FLORIDA POWER AND LIGHT COMPANY
TURKEY POINT UNITS 3 AND 4
ADMINISTRATIVE PROCEDURE 0300
NOVEMBER 19, 1981

1.0 Title:

HOT LICENSE OPERATOR TRAINING PROGRAM

2.0 Approval and List of Effective Pages:

2.1 Approval:

Reviewed by Plant Nuclear Safety Committee: 81-77

and Approved by Plant Manager - Nuclear: 11/19/81

2.2 List of Effective Pages:

Page	Date	Page	Date	Page	Date	Page	Date
1	11/19/81	10	11/19/81	19	11/19/81	28	11/19/81
2	11/19/81	11	11/19/81	20	11/19/81	29	11/19/81
3	11/19/81	12	11/19/81	21	11/19/81	30	11/19/81
4	11/19/81	13	11/19/81	22	11/19/81	31	11/19/81
5	11/19/81	14	11/19/81	23	11/19/81	32	11/19/81
6	11/19/81	15	11/19/81	24	11/19/81	33	11/19/81
7	11/19/81	16	11/19/81	25	11/19/81	34	11/19/81
8	11/19/81	17	11/19/81	26	11/19/81	35	11/19/81
9	11/19/81	18	11/19/81	27	11/19/81	36	11/19/81

3.0 Scope:

3.1 Purpose:

A positive commitment to training by management will provide the most successful training processes. Written procedures and policy will provide the necessary consistency and prevent misunderstanding of goals and actions.

This procedure provides the instructions and guidelines for the selection, education, training, testing, and procurement of NRC Reactor or Senior Reactor Operator Licenses for the licensed control room positions on Turkey Point Units 3 and 4.

3.2 Discussion:

Enthusiastic, highly qualified, fully trained, copiously proficient licensed reactor and senior reactor operators for the positions of reactor control operator, nuclear watch engineer, and nuclear plant supervisor are absolutely necessary if Turkey Point Units 3 and 4 are to be operated in a safe, synergistic, efficient and reliable manner. Upon completion of this program the successful hot license candidate will be competent in the following:

3.2.1 An understanding of the fundamental principles of the disciplines which relate to his responsibilities.

3.2.2 A knowledge of the systems, components, and instruments over which he has responsibility and control.

3.2.3 A knowledge of applicable plant normal and emergency operating procedures, including administrative, regulatory and licensing conditions.

3.2.4 A skill in manipulation of plant controls.

3.2.5 A knowledge of plant response to various normal and casuality transients, including prevention and mitigation thereof.

The objective is to develop licensed operators who abundantly possess these above skills such that the company can realize the greatest return from its personnel, capital and plant resources.

3.3 Definitions:

3.3.1 Hot License Candidate - An FPL employee who has met the screening, and seniority requirements and has been selected by the plant management to attend the hot license class and prepare him/her self for the position of licensed reactor operator (RCO).

3.3.2 Reactor Operator License - Authorization by the Nuclear Regulatory Commission for an individual to manipulate the controls of the nuclear facility for which he is licensed, pursuant to Title 10, Code of Federal Regulations, Part 55, "Operators' Licenses".

3.3.3 Senior Reactor Operator License - Authorization by the Nuclear Regulatory Commission for an individual to direct the licensed activities of licensed operator or the nuclear facility for which he is licensed, pursuant to Title 10, Code of Federal Regulations, Part 55, "Operators' Licenses".

4.0 Precautions:

None

5.0 Responsibilities:

5.1 The Training Supervisor's responsibilities include the following:

5.1.1 Designating the hot license training instructor.

5.1.2 Prior to the beginning of classes for a new hot license group, the training supervisor will meet with the designated hot license training instructor and review the course schedule, content, and training material to insure that the training program reflects a course that will develop competent licensed operators, satisfies current NRC regulations, and includes recent plant modifications and procedure changes.

5.1.3 Review and critique training progress, in particular define and provide assistance to the hot license training instructor for specific training deficiencies or student problems as observed or requested by the instructor.

5.1.4 Provide assistance to the Training Instructor in keeping cognizant of new topics and areas of emphasis for the hot license class.

5.1.5 Make final determinations for dropping candidates from the program because of failure to meet performance standards.

5.1.6 Make final determinations for candidates' application to the NRC for license examination.

5.1.7 Make final decisions on those candidates eligible for Senior Reactor Operator.

5.1.8 Establish with the assistance of the Hot License Training Instructor additional course requirements for potential Senior Reactor Control Candidates.

