2--plant secondary systems (19 weeks)

         (a) Print reading
            1) Flow diagrams
            2) Control diagrams
            3) Logic diagrams

         (b) Auxiliary equipment
            1) Pumps
            2) Air compressors
            3) Feedwater heaters
            4) Evaporators
            5) Demineralizers
            6) Filters
            7) Valves

         (c) Instruments
            1) Flow
            2) Level
            3) Pressure
            4) Temperature

         (d) Operating procedures
            1) Clearance procedures
            2) System operating instructions (SOIs)
            3) General operating instructions (GOIs)

         (e) Systems
            1) Condenser circulating water
            2) Condensate
            3) Feedwater
            4) Steam
            5) Compressed air
            6) Cooling water
            7) Fire protection
            8) Heating and ventilating

(f) Systems written and oral examinations

(g) Academic subjects
1) Calculus and analytic geometry
2) Oral communication
3) Thermodynamics

b. Student II (25 weeks)

(1) Step 1--electrical theory (13 weeks)

(a) Electrical theory
1) Magnetism
2) Electrostatics
3) Voltage and current
4) Producing an EMF
5) DC circuits
6) AC circuits

(b) Electrical equipment
1) Motors
2) Generators
3) Batteries
4) Fuses and circuit breakers
5) Transformers
6) Relays

(c) Electrical systems
1) Common station service
2) Unit station service
3) 250-V DC
4) 125-V DC
5) Low voltage AC
6) Main single line diagram

(d) Electrical written and oral examinations

(e) Academic subjects
1) English composition
2) Solid-state principles

(2) Step 2--turbines (12 weeks)

(a) Turbine construction
1) Types
2) Bladings
3) Bearings
4) Valves
5) Support and expansion

(b) Turbine operation
1) Hydraulic system
2) Speed control
3) Protective devices
4) Turning gear
5) Abnormal operating conditions

(c) Turbine-generator
1) Lubrication system
2) Sealing systems
3) Supervisory instruments

(d) Turbine written and oral examinations

(e) Academic subject
Report writing

c. Student III (40 weeks)

(1) Step 1A--nuclear theory (9 weeks)

(a) Nuclear physics
1) Mathematics review
2) Atomic structure
3) Equivalence of mass and energy
4) Fission process
5) Behavior of subatomic particles and waves
6) Molecular density
7) Radioactive decay

(b) Reactor theory
1) Induced nuclear reactions
2) Cross section
3) Neutron interaction with reactor materials
4) Neutron moderation and diffusion
5) Neutron multiplication factors
6) Reactor flux distribution
7) Reactor kinetics
8) Reactor control
9) Power coefficients
10) Fission product poisons
11) Reactor core characteristics
12) Subcritical multiplication
13) Reactor operations
14) Core hydraulics and heat transfer
15) Effect of radiation on materials
16) Primary water chemistry

(c) Health physics
1) Radiation protection standards and guidelines
2) ALARA concept
3) Radiation monitoring instruments
4) Respiratory equipment
5) Protective clothing
6) Principles of radiation protection (time, distance, shielding)
7) Special work permits
8) Radiological Emergency Plan

(d) Nuclear physics and reactor theory written examination

(e) Academic subject
Industrial psychology

(2) Health and safety (1 week)
(3) Fire training (1 week)
(4) Step 1B--PWR or BWR technology (7 weeks)

(a) PWR technology
1) Nuclear instrumentation
2) Reactor protection
3) Reactor vessel and internals
4) Flux mapping and thermocouple system
5) Reactor coolant
6) Chemical and volume control system
7) Control rod drive and control systems
8) Estimating critical position
9) Steam dump
10) Spent fuel pit cooling and cleanup
11) Residual heat removal
12) Containment spray system
13) Emergency core cooling systems
14) Radwaste systems
15) Containment, containment ventilation, and pressure suppression
16) Emergency gas treatment
17) Fuel handling

(b) BWR technology
1) Nuclear instrumentation
2) Reactor protection system
3) Reactor vessel and internals
4) Reactor water cleanup system
5) Reactor recirculation system
6) Control rod drive system
7) Emergency core cooling systems
8) Residual heat removal system

9) Spent fuel pool coolant system
10) Standby liquid control system
11) Radwaste systems
12) Primary containment
13) Standby gas treatment system
14) Secondary containment

(c) PWR or BWR technology written and oral examinations

(5) Step 2--PWR or BWR plant systems (22 weeks in-plant)

(a) PWR (SQN, WBN) plant systems
1) Compressed air system
2) Condenser circulating water system
3) Raw cooling water system
4) Essential raw cooling water system
5) Component cooling water system
6) Condensate system
7) Feedwater system
8) Main steam system
9) Auxiliary feedwater system
10) Steam-driven auxiliary feedwater pump turbine operation
11) Main feedwater pump and turbine operation
12) High pressure fire protection system
13) CO_2 fire protection system
14) Auxiliary boiler operation
15) Heating, ventilation, and air-conditioning system
16) Diesel engine operation
17) Makeup water treatment system
18) Condensate demineralizer system
19) Reactor vessel, internals, and core components
20) Reactor coolant system components
21) Reactor coolant system and water quality
22) Excore nuclear instrumentation
23) Incore flux detector and thermocouple system
24) Chemical and Volume Control System (CVCS) letdown and charging
25) Volume Control Tank (VCT) controls, chemical shim control, and CVCS operation

