CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

BRUNSWICK PLANT REACTOR OPERATOR REPLACEMENT TRAINING PROGRAM

TRAINING INSTRUCTION: TI-201

VOLUME I

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1.0 Purpose

The purpose of the Brunswick Operator Replacement Training Program is to ensure that operator replacement personnel are provided with sufficient formal and on-the-job training to meet or exceed the requirements of ANSI Standards N18.1-1971. Selection and Training of Nuclear Power Plant Personnel, and 10CFR55, Operator's Licenses. It is intended that graduates of this program be prepared to pass the NRC hot license examinations and operate the Brunswick plant in a safe and efficient manner.

2.0 Procedure

2.1 No single training program can account for the wide differences in prior training or experience that may be encountered by the prospective candidates of this program. To equalize the candidate's entry level, each candidate will satisfactorily complete the Auxiliary Operator qualifications prior to enrolling in this program. Exemptions to this and other prerequisites and to portions of the program may be granted by the Director - Training in accordance with the Training Unit's procedure.

2.2 The training program described in this instruction represents the minimum training for candidates having little or no previous nuclear experience. The Director - Training retains the option of giving entrance examinations to class candidates to determine their entry level and ability to complete the program. He may adjust the scope and content of various phases of the program to fit applicable NRC regulatory guides.

Prior to participating in an NRC license examination, each candidate will hold a high school diploma and will have at least two years of power plant experience, at least one year of which is nuclear power plant experience. The Operator Replacement Training Program is divided into four basic phases:

2.2.1 Classroom training

2.2.2 Simulator

2.2.3 RTGB on-the-job training

2.2.4 Simulator certification

Training is recommended in the above order but may be altered to fit special circumstances. The following is a description of each phase of training.

2.3 Phase 1: Classroom Training

This phase will consist of two classroom periods. The first period will last approximately six weeks and will include, but will not be limited to, the following topics:

2.3.1 Reactor Theory and Principles of Reactor Operation

2.3.1.1 Atomic and nuclear physics

2.3.1.2 Fission process

2.3.1.3 Neutron multiplication

2.3.1.4 Reactivity

2.3.1.5 Reactivity coefficients

2.3.1.6 Reactor control

2.3.1.7 Rod worth

2.3.1.8 Xenon, samarium, and control poison effects

2.3.1.9 Shutdown margin

2.3.2 Quality Assurance Responsibilities for Operations Personnel

2.3.3 Heat Transfer, Fluid Flow, Thermodynamics

2.3.3.1 Basic properties of fluid and matter

2.3.3.2 Fluid statics

2.3.3.3 Fluid dynamics

2.3.3.4 Heat transfer for conduction, convection, radiation

2.3.3.5 Change of phase--boiling

2.3.3.6 Burnout and flow instability

2.3.3.7 Reactor heat transfer limits

2.3.4 Radiation Control and Protection

2.3.4.1 Radiation and contamination

2.3.4.2 Biological effects

2.3.4.3 Time/distance, shielding

2.3.4.4 10CFR19, 10CFR20, 10CFR100

2.3.4.5 Monitoring systems and instruments

2.3.4.6 Radiation procedures

2.3.5 Chemistry

2.3.5.1 Chemistry control and limits

2.3.5.2 Chloride intrusion

2.3.6 Technical Specifications

2.3.6.1 Organization and format

2.3.6.2 Safety limits and limiting safety system settings

2.3.6.3 Discharge limits

The second classroom phase will last approximately 300 hours. This phase of training will consist of, but not be limited to, the following topics:

2.3.7 Design Features

2.3.7.1 Nuclear Steam Supply System

2.3.7.1.1 Reactor vessel and internals

2.3.7.1.2 Fuel

2.3.7.1.3 Recirculation System

2.3.7.1.4 Reactor Water Cleanup

2.3.7.2 Steam, Condensate, Feedwater, and related systems

2.3.7.3 Turbine-Generator and supporting systems

2.3.7.4 Safety systems

2.3.7.4.1 HPCI

2.3.11 Instrumentation and Control Systems

- 2.3.11.1 Nuclear Instrumentation
- 2.3.11.2 Reactor Manual Control
- 2.3.11.3 Rod Position Indication
- 2.3.11.4 Rod Worth Minimizer
- 2.3.11.5 Rod Sequence Control System
- 2.3.11.6 Recirculation Pump Speed Control
- 2.3.11.7 Electrohydraulic Control System
- 2.3.11.8 Reactor Vessel Level Control
- 2.3.11.9 Reactor Protection System
- 2.3.11.10 Primary Containment Isolation
- 2.3.11.11 Steam Leak Detection
- 2.3.11.12 ECCS Initiation and Control Logic

2.3.12 Standard and Emergency Operating Procedures

- 2.3.12.1 Administrative Procedure
  - 2.3.12.1.1 Duties and responsibilities
  - 2.3.12.1.2 Conduct of operations
  - 2.3.12.1.3 Overall plant operating procedures
- 2.3.12.2 Precautions and limitations
- 2.3.12.3 Overall plant operating procedures (GP-01 - GP-10)
- 2.3.12.4 Emergency Operating Procedures (flow paths)
- 2.3.12.5 Abnormal Operating Procedures
- 2.3.12.6 Emergency Response Plan and Plant Emergency Procedures

2.4 Phase 2: Simulator and Reactor Startup Experience

This phase of training may consist of two parts:

Part 1 - Simulator training, including simulator certification

The simulator training phase will last approximately 300 hours. The general concept of the simulator training will be to enhance the ability of candidates to competently operate the Brunswick plant during normal operation and analyzed transient conditions.