5.1.9 At the conclusion of the preceding Hot License Class, (or when the need exists) the Training Supervisor will post job notices, schedule the screening processes, interview and select personnel for the next hot license class, based on bargaining unit contract procedures. The number of candidates desired and approval by management services, if necessary, will be the responsibility of the Plant Supervisor of Nuclear Operations based on his projected licensed personnel needs.

5.1.10 Development of training material.

5.1.11 Periodically review the hot license program and incorporate improvements.

5.2 The Hot License Training Instructor shall be responsible for:

5.2.1 Maintaining his NRC Senior Reactor Operator license current per the requirements of Administrative Procedure 0301, Licensed Operator Requalification Program.

5.2.2 Scheduling, coordinating and conducting all aspects of the hot license program.

5.2.3 Provide interface with other departments and vendors for full utilization of departmental expertise for the benefit of the hot license group.

5.2.4 Preparation of lesson plans and presentation to class.

5.2.5 Preparation and/or evaluation of both written and oral examinations administered during the program, and review of examinations/ evaluations provided by other departments.

5.2.7 Maintaining required documentation for each hot license candidate.

5.2.8 Reports to the Training Supervisor concerning candidate concerns and problems and failure of candidate(s) to meet performance standards.

5.2.9 Making recommendations for Reactor Operator and Senior Reactor Operator License examination applications.

5.2.10 Schedule medical exams.

5.2.11 Making application to NRC for license examinations.

5.3 The Hot License Candidate shall be responsible for:

5.3.1 Attending lectures, examinations, simulator training and on-shift training as scheduled.

5.3.2 Conducting him or herself in an alert and courteous manner, participating in class discussions and cooperating fully with the instructor and fellow class members.

5.3.3 Completing all required homework by due date.

5.3.4 Completing the hot license candidate sign-off qualification manual by the scheduled due dates.

5.3.5 Maintain an average grade of 80% or higher on written exams.

5.3.6 Scoring 80% or higher overall on written exams and 70% or higher on each section.

5.3.7 Meet or exceed specified performance standards.

5.3.8 Insuring the use of current controlled documents.

5.3.9 Maintain the classroom in a neat and orderly manner.

6.0 References:

6.1 10 CFR 50

6.2 10 CFR 55

6.3 ANS 3.4/ANSI N546

6.4 ANS 3.1

6.5 NUREG 1750

6.6 NUREG 0737

6.7 Institute of Nuclear Power Operations - Guidelines for Qualification Programs at Operational Units

6.8 Institute of Nuclear Power Operations - Nuclear Power Plant Training Personnel

6.9 Turkey Point Plant Hot License Group Seven Class Schedule

7.0 Records and Notifications:

7.1 Records of the following will be maintained by the Nuclear Training Department and transferred to Document Control upon acquisition of an NRC license by the candidate:

7.1.1 Master copies of all written exams and answer keys (does not include quizzes)

7.1.2 Candidate's completed exams.

7.1.3 Candidate's oral evaluations.

7.1.4 Candidate's completed qualification book.

7.1.5 Screening results

7.1.6 Copies of the NRC license application including NRC 396 forms, Resumes, and other 10 CFR 55 requirements. (Copies of these documents also retained by Q. C.)

7.1.7 Simulator training records.

8.0 Instructions:

8.1 Selection

8.1.1 Qualifications

In order to meet the requirements specified by the Nuclear Regulatory Commission and to provide the Company with competent operators, the following specific minimum requirements shall be met for selection as a Reactor Control Operator Hot License Candidate.

1. Education must be a high school graduate or have successfully completed the general education development (GED) test.

2. Medical must be able to pass the Florida Power and Light Company Medical Exam, the NRC Form 396 medical exam and the guidelines of the current revision of ANS 3.4/ANSI N546, "American National Standard Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants".

3. Experience

(1) Reactor Operator - shall have by the conclusion of the hot license training program at least 2 years of power plant experience, 1 year of which shall be nuclear power plant experience. Experience should be evaluated on a case-by-case basis within the guidelines of ANS 3.1 and current NRC regulations.