26) Boron recovery system
27) Primary makeup water system
28) Boron injection system
29) Residual Heat Removal (RHR) system
30) Emergency core cooling system
31) Upper head injection system
32) Control rod drive
33) Reactor containment design, construction, and operation
34) Containment isolation
35) Containment ventilation system
36) Containment emergency pressure suppression system
37) Spent fuel pit cooling system
38) Refueling and fuel loading equipment
39) Cask decontamination system
40) Fuel loading and startup
41) Liquid waste disposal system
42) Gas disposal system
43) Solid waste disposal systems
44) Radiation monitoring system
45) Solid-state reactor protection system
46) Review of main turbine control system
47) Steam dump control system
48) Short- and long-term transients
49) General operating instructions (GOIs)
50) Abnormal operating instructions (AOIs)
51) Emergency operating instructions (EOIs)
52) Surveillance instructions (SIs)
53) Standard practices
54) Radiological Emergency Plan (REP)
55) In-plant electrical (2 weeks)
    - aa) Offsite power supplies, common station service transformers, start buses, 6.9-kV common boards, and 480-V common boards
    - bb) Unit boards (6.9-kV, 480-V)
    - cc) Shutdown boards (6.9-kV, 480-V)
    - dd) Diesel generators
    - ee) Batteries and chargers
    - ff) Plant 250-V DC systems
    - gg) Emergency lighting
    - hh) Preferred and nonpreferred power and plant computer power
    - ii) Plant 125-V DC systems
    - jj) Vital and nonvital instrument power system
56) Integrated plant systems
57) Student III, Step 2 review
58) Student III, Step 2 written examination
59) Student III, Step 2 oral examination

General Revision

(b) PWR (BLN) plant systems

1) Solid state control system (IL)
2) BLN drawing system
3) Condenser circulating water system (KH)
4) Raw cooling water (KW)
5) Raw service water/high pressure fire protection system (RS/PF)
6) Hypochlorite system (YL)
7) Carbon dioxide system (GC)
8) Compressed air system (RK)
9) Makeup water treatment (YT)
10) Nitrogen gas system (GT)
11) Condensate storage and transfer system (CS)
12) Condensate system (CM)
13) Condensate demineralizer (CN)
14) Injection water system (CI)
15) Feedwater system (CF)
16) Feedwater turbine system (CP)
17) Feedwater treatment system (CT)
18) Heater vent and drains (CD and CE)
19) Gland seal system (CG)
20) Steam generator startup and recirculation system (CR)
21) Auxiliary feedwater system (CA)
22) Auxiliary boiler system (BA)
23) Fuel oil storage and transfer system (FD)
24) Auxiliary steam system (SA)
25) Main and reheat steam system (SM)
26) Extraction steam system (SE)
27) Potable water system (YP)
28) Equipment and floor drain system (WE)
29) Hot water heating system (VH)
30) Turbine building vent system (VT)
31) Sampling and water quality system (YQ)
32) Turbine lubricating oil system (TL)
33) Turbine control fluid system (LH)
34) Main turbine oil print
35) BBC turbine decontic system
36) Turbine steam seal system (TS)
37) Turbine drains and miscellaneous systems (TD)
38) Turbine supervisory instruments (TM)
39) Condenser vacuum system (CV)
40) Generator seal oil system (TO)
41) Generator hydrogen cooling system (TH)
42) Generator stator cooling system (TK)
43) Reactor vessel and internals
44) Nuclear fuel assembly system

General Revision

45) Reactor coolant system (NC)
46) Reactor protective system (IE)
47) Nuclear instrumentation system (IN)
48) Nonnuclear instrumentation system and safety-related control and instrumentation (IT)
49) Fuel handling and reactor services system (NF)
50) Spent fuel cooling system (NM)
51) Makeup and purification system (NV)
52) Decay heat removal system (ND)
53) Core flood system (NL)
54) Reactor building spray system (NS)
55) Reactor building air conditioning and cooling system (VJ)
56) Control rod drive system (NR)
57) Chemical addition and boron recovery system (NB)
58) Waste disposal system (WD)
59) Engineered safety features actuation system (IE)
60) Incore monitoring system (IM)
61) Essential raw cooling water system (KE)
62) Component cooling water system (KC)
63) Radiation monitoring system (IR)
64) Temperature monitoring system (IK)
65) Core loose parts monitoring system (IW)
66) Integrated control system (II)
67) General operating instructions (GOIs)
68) Abnormal operating instructions (AOIs)
69) Emergency operating instructions (EOIs)
70) System operating instructions (SOIs)
71) Administrative instructions (AIs)
72) Radiological Emergency Plan (REP)
73) Auxiliary building vent system (VA, VB, VC, VE, VF)
74) Control building vent system (VK)
75) Reactor building vent and purge system (VH) Secondary containment purge and pressure control system (VV)
76) Containment combustible gas and environment monitoring system (NO and NP)
77) In-plant electrical systems (2 weeks)
    aa) 6.9-kV and 13.8-kV nonvital AC
    bb) 6.9-kV vital shutdown AC
    cc) 480-V nonvital AC
    dd) 480-V vital shutdown AC
    ee) Low voltage AC nonvital
    ff) Low voltage AC vital
    gg) Unit nonvital DC