Instruction during this period shall include:

2.4.1 Standard and emergency operating procedures.

2.4.2 Plant transients.

2.4.3 Accident identification and analysis, including trending.

2.4.4 Controlling the plant from a central Control Room during normal, abnormal, and emergency situations.

2.4.5 Operating philosophy, use of procedures, shift and relief turnover, and verification of system status.

As a minimum, the license candidate shall participate in training sessions that include the following manipulations:

2.4.6 Plant or reactor startups, to include a range that reactivity feedback from the nuclear heat addition is noticeable and heatup rate is established

2.4.7 Plant shutdown

2.4.8 Manual control of feedwater during startup and shutdown

2.4.9 Standby liquid control use during power operation

2.4.10 Any significant (10 percent) power changes due to manual changes in control rod position or recirculation flow

2.4.11 Any reactor power change of 10 percent or greater where load change is performed with load limit control or where flux, temperature, or speed control is on manual

2.4.12 Loss of coolant including:

2.4.12.1 Inside and outside primary containment

2.4.12.2 Large and small, including leak rate determination

2.4.13 Loss of instrument air if simulated plant-specific

2.4.14 Loss of electrical power or degraded power sources (or both)

2.4.15 Loss of core coolant flow/natural circulation

2.4.16 Loss of condenser vacuum

2.4.17 Loss of service water

2.4.18 Loss of shutdown cooling

2.4.19 Loss of component cooling system or cooling to an individual component

2.4.20 Loss of normal feedwater or normal Feedwater System failure

2.4.21 Loss of all feedwater (normal and emergency)

2.4.22 Loss of Protective System channel

2.4.23 Mispositioned control rod or rods (or rod drops)

2.4.24 Inability to drive control rods

2.4.25 Fuel cladding failure or high activity in reactor coolant or off-gas

2.4.26 Turbine or generator trip

2.4.27 Malfunction of automatic control system(s) which affect reactivity

2.4.28 Malfunction of reactor coolant pressure/volume control system

2.4.29 Reactor trip

2.4.30 Main steam line break (inside or outside containment)

2.4.31 Nuclear instrumentation failure(s)

Participants will be in groups of no more than four people manipulating the controls or directing the activities of individuals during plant exercises. Successful completion of the simulator exercises provides evidence for qualification.

Part 2 - University Reactor Startup Experience (Optional)

The university training will provide the candidates with observations of nuclear instrumentation responses during subcritical multiplication, approach to criticality, and subcritical operation. Also included in this program are experiments concerning radiological and chemistry topics. This training will last approximately five days and will normally be scheduled after completion of Phase 1 classroom training.

2.5 Phase 3: RTGB On-the-Job Training

After the candidates successfully complete approximately 200 hours of simulator training, they will be assigned to the Operations group for a minimum of 12 weeks' RTGB on-the-job training. During this period, the candidate will operate the Brunswick plant under the instruction of a licensed Control Operator. Evolutions will be documented by the candidate and reviewed daily by the duty Control Operator. Successful performance on the job and completion of simulator exercises complete the candidate's practical qualifications.

2.6 Phase 4: Simulator Certification

A simulator final certification will be provided, to include the minimum requirements as listed in ANSI-3.1-1981 (5.2.1.3.2), such that the candidate must competently demonstrate the ability to:

2.6.1 Manipulate controls in a safe and competent manner.

2.6.2 Predict instrument response and use the instrumentation available.

2.6.3 Follow facility procedures.

2.6.4 Understand alarms and annunciators and take proper action.

2.6.5 Communicate promptly and effectively.

3.0 <u>Responsibility</u>

3.1 Manager - Operations

The selection of candidates will be the responsibility of the Manager - Operations and the Director - Training. No more than 12 candidates will be selected to enter the simulator phase of this training program.

3.2 Director - Training

3.2.1 The Director - Training will be responsible to the Manager - Nuclear Training Section.

The Director - Training will be responsible for the following (concerning operator training):

3.2.1.1 The execution and overall conduct of the Operator Replacement Training Program

3.2.1.2 Timely initiation of license applications for the NRC hot license examinations

3.2.1.3 Determination of the duration and content of Hot License Training Program

3.2.2 The Director - Training or designated assistant will be responsible to the Manager - Nuclear Training Section for the proper maintenance of records pertaining to this training program, including:

3.2.2.1 Copies of study material, lesson plans, and instructional aids.

3.2.2.2 Copies of examinations administered and the answers provided by the candidates.

3.2.2.3 Lecture attendance and grade sheets.

3.2.2.4 Training reports as required.

3.3 Shift Operating Supervisors

Shift Operating Supervisors will be responsible for the supervision of training during Phase 3 for candidates assigned to their shifts and will provide final evaluation of candidates' performance based on simulator exercises and performance as an extra man on shift.

4.0 Documentation

Documentation of training obtained under this procedure will be kept on file in accordance with plant filing instructions. It will be used to substantiate information on license applications and certifications.

5.0 Student Evaluation

Evaluations for student performance will occur at frequent intervals. Evaluation methods will consist of the following methods:

5.1 Weekly examinations

5.2 Six-week theory final examination

5.3 North Carolina State University test reactor examination

5.4 Twelve-week final examination

5.5 Weekly simulator examinations

5.6 RTGB on-the-job training evaluation

5.7 Final certification examination (written, simulator, and oral)