(2) Senior Reactor Operator - shall have the conclusion of the hot license course or SRO upgrade training 4 years of resposible power plant experience (a maximum of 2 years which can be fulfilled by acedemic or related technical training on a one for one basis), 2 years shall be nuclear power plant experience - 6 months of which shall be on the Turkey Point units. The SRO candidate shall also be required to have at least 1 year experience in a licensed capacity at a nuclear power plant. This 1 year license experience may be waived if the candidate is a degree holding engineer and has completed a "cold license" training course as prescribed by the applicable revision of ANS 3.1.

4. Screening

The applicant will be required to take and pass a screening exam. This examination will be administered and evaluated by an independent organization, organized for this purpose without affiliation to Florida Power and Light Company. The minimum score for passing will be determined by the Nuclear Training Supervisor using appropriate data from the screening organization to determine a reasonable probability of meeting the NRC examination requirements.

8.1.2 Selection Process

Candidates will be selected through the normal bargaining unit job bidding process as illustrated in the Appendix A flow chart. Selection will be based upon seniority of those who meet or exceed the minimum qualification requirements. In the event that an insufficient number of candidates are provided by this bidding process, a selection process (Appendix A) will be utilized to obtain the balance of personnel required to fill the hot license class, still however, maintaining the required minimum qualifications.

8.1.3 NRC Reactor and Senior Reactor Operator License Application

Sixty days prior to the scheduled date for the NRC simulator/plant examinations, application will be made to the NRC for administering the license examinations. 10 CFR 55 specifies the material that must be included in the application. Application will be made to the NRC only for those candidates who are satisfactorily passing the course work, those who fail to satisfactorily complete the course after application has been made, will be denied permission to sit for the NRC examinations. At the discretion of the Nuclear Training Supervisor, if a particular candidate exceeds the Reactor Operator minimum standards to such an extent that he is a viable Senior Reactor Operator candidate, and meets the additional minimum experience qualifications (8.1.1.3) he may be allowed application to the NRC for the Senior Reactor Operator license examination. This will be provisional on his completing additional training requirements as determined by the Training Supervisor. These additional requirements will be at a minimum, additional self study to broadening his knowledge of all aspects of theory and plant operation and passing a written and oral FPL Senior Reactor Operator examination.

8.2 Hot License Training Program

8.2.1	Classroom	39 weeks
	Mathematics	2 weeks*
	Reactor Theory	5 weeks*
	Reactor Chemistry	1 week*
	Heat Transfer and Fluid Flow	3 weeks*
	Materials Science	1 week*
	Health Physics	1 week*
	Plant Systems	12 weeks*
	Operating Procedures Training	4 weeks*
	Administrative Procedures and Requirements	1/2 week*
	Recent Operating experiences	1/2 week*
	Mitigating Core Damage and Transient Analysis	2 weeks*
	Final Review	7 weeks*

*Time allotments shown are for guidance, they may be adjusted as necessary at the discretion of the Hot License Training Instructor.

8.2.2	Simulator	6 weeks
	Control Room Familiarization	
	Start-up Training	
	Transient/Casualty Training	
	NRC Evaluations	
8.2.3	On-Shift Training	20 weeks
	On-Shift Nuclear Operator Training	3 weeks
	On-Shift Health Physics Phase	1 week
	On-Shift Turbine Operator Training	2 weeks
	On-Shift Control Room Training (extra person in Control Room)	14 weeks

8.3 Hot License Candidate Evaluation

8.3.1 Quizzes - Short written quizzes, usually essay type question, given periodically, usually without notice at the discretion of the instructor.

8.3.2 Tests

Written - Comprehensive exams given at the conclusion of various segments of the course, generally at time intervals not to exceed 3 weeks. These exams will generally be constructed and graded in the NRC format.

Oral - NRC type oral examinations are to be administered to each candidate, preferably one-on-one, by the training instructor or his designee. These examinations are to be administered as frequently as possible at the discretion of the training instructor. A minimum of 6 of these examinations shall be given throughout the course.

8.3.3 FPL Final Examinations:

Written - NRC type examination written and administered by the Nuclear Training Department at the conclusion of the Training Course.

Oral - NRC type examination administered by SRO licensed personnel of the Nuclear Training Department or members of plant management currently holding SRO licenses and designated by the Nuclear Training Supervisor. These examinations are to be administered at the conclusion of the hot license training course prior to the NRC examinations.