General Revision

hh) Unit vital DC
ii) Common nonvital DC
jj) Diesel generators
kk) Lighting system
ll) Excitation system
mm) Single line
nn) Switchyard

78) Student III, Step 2 review
79) Student III, Step 2 written examination
80) Student III, Step 2 oral examination

(c) BWR (BFN) plant systems

1) Compressed air system
2) Condenser circulating water system
3) Hypochlorite system
4) Raw cooling water system
5) Emergency equipment cooling water system
6) Reactor building closed cooling water (RBCCW)
7) Condensate system
8) Feedwater system
9) Main steam system
10) Auxiliary feedwater system
11) Steam-driven auxiliary feedwater pump turbine operation
12) Main feedwater pump and turbine operation
13) High pressure fire protection system
14) CO^2 fire protection system
15) Auxiliary boiler operation
16) Heating, ventilation, and air conditioning system
17) Diesel engine operation
18) Diesel generator control
19) Makeup water treatment system
20) Condensate demineralizer system
21) Reactor vessel, internals, and core components
22) Reactor coolant system components
23) Reactor coolant system and water quality
24) Nuclear instrumentation
25) Turbine lubricating oil system
26) Turbine electrohydraulic control system
27) Turbine supervisory instruments
28) Main generator excitation
29) Diesel generator (DG) excitation
30) Generator core monitoring
31) Transformer yard panels, 4160-V, 480-V, 120-V, and 250-V DC boards
32) Standby gas treatment system
33) Reactor building, drywell, diesel generator building, and turbine building sumps
34) Radwaste disposal system

35) Reactor servicing and refueling
36) Reactor safety features
37) Engineered safety systems
38) Containment pressure suppression system
39) Process radiation monitoring, area, and environmental monitoring system
40) Off-gas system
41) Short and long holdup volume
42) Neutron monitoring system (SRM, IRM)
43) Neutron monitoring system (LPRM, APRM, and TIP)
44) Rod worth minimizer (RWM)
45) Rod sequence control system (RSCS)
46) Rod block monitor
47) Reactor manual control
48) Control rod drive system
49) Feedwater pump controls
50) Recirculation pump controls
51) Reactor vessel instrumentation
52) Fuel handling
53) General operating instruction, panel, valve, and system checklists - plant startup
54) Operating instructions (OIs)
55) Emergency operating instructions (EOIs)
56) Standard practices
57) Radiological Emergency Plan (REP)
58) In-plant electrical (two weeks)
    aa) Offsite power supplies, common station service transformers, start buses, 4.16-kV common boards, and 480-V common boards
    bb) Unit boards (4.16-kV, 480-V)
    cc) Shutdown boards (4.16-kV, 480-V)
    dd) Diesel generators
    ee) Batteries and chargers
    ff) Plant 250-V DC systems
    gg) Emergency lighting
    hh) Preferred and nonpreferred power and plant computer power
    ii) Plant 125-V DC systems
    jj) Vital and nonvital instrument power system
59) Integrated plant systems
60) Student III, Step 2 review
61) Student III, Step 2 written examination
62) Student III, Step 2 oral examination

d. Student IV (20 weeks in-plant)

(1) AUO break-in and OJT (20 weeks)

During this period, students are provided with "in-plant" opportunities to perform, practice, and apply the technical skills that were learned in the classroom.

(2) Each plant shall develop and implement a plant systems familiarization program for use by the nuclear student generating plant operators during the fourth period of the training program.

(3) Plant familiarization program

(a) Purpose

The plant familiarization program is a study guide to be used by the operators to learn the plant systems.

(b) Description

This program is composed of system information that the operator may use as a study guide for each system. The information available on each system makes it possible for the trainee to quickly acquire an understanding of the purpose, arrangement, physical location, and operation of each system.

(c) Prerequisites

There are no prerequisites for the plant familiarization program. Any classification of operators may use this course to become familiar with the plant systems; however, this program is used very effectively for newly assigned Student IV operators and could be used for other classifications assigned to a new plant.

(d) Evaluation and documentation

The trainee is evaluated on his knowledge of each system during walk-through type examinations. The results of each walk-through examination are documented in the trainee's training file.

(e) BLN plant systems familiarization program outline

1) 500-kV Switchyard system as one offsite power system (XE)
2) 500-kV main transformer system (XM)
3) Load break switch/24-kV generator bus (XP)
4) Unit station service transformer (XU)
5) 161-kV switchyard system as one offsite power system (XB)
6) Reserve station transformer (XR)
7) TVA offsite power system - RCP boards (EA)
8) TVA offsite (preferred) power system unit boards (EB)
9) 480-V normal AC auxiliary power system (ED)
10) 480-V/277-V normal AC lighting system (EL)
11) Class 1E engineered safety AC auxiliary power system (EG)
12) 480-V class 1E AC auxiliary power distribution system, unit 1 (EI)
13) 120-V vital AC power system (EJ)
14) 120-V Class 1E AC auxiliary power distribution system, unit 1 (EK)
15) 250-V battery system (EP)
16) 125-V DC power distribution, unit 1 (EQ)
17) 48-V normal DC power distribution, unit 0 (ER)
18) 48-V DC telephone power distribution system (EW)
19) 26-V turbine battery distribution, unit 1 (ES)
20) 24-V normal DC power distribution, unit 0 (ET)
21) 125-V class 1E vital DC power system (EU)
22) 120-V AC preferred power system (EY)
23) 120-V AC normal power system (EV)
24) 120-V AC instrument power system (EZ)
25) Diesel generator starting air (RG)
26) Diesel generator, unit 1 (RT)
27) Solid state control system (IL)
28) Heat rejection system (KH)
29) Sodium hypochlorite system (YA)
30) Raw water chlorination system (YC)
31) Raw cooling water system (KW)
32) Essential raw cooling water system (KE)

33) Component cooling water system (KC)
34) Essential compressed air system (RK)
35) Raw service water system (RS)
36) Makeup water treatment system (YT)
37) Makeup demineralizer system (YM)
38) Demineralized water storage system (RE)
39) Potable water system (YP)
40) Fuel oil storage and transfer system (FD)
41) Fuel oil system (diesel generator supporting auxiliary) (FF)
42) Auxiliary boiler (BA)
43) Auxiliary steam system (SA)
44) Hot water heating system (VU)
45) High pressure fire protection system (RF)
46) CO^2 Fire protection system - diesel generator building and powerhouse (GC)
47) Nitrogen system (GN)
48) Hydrogen storage and transfer system (GS)
49) Condensate and condensate transfer system (CM)
50) Condensate demineralizer high crud filter system (CN)
51) Main feedwater system (CF)
52) Steam generator startup and recirculation system (CR)
53) Main steam and reheat steam system (SM)
54) Extraction steam system (SE)
55) HP Heater drains and vents (CD)
56) LP Heater drains and vents (CE)
57) Lube oil storage and transfer system (LS)
58) Turbine control fluid and lubricating oil system (TL)
59) Turbine-generator control and instrumentation system (TC)
60) Turbine steam seal system (TS)
61) Turbine drain system (TD)
62) Condenser vacuum system (CV)
63) Generator seal oil system (TO)
64) Generator hydrogen gas system (TH)
65) Generator stator cooling water system (TK)
66) Generator excitation system (TE)
67) Turbine building ventilation and air conditioning system (VT)

68) Sampling and water quality system (YQ)
69) Station drainage system (WE)
70) Reactor coolant system (NC)
71) Control rod drive system (NR)
72) Control rod drive cooling water system (KD)
73) Incore monitoring system (IM)
74) Nuclear instrumentation system (IN)
75) Reactor protection system (IP)
76) Makeup and purification system (NV)
77) Chemical addition and boron recovery system (NB)
78) Engineered safety features actuation system (IE)
79) Decay heat removal system (LPI and recirculation) (ND)
80) Core flood system (NL)
81) Reactor building spray system (NS)
82) Reactor building cooling system (VJ)
83) Post-LOCA hydrogen recombiner (NO)
84) Containment environment monitoring system (NP)
85) Auxiliary feedwater system (CA)
86) Spent fuel cooling systems (NM)
87) Fuel handling equipment and failed fuel detection equipment (NF)
88) Safety-related display instrumentation, post-accident monitoring and NNI Systems (IT)
89) Unit integrated control system (II)
90) Area, airborne, effluent and process radiation monitoring system (IR)
91) Temperature monitoring system (IK)
92) Core loose parts monitoring system (IW)
93) Waste gas system (WG)
94) Liquid radwaste system (WL)
95) Solid radwaste system (WS)
96) Auxiliary building ESF zone pressure control and air cleanup (VA)
97) Auxiliary building fuel handling area environmental control system (VB)
98) Auxiliary building common zone environmental control system (VC)
99) Auxiliary building trained areas (VE)
100) Auxiliary building common area air conditioning system (VF)
101) Control building environmental control system (VK)

102) Non-ESF area control building HVAC system (VL)
103) Control room emergency air system (VM)
104) Reactor building and secondary containment purge and pressure control systems (VH)
105) Miscellaneous plant ventilation exhaust systems (VY)
106) Secondary containment air cleanup system (VX)
107) Plant computer (IC)
108) Status, environmental, and alarm monitoring system (IS)
109) Sound powered telephone system (QB)
110) High-frequency radio system (QR)
111) Automatic telephone system (QT)

(f) BFN systems familiarization program outline

Suggested sequence of study (system number is listed in parentheses before the system).