8.3.4 FPL Reactor Operator Qualification Manual

The purpose of this manual is to provide the candidate with a guide for acquiring a practical knowledge of systems, theory, technical specifications, procedures and plant evolutions. Each system, procedure and evolution will require a signature from a specified license holder, all signatures shall be obtained prior to the FPL final written exam. This manual will become a permanent part of the candidates training records. This book when utilized fully, will aid the candidate greatly in perfecting his operational and oral communications skills.

8.3.5 Homework

Homework will periodically be assigned by the Training Instuctor, usually time will be available during class, however, like studying for exams, sometime maybe required outside of class for completion of homework. This homework will range from short projects to NRC type essay questions and answers.

8.3.6 Simulator

The candidate will be evaluated throughout simulator training by the simulator staff and the hot license training instructor. This evaluation will include the candidates knowledge of systems, procedures, concepts, transients, casualties, reactor theory, heat transfer and fluid flow; basically the candidate will be evaluated on his ability to put into practice the previously learned subjects.

8.4 Performance Standards

8.4.1 Minimum Requirements

1. Quizzes - 80% considered passing

2. Tests

Written - 80% overall and 70% per section considered passing

Oral - Evaluation made by interviewer to be satisfactory, marginal or unsatisfactory. Marginal and satisfactory considered passing.

3. FPL Final Examinations

Written - 80% overall and 70% per section considered passing

Oral - Evaluation made by interviewer to be satisfactory, marginal or unsatisfactory. Marginal and satisfactory considered passing.

4. FPL Reactor Operator Qualification

   Manual - Completion of all signatures by assigned due dates.

5. Homework - Completion of all homework on assigned due dates.

6. Simulator - The candidate must show a proficiency in routine and casualty plant operations, procedures, plant responses, reactor theory, systems, heat transfer, and fluid flow to the simulator staff and/or the Nuclear Training Department representative.

7. Course Average - The student must maintain an overall average of 80% when all written tests (not quizzes) are averaged.

8.4.2 Failure to meet Standards

1. Quizzes - Failure to make an 80% or higher grade on a quiz will result in a make up quiz, or additional homework in that subject as determined by the instructor.

2. Tests

   Written - Failure to pass a written test will result in probation, failure of two tests in a row will result in being dropped from the course. Probation at the option of the instructor will result in additional homework or make-up test(s) to aid the student in any deficiencies.

   Oral - Failure to pass an oral examination will result in additional oral examinations, if after additional orals are given insufficient improvement is made, further evaluation will be made by the Nuclear Training Supervisor. This evaluation will consider the candidate's written test average, skills in oral communications, and any other material variables. The Training Supervisor has the option to drop the candidate at this point.

8.4.3 FPL Final Examinations:

Written - Failure to meet the minimum required grades will constitute failure of the course and withdrawal of the NRC license application. However, in the event that a candidate has continuously met or exceeded all other performance standards he/she may be given a final make up exam in the sections with scores less than 70%, and if scores of 80% or greater are obtained, and when averaged with the balance of the original exam average 80% or greater, then the student will be considered to have passed the course and allowed to take the NRC exam. It should be noted that due to scheduling problems this option may be impossible and would require the candidate to re-apply to the NRC for an examination at a later date. These options are at the discretion of the Nuclear Training Supervisor and approval from the Nuclear Plant Manager, however, failure to meet the make-up exam criteria will result in being dropped from the course.

Oral - Failure to pass the final oral exam will require further evaluation by SRO members of the Nuclear Training Department. Based on previous records and the combined evaluations of the interviewers a determination will be made by the Nuclear Training Supervisor, if he decides to let the student sit for the NRC examination approval must be obtained from the Nuclear Plant Manager. A negative determination by the Nuclear Training Supervisor will result in being dropped from the course.

8.4.4 FPL Reactor Operator Qualification Manual

Satisfactory completion of the RCO training course will require completion of all signatures in the qualification manual, therefore, failure by the candidate to acquire all signatures will result in being dropped from the course. If a candidate becomes significantly behind schedule in obtaining the required signatures, and is unable to provide the training department with a reason, he will be given a two week period to show improvement. If no improvement is shown the candidate will be dropped from the program.

8.4.5 Homework

Homework is an important phase of the learning process and required as part of class, failure to do so will result in being immediately dropped from the course.

8.4.6 Simulator

The candidate must satisfactorily complete simulator training prior to taking the NRC simulator exam, failure to do so will result in being dropped from the course.

8.4.7 Course Average

A student with a written test average of less than 80% will be placed on probation. Failure of any two exams and an overall grade average of less than 80% will result in an automatic drop from the course (see 8.4.2.2 Tests for probation responsibilities).