1) (1) Main steam system
2) (2) Condensate system
3) (3) Reactor feedwater system
4) (46) Feedwater control system
5) (68) Reactor water recirculating system
6) (96) Recirculating flow control system
7) (5) Extraction steam system
8) (6) Heater drains and vents
9) (47) Main turbine and generator
   a. (47) Electrohydraulic control
   b. (5) Extractions
   c. (20) Lubrication
10) (35) Generator cooling system
11) (12) Auxiliary boiler system
12) (18) Fuel oil system
13) (24) Raw cooling water system
14) (25) Raw service water system
15) (26) High pressure fire protection and cable tray deluge system
16) (39) CO_2 (fire protection, purging, and storage)
17) (27) Condenser circulating water system and cooling towers
18) (28) Water treatment system
19) (29) Potable water system

20) (32 and 33) Control and service air systems
21) (30) Ventilation systems
22) (65) Standby gas treatment systems
23) (64) Primary containment system
24) (84) Containment air dilution system
25) (69) Reactor water cleanup system
26) (63) Standby liquid control system
27) (23) Residual heat removal service water system
28) (67) Emergency equipment cooling water system
29) (71) Reactor core isolation cooling system
30) (74) Residual heat removal system
31) (73) High pressure coolant injection system
32) (74) Containment spray system
33) (75) Core spray system
34) (80) Containment dilution system
35) (77) Radwaste system
36) (66) Off-gas system
37) (79) Fuel handling
38) (78) Spent fuel pool cooling
39) (82) Diesel generators
40) (85) Control rod drive hydraulic system
41) (92) Neutron monitoring system
42) (94) Traversing incore probes
43) (57) Electrical systems
44) (99) Reactor protection system
45) (90) Radiation monitoring

(g) SQN systems familiarization program outline

Suggested sequence of study (system number is listed in parentheses before the system).

1) (1) Main steam system
2) (2) Condensate system
3) (54) Injection water system
4) (37) Gland seal water system
5) (3) Main and auxiliary feedwater
   a. Description
   b. (46) Control
      (1) Feedwater pumps
      (2) Steam generators
6) (5) Extraction steam system
7) (6) Heater drains and vents

8) (47) Main turbine
   a. Description
   b. Electrohydraulic control
9) (35) Generator cooling system
10) (12) Auxiliary boiler system
11) (18) Fuel oil system
12) (20) Central lubricating oil system
13) (24) Raw cooling water system
14) (25) Raw service water system
15) (26) High pressure fire protection system
16) (39) CO^2 (fire protection, purging, and storage)
17) (27) Condenser circulating water system
18) (28) Water treatment system
19) (29) Potable water system
20) (32 and 33) Control and service air systems
21) (30) Ventilation systems
   a. Turbine building
   b. Control building
   c. Auxiliary building
   d. Reactor building
22) (61 and 64) Ice condenser system
23) (62) Chemical and volume control system
24) (63 and 87) Safety injection system
   a. Upper head injection
   b. Cold leg accumulators
   c. Centrifugal charging pumps
   d. Safety injection pumps
   e. Residual heat removal pumps
25) (65) Emergency gas treatment system
26) Auxiliary building gas treatment system
27) (67) Essential raw cooling water system
28) (68) Reactor coolant system
29) (70) Component cooling system
30) (72) Containment spray system
31) (74) Residual heat removal system
32) (77) Waste disposal system
   a. Liquid
   b. Gaseous
   c. Solid
33) Fuel handling
34) (78) Spent fuel pool cooling
35) (59) Demineralized water and cask decontamination system
36) (81) Primary water makeup system

General Revision

37) (82) Diesel generators
38) (85) Control rod drive system
39) (88) Containment isolation system
40) (92) Excore neutron detectors
41) (94) Incore flux detectors
42) (57) Electrical systems
43 (99) Reactor protection system
44) (90) Radiation monitoring system
45) (44) Building heat
46) (34) Vacuum priming

(h) WBN systems familiarization program outline

Suggested sequence of study (system number is listed in parentheses before the system).

1) (28) Water treatment system
2) (59) Demineralized water and cask decontamination system
3) (29) Potable (treated) water distribution system
4) (32) Control air system
5) (33) Service air system
6) (24) Raw cooling water system
7) (25) Raw service water system
8) (26) High pressure fire protection system
9) (12) Auxiliary boiler system
10) (18) Fuel oil system
11) (30) Ventilating system
12) (31) Air-conditioning (cooling-heating) system
13) (44) Building heating system
14) (57) Associated electrical systems
15) (38) Insulating oil system
16) (20) Central lubricating oil system
17) (47) Turbogenerator control system
18) (67) Essential raw cooling water system
19) (70) Component cooling system
20) (40) Station drainage system
21) (77) Waste disposal system
22) (27) Condenser circulating water system
23) (2) Condensate system
24) (14) Condensate demineralizer system
25) (37) Gland seal water system
26) (54) Injection water system
27) (3) Main and auxiliary feedwater system
28) (41) Layup water treatment system

29)	(46)	Feedwater control system
30)	(1)	Main steam system
31)	(5)	Extraction steam system
32)	(6)	Heater drains and vents system
33)	(35)	Generator cooling system
34)	(39)	CO^2 storage, fire protection, and purging system
35)	(36)	Feedwater secondary treatment system
36)	(43)	Sampling and water quality system
37)	(82)	Standby diesel generator system
38)	(68)	Reactor coolant system
39)	(85)	Control rod drive system
40)	(99)	Reactor protection system
41)	(62)	Chemical and volume control system
42)	(81)	Primary makeup water system
43)	(61)	Ice condenser system
44)	(72)	Containment spray system
45)	(65)	Emergency gas treatment system
46)	(80)	Primary containment cooling system
47)	(88)	Containment isolation system
48)	(63)	Safety injection system
49)	(74)	Residual heat removal system
50)	(87)	Upper head injection system
51)	(83)	Hydrogen recombination system
52)	(90)	Radiation monitoring system
53)	(55)	Annunciator and sequential events recording system
54)	(56)	Temperature monitoring system
55)	(78)	Spent fuel pit cooling system
56)	(84)	Flood mode boration makeup system
57)	(92)	Neutron monitoring system (excore)
58)	(94)	Incore flux detectors and thermocouples

B. Nuclear Power Plant Fundamentals Course (NPPFC)

1. Purpose

This course was developed to serve as a part of the training experienced plant operators would receive when transferring from a fossil power plant to a nuclear power plant.

2. Description

The NPPFC is a 16-week (640-hour) course designed for ex-fossil operators who have transferred to a nuclear plant. The course covers mathematics, physics, chemistry, thermodynamics, reactor theory and operation, and health physics.

The academic courses (mathematics, physics, chemistry, and thermodynamics) are college credit courses taught by college instructors or other qualified instructors.

The reactor theory and operations portion shall contain instruction in:

a. Principles of reactor operation

(1) Atomic structure and radioactivity
(2) Nuclear reaction and the fission process
(3) Neutron behavior and control of the fission process
(4) Core and Nuclear Steam Supply characteristics and thermal hydraulic design

b. Design features of the nuclear power plant
c. General operating characteristics of the nuclear power plant
d. Reactor instrumentation and control systems
e. Radiation control and safety provisions[12]

The reactor theory and operations course shall be taught by a qualified TVA instructor.

The health physics course shall contain instruction in:

a. Atomic and nuclear structure
b. Modes of radioactive decay
c. Interaction of radiation with matter
d. Radiation measurement units and radiation
e. TVA's radiation protection standards
f. Biological effects of ionizing and practical aspects of health physics

[12]ANS 3.1, December 17, 1981, Section 5.2.1.1.

General Revision

Health physics shall be taught by a qualified TVA instructor.

3. Prerequisites

Trainees entering this program should be a fossil or nuclear AUO or higher classification.

4. Evaluation and documentation

Weekly written examinations and a comprehensive final written examination are administered during this program.

The weekly and final examination scores shall be recorded and placed in each trainee's training file. Final examinations for reactor theory and operation shall be sent to Administrative Services, Training Records, at the POTC.

Refer to part VII of this procedure for QA record requirements.

C. Plant Specific Training

1. Purpose

This training is provided to experienced power plant operators transferring to a nuclear plant from a fossil plant or another nuclear plant.

2. Description

Plant specific training familiarizes the operator with plant equipment and systems. This training requirement could be satisfied by successful completion of any of the following courses:

a. Onsite lecture series
b. Student III, Step 2 plant systems training
c. Plant familiarization course
d. Assigned plant break-in program

The length of this training may vary according to the trainee's previous training and experience, but in no case shall be less than four weeks in duration.

3. Prerequisites

Trainees entering this program should be fossil or nuclear AUOs or higher classifications.

4. Evaluation and documentation

Written examinations, system study check-offs, and/or oral examinations are used as appropriate for evaluation.

Examination scores or checkoff lists will be recorded and placed in each trainee's training file.

A final oral examination shall be administered by an examination board consisting of two members. One member shall be equal to or higher in classification than the trainee. The other member shall be higher in classification than the trainee. The candidate must pass the final oral examination before assuming shift duties.

Refer to part VII of this procedure for QA record requirements.

D. Assistant Unit Operator Requalification Training Program

1. Purpose

Individuals permitted to independently operate systems or equipment that could affect the quality of structures, systems, and components important to safety shall receive instruction for tasks to be performed.

This program provides the necessary instruction for the AUOs at the nuclear plants.

2. Description

This is at minimum a one-week-per-year program presented in a formal classroom setting by a qualified instructor approved by the Plant Training Review Board or Chief, Nuclear Training Branch. All AUOs shall attend this program.

3. Prerequisites

There are no prerequisites for this program; however, the classes normally consist of AUOs.

4. Evaluation and documentation

The AUO's understanding of the information provided by this program shall be evaluated by written examinations. The results are documented in the trainee's training file. Refer to part VII of the procedure for QA record requirements.

5. AUO training outline

The AUO training shall include as a minimum the following topics:[13]

a. Generic equipment or component design and applications
b. Specific equipment or system operation and operational requirements
c. Specific equipment and system operating procedures
d. Specific equipment and system function during a transient (if applicable)
e. Relationship of specific equipment and systems to plant safety and technical specification limiting conditions for operation and surveillance requirements (if applicable)
f. Responsibilities during transients
g. Identification and reporting of equipment or system deficiencies

[13]ANS 3.1, December 17, 1981, Section 5.3.5.