8.5 Recommended Schedule

The following is a suggested outline for the sequence of presentation of course material, tests, on shift time, simulator training, NRC examinations and approximate time allocation for each. Due to problems in scheduling simulator time adjustments may be required, however, scheduling simulator time well in advance will greatly enhance the ability to schedule as desired.

WEEK 1 - Mathematics, Test No. 1

WEEK 2 - Mathematics, Test No. 2

WEEK 3 - Primary Plant Systems

WEEK 4 - Primary Plant Systems, Test No. 3

WEEK 5 - Primary Plant Systems

WEEK 6 - Primary Plant Systems, Test No. 4

WEEK 7 - Primary Plant Systems,

WEEK 8 - Primary Plant Systems, Test No. 5

WEEK 9 - Primary Plant Systems

WEEK 10 - On-Shift N. O. Training and Oral Evaluations

WEEK 11 - On-Shift N. O. Training and Oral Evaluations

WEEK 12 - On-Shift N. O. Training and Oral Evaluations

WEEK 13 - Test No. 6 (N.O. Final Exam), Secondary Plant Systems

WEEK 14 - Secondary Plant Systems

WEEK 15 - Secondary Plant Systems

WEEK 16 - On-Shift T. O. Training and Oral Evaluations

WEEK 17 - On-Shift T. O. Training and Oral Evaluations

WEEK 18 - Test No. 7 (T.O. Final Exam), Health Physics

WEEK 19 - On-Shift Health Physics Training

WEEK 20 - Test No. 8 (H.P. Final) Materials Science

WEEK 21 - Reactor Theory, Test No. 9

WEEK 22 - Reactor Theory

WEEK 23 - Reactor Theory, Test No. 10

WEEK 24 - Reactor Theory

WEEK 25 - Reactor Theory

WEEK 26 - Test No. 11 (Reactor Theory Final), Control and Protection Systems

WEEK 27 - Reactor Control and Protection Systems

WEEK 28 - Reactor Control and Protection Systems, Test No. 12, Reactor Chemistry

WEEK 29 - Test No. 13 (Reactor Chemistry), Heat Transfer and Fluid Flow

WEEK 30 - Heat Transfer and Fluid Flow, Test No. 14

WEEK 31 - Heat Transfer and Fluid Flow

WEEK 32 - Test No. 15 (HT and FF Final), Operating Procedures and Technical Specifications

WEEK 33 - Operating Procedures and Technical Specifications, Test No. 16

WEEK 34 - Operating Procedures and Technical Specifications

WEEK 35 - Operating Procedures and Technical Specifications

WEEK 36 - Test No. 17, Mitigating Core Damage and Transcient Analysis

WEEK 37 - Mitigating Core Damage and Transcient Analysis

WEEK 38 - Test No. 18, Administrative Procedures, Recent Operating Experiences

WEEK 39 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 40 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 41 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 42 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 43 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 44 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 45 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 46 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 47 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 48 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 49 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

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WEEK 50 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 51 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 52 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 53 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 54 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 55 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 56 - On-Shift Control Room Training, Oral Evaluations and 4 Weeks Simulator Training Per Student

WEEK 57 - FINAL REVIEW

WEEK 58 - FINAL REVIEW

WEEK 59 - FINAL REVIEW

WEEK 60 - FINAL REVIEW

WEEK 61 - FINAL REVIEW

WEEK 62 - FINAL REVIEW

WEEK 63 - Florida Power and Light Co. Written and Oral Final Reactor Operator Examinations

WEEK 64 - Simulator Training

WEEK 65 - Simulator Training and NRC Simulator Examinations

WEEK 66 - Review

WEEK 67 - NRC On-Site Examinations

8.6 Course Content

8.6.1 Classroom

1. Mathematics

(1) Topics

Whole Numbers
Fractions
Decimals
Ratio, Proportion and Variation
Percent
Measurement
Signed Numbers
Metric System and Unit Conversion
Scientic Notation
Algebraic Expressions
Algebraic Fractions
Linear Equations
Fractional Equations
Formulas
Systems of Equations
Exponents, Powers and Roots
Common Logarithms
Evaluation of Log Formulas
Introduction to Base e
Evaluation of Natural Log Formulas
Natural Logarithm Applications
Linear Graphs
Semi-Log Graphs
Interpreting Charts and Graphs
Introduction to Trigonometry
Intregal and Derivative Functions and Graphs