General Revision

h. Specific tasks involved in operation of systems or equipment

E. Electrical Upgrade Training

1. Purpose

The Electrical Upgrade Program is designed to teach the nuclear plant operator the knowledge required to carry switchyard duties at the nuclear power plants.

2. Description

The electrical training for nuclear operators is presented in four steps as follows:

Step 1 - Basic Electrical Theory and Equipment Training
This is a 13-week program which is presented during Student II, Step 1 of the NOTP.

Step 2A - In-plant Electrical Training
This is a two-week program which is presented during Student III, Step 2 of the NOTP.

Step 2B - UO Upgrade Electrical Training
This is a four-week program which is required prior to entering license training.

Step 3 - ASE Upgrade Electrical Training
This is a six-week program which is required prior to taking the accrediting examination for ASE.

3. Prerequisites

The prerequisites for each part of the nuclear operator electrical training is as follows:

Step 1A - A student operator shall successfully complete Student I, Step 2 of the NOTP before entering this portion of training.

Step 2A - A student operator shall successfully complete Student III, Step 1B of the NOTP before entering this portion of training.

Step 2B - An AUO may enter this portion of training after having served 12 months as an accredited AUO and having satisfactorily passed a UO preliminary examination.

Step 3 - A candidate may enter this training at any time after becoming a UO. This training is required prior to taking the accrediting examination for ASE.

4. Evaluation and documentation

a. Evaluation

A trainee's knowledge is evaluated daily through oral feedback and weekly by administering a written examination. A comprehensive step written examination is administered for steps 1, 2B, and 3 over the material covered. The minimum passing grade for weekly and step written examinations is 70 percent. A final oral examination is administered by representatives of the local subcommittee for completion of steps 1 and 2B. A final oral examination is administered by the accrediting subcommittee at the completion of step 3. Should the trainee's progress prove to be unsatisfactory, the local and/or accrediting subcommittee may recommend additional training and examinations for steps 2B and 3.

Step 2A of the electrical training is administered during Student III, Step 2 of the NOTP. The minimum acceptable grade for weekly written examinations, step written examinations, and course average shall be 70 percent. The minimum acceptable grade for oral examinations shall be satisfactory as determined by the oral examination board.

b. Documentation

The following will be sent to Administrative Services, Training Records at the POTC:

(1) Each trainee's weekly examination score
(2) The original weekly examination if scored unsatisfactory (less than 70 percent) with another trainee's examination which is scored satisfactory.
(3) All final step written and oral examinations.

Refer to part VII of this procedure for QA record requirements.

5. Basic electrical theory and equipment training outline (step 1, 13 weeks)

   a. Basic electrical theory

   b. Print reading

   c. Components

   d. Electrical safety

   e. DC Circuits

   f. DC Equipment

   g. AC Principles

   h. AC Equipment

   i. Transformers

   j. Batteries

   k. Solid-state electrical theory

   l. Instrumentation

   m. Low-voltage AC systems

   n. Relays

   o. Plant systems

   p. Offsite power

6. In-plant electrical training outline (step 2A, two weeks classroom)

   a. Offsite power supplies

      (1) Common station service transformers
      (2) Start buses
      (3) 6.9-kV (4.16-kV), 480-V common boards

   b. Unit boards (6.9-kV, 4.16-kV, 480-V)

   c. Shutdown boards (6.9-kV, 4.16-kV, 480-V)

   d. Diesel generators

e. Batteries and chargers

f. Plant 250-Volt DC systems

g. Emergency lighting

h. Plant 120-V AC systems

i. Plant 125-Volt DC systems

j. Plant computer power systems

7. Unit operator upgrade electrical training outline (step 2B, four weeks)

a. Main generator

b. Main single line to pneumatic circuit breakers

c. Station service single line

d. Station service boards

e. Circuit breakers

f. Transformers

g. Station 120-Volt AC systems

h. Station batteries

i. Plant communication systems

j. Annunciator systems

k. Diesel generators

l. Miscellaneous plant systems and components

m. Operation of motors and generators

n. Plant clearance procedure

o. Plant operating instructions

p. Technical specifications for plant electrical systems

q. Electrical system safety

r. Control room operation of plant electrical systems

Ceneral Revision

8. ASE upgrade electrical training outline (step 3, six weeks)

   a. Main single line

   b. Main transformers

   c. Circuit breakers

   d. Motor-operated disconnects

   e. Relay protection

   f. Instrumentation and control

   g. In-plant low voltage (AC) systems

   h. Plant battery (DC) systems

   i. Plant lighting systems

   j. Procedures

   k. Communications

   l. Transformer and switchyard safety

F. Fire Brigade Member and Leader Training

Operators who are fire brigade members or leaders must meet certain requirements as to initial training, retraining, participation in fire drills, and medical certification of fitness for duty.