8.6.2 Reactor Theory

1. Topics

Atomic Nomenclature

Neutrons
Protons
Electrons
Nucleous
Atoms
Elements
Compounds
Molecule
Atomic Number
AMU
Avagardro's Number
Bohr Model

Atomic Mass Number
Atomic Weight
Gram Atomic Weight
Gram Molecular Weight
Electron Shells
Isotopes
Isotones
Isobars
Isomers
Ionization
Ion Pairs
Kinetic Energy
Electron Volt
Photon
Gamma
Xray
Alpha
Curie

Physics of Atoms

Nuclear Forces
Coulombic Forces
Mass Defect
Binding Energy
Nuclear Stability
Excitation Energy
Critical Energy
Radioactivity
Radioactive Decay
Atomic Concentration

Physics of Neutrons

Energy Classifications
Prompt and Delayed
Microscopic and Macroscopic Cross Sections
Slowing Down Length
Thermal Diffusion Length
Migration Length
Mean Free Path
Neutron Flux
Moderator Properties
Neutron Sources
Reflectors - Absorbers

Nuclear Reactions

Elastic
Inelastic
Radioactive Capture
Particle Ejection
Fission

The Fission Process

- Liquid Drop Model
- Fission Fragments
- Neutron Yield
- Beta Decay
- Gamma Reactions
- Energy Liberated
- Six Factor Formula
- Fuels
- Reaction Rate
- Power and Power Density
- Depletion Rate

Reactor Kinetics

- Reactivity
  - Coefficients
  - Temperature Effects
  - Fuel Effects
  - Core Age Effects
  - Pressure Effects
  - Fission Product Poison Effects
  - Voiding Effects
  - Soluble Poison Effects
  - Burnable Poison Effects
- Excess Multiplication Factor
- Subcritical Multiplication
- Inverse Count Rate Plots
- Subcritical
- Critical
- Super Critical
- Prompt Critical
- Delayed Neutron Fractions
- Generation Times
- Reactor Period and Startup Rate
- Reactor Transient Equations
- Reactor Transient Behavior
- Doppler Effects

Reactor Operation

- Reactor Startup
- Reactor Shutdown
- Operating Limits
- Power Distribution and Peaking Factors
- Estimated Critical Conditions and Reactivity Balances
- Calorimetrics
- Transients
- Fuel Cycles

8.6.3 Reactor Chemistry

1. Topics

Introduction to Chemistry
Valence
Periodic Chart
Compounds
Radicals
Molecular Weight
Mole
Chemical Equations
Water
Hydrates
Solutions and Solubility
Electrolyte
Acids
Bases
Salts
Reaction Rates and Equilibrium
Reversibility
Hydrolysis
Buffer Solutions
Concentration
Dilution
Gases
- Boyles Law
- Charles Law
- Ideal Gas Law
- Avogardo's Law of Gases
- Dalton's Law of Partial Pressure
- Solubility

Ion Exchangers
- Purpose
- Resins
- Types

Oxidation
Radiation Effects on Water
- Ionization
- Gamma

Corrosion
- General
- Localized
- Galvanic
- Pitting
- Zircalloy

Radiochemisty
Primary Chemistry Control and Limits
Secondary Chemistry Control and Limits
Sampling Techniques and Equipment
Post Accident Chemistry Considerations

8.6.4 Heat Transfer and Fluid Flow

1. Topics

Basic Properties of Fluids and Matter

- Dimensions and Units
- Properties
- Heat
- Work
- Energy
- Internal Energy
- Steam Tables
- Saturated Liquids
- Saturated Vapor
- Subcooled Liquid
- Superheated Vapor
- Latent Heat
- Sensible Heat
- Enthalpy
- Quality and Void Fraction
- Open and Closed Systems
- Gas Relationships

Fluid Statics

- Pressure
- Temperature
- Volume
- Pascal's Law
- Potential Energy

Fluid Dynamics

- Viscosity
- Reynolds Number
- Friction Losses
- Laminar Flow
- Turbulent Flow
- Flow Energy
- First Law of Thermodynamics
- General Energy Equation
- Bernollis Principle
- Venturis - Orifices
- NPSH
- Carry Over
- Carry Under
- Two Phase Flow
- Application
  - Turbines
  - Pumps
  - Heat Exchangers
  - Reactor Plants