The Operator Training Group does not conduct fire training. The TVA Fire Training Center administers Fire Brigade Member and Fire Incident Command training, and the plant safety staff conducts fire training which is plant-specific.

1. Initial Training

   a. Each fire brigade member shall satisfactorily complete the Fire Brigade Member Course at the central fire training facility.

   b. Each fire brigade leader shall satisfactorily complete the Fire Incident Command Course at the central fire training facility.

2. Retraining

   a. Quadrennial Requirements

      (1) Each fire brigade member shall satisfactorily complete the Fire Brigade Member Course at the central fire training facility within four (4) years (+3 month extension) of the anniversary date of his/her initial training and every four (4) years (+3 month extension) thereafter.

      (2) Each fire brigade leader shall satisfactorily complete the Fire Incident Command Course at the central fire training facility within four (4) years (+3 month extension) of the anniversary date of his/her initial training and every four (4) years (+3 month extension) thereafter.

   b. Biennial Requirements

      Each fire brigade member or leader shall attend a minimum of six of eight quarterly classroom training sessions during a 2-year period. The classroom training provided as part of the annual refresher training will count for one of the required quarterly sessions each year (therefore, the biennial requirement will be satisfied by participation in four of eight quarterly classroom sessions along with two annual retraining sessions).

c. Annual Requirements

Each fire brigade member or leader shall be required to receive annual fire brigade refresher training. Each individual shall attend and satisfactorily complete the annual refresher training within twelve months (+25 percent extension) of his/her last Fire Incident Command or Fire Brigade Member training or previous years' annual refresher training. Plant-level refresher training shall not be required during any calendar year that the individual attends either the Fire Brigade Member or Fire Incident Command course.

3. Participation in Fire Drills

Each fire brigade member or leader shall participate in a minimum of two fire drills per year.[14] Should an individual not meet this requirement at the end of twelve months, he/she will be removed from the active duty list and must complete the annual refresher training in order to be reinstated.

4. Medical Examination

Each fire brigade member or leader shall receive a physical examination each year in order to certify his/her ability to withstand the strenuous duties of firefighting.

G. Fuel Handling and Inspection Certification

1. Purpose

This program was developed to ensure that fuel inspection and fuel handling operations at each of TVA's nuclear power plants are conducted safely and effectively by qualified personnel who are certified to perform these duties.

2. Description

a. General

The Operations Section Supervisor at each plant shall have the responsibility to see that all personnel assigned to conduct fuel inspection and fuel handling operations are certified to perform these duties.

[14]NRC requirement, 10 CFR 50, Appendix R, paragraph III.I.B.3.

b. Fuel Handling

(1) All personnel performing fuel handling operations shall possess the knowledge and experience required for the usage of fuel handling equipment. These personnel are under the direct supervision of the fuel handling supervisor, who shall hold a Senior Reactor Operator's License or an SRO license limited to fuel handling.

(2) The fuel handling supervisor is certified to oversee and perform fuel handling operations by virtue of possession of a Senior Reactor Operator's License or an SRO license limited to fuel handling.

(3) Other fuel handlers will be certified by a certified fuel handler after demonstrating correctly the manipulation of an actual or dummy fuel assembly using the requisite fuel handling equipment.

(4) Recertification in fuel handling is not required; however, the fuel handling crew will receive refresher training by performing equipment checkout as detailed in the plant's fuel handling instructions.

c. Fuel Inspection

(1) All personnel assigned to conduct fuel receipt inspections either shall be certified fuel receipt inspectors or shall be monitored under the close supervision of a certified fuel receipt inspector.

(2) To obtain certification in fuel inspection, a candidate must meet one of the following requirements:

(a) Satisfactory completion of a training class on fuel receipt inspection, which may consist of classroom lectures and/or "hands-on" experience in inspection procedures using a dummy assembly, or

(b) Experience acquired in working with a certified inspector during actual performance of all required inspections on a single shipping container and fuel assembly proper.

(3) Recertification in fuel inspection is required every two (2) years.

3. Prerequisites

Fuel handling supervisors shall hold a Senior Reactor Operator's License or an SRO license limited to fuel handling. Fuel receipt inspectors and fuel handlers shall be classified as Student IV operators or higher and shall be assigned to the operations section.

4. Evaluation and Documentation

Participation in this program shall be documented by a letter of certification which will be placed in the plant training file of each certified individual. Certification for fuel receipt inspection and fuel handling should be on separate forms. Refer to Part VII of this procedure for QA record requirements.

H. Miscellaneous Training

Operating personnel may be required to attend other training courses, such as General Employee Training (GET), First Aid, or new equipment training sessions.

I. Basic Nuclear Course

This course was provided to experienced fossil power plant operators transferring to a nuclear power plant. The course included instruction in reactor theory and operation. This course has been replaced by more effective courses, such as the Nuclear Power Plant Fundamentals Course.

J. Plant Technology Course

This course was provided to experienced fossil power plant operators transferring to a nuclear power plant. The course included instruction in plant-specific equipment and systems. This course has been replaced by more effective courses, such as the Plant Familiarization Course or Student II, Step 2 systems training.