Heat Transfer

- Conduction
- Connection
  - Forced
  - Natural
- Radiant

Change of Phase

- States of Matter
- Enthalpy
- Entropy
- Second Law of Thermodynamics
- Carnot Cycle
- Rankine Cycle
- Efficiency
- Reactor Plant Application
- Heat Balances

Burn Out and Flow Instability

- Boiling Water Curve
- Critical Heat Flux
- DNBR
- Hot Channel Factors
- Two Phase Flow - Voids
- Reflux
- Vapor Binding

Reactor Heat Transfer Limits

- Core Thermal Limits
- Fuel and Reactor Design
- Peaking Factors
- Axial and Radial Flux
- Transient Effects
- Accident Criteria

8.6.5 Materials Science

1. Topics

- Structure of Metals
- Properties of Metals
- Alloying and Alloys used in plant
- Plant Materials Selection and Application
  - Basis
  - Limitations
- Brittle Fracture
  - Characteristics
  - Analysis
    - Charpy V-Notch Test

Minimum Pressurization Temp.
RTNDT
Irradiation Effects
Heat-up/Cooldown Limitations
Specific Plant Material Problems
Fuel Densification
Steam Generator Tube Denting
Effects from fuel burnup

8.6.6 Health Physics

1. Topics

Radiation and Radioactive Decay

Alpha
Gamma
Beta
Neutron

Units of Measurement

Roentgen
Rad
Rem
Dose
Dose Rate

Methods of Detection and Measurement

Dosimeters
TLD
Portable Instruments
Bioassays
Whole Body Scan
Process Radiation Monitors
Area Radiation Monitors
Laboratory Instruments
Air Sample
Swipes
Liquid Samples

Detector Principles of Operation
Detector Curve
Gas Filled Detectors
Scintillation Detectors
Personnel Detectors

Biological Effects of Radiation
Internal Hazards
External Hazards
FPL Guidelines
NRC Limits
Emergency Limits

Principles of Radiation Protection

- Methods of Reducing Exposure
  - Time
  - Distance
  - Shielding
- Radiation Source Calculations
  - Point Source
  - Line Source
  - Plane Source
- Contamination
  - Types
    - Airborne Particulate
    - Liquid
    - Gaseous
    - Loose Surface
    - Fixed Surface
  - Protective Clothing
  - Respirators
  - Decontamination
- Posted Areas
  - Radiation Controlled Area
  - Radiation Area
  - High Radiation Area
  - Locked High Radiation Area
  - Hot Spot
  - Contaminated Area
  - Airborne Radioactivity Area
- Survey Maps
- Radiation Work Permits
- Radiation Exposure Report
- Radiation Exposure Extension Request
- Health Physics Manual
- Health Physics Procedures

8.6.7 Plant Systems

1. Goals

System training will provide the candidate with a knowledge of the following concepts for each of the listed systems.

- Purpose
- Design Bases
- Components
  - Location
  - Characteristics
- Power Supplies
- Associated Precautions, Limitations, Setpoints and Bases
- System Interrelationships

Automatic Functions
Alternate Modes of Operation
Associated Instrumentation, Alarms, Indications and Controls
Failure Modes
Related Modes
Related Technical Specifications
Normal, Off-Normal and Emergency Operating Procedures
Surveillance Procedures

2. Topics

Primary Systems

Reactor Coolant Systems
Pressurizer
Pressurizer Relief Tank
Reactor Vessel, Core and Internals
Reactor Coolant Pumps
Steam Generators
CVCS - Charging and Letdown
CVCS - Makeup and Boron Control
Primary Water System
CVCS - Boron Recycle
Lo-Head Safety Injection
Hi-Head Safety Injection
Passive Safety Injection
Residual Heat Removal System
Emergency Containment Coolers, Filters and Sprays
Ventilation Systems - Containment, Aux. Building, Control Room and Containment Purge
Containment and Aux. Building Structure
Containment Hydrogen Control System
Spent Fuel Pit and Cooling System
Component Cooling System
Sampling System
Heat Tracing
Waste Disposal System - Liquid
Waste Disposal System - Gas
Waste Disposal System - Solid
Primary Process Instrumentation
Process Radiation Monitoring System
Area Radiation Monitoring System
Nitrogen Back-up Systems
Breathing Air System
Fuel Handling System
Electrical Systems
Emergency Diesel Generators

Secondary Systems

Main Steam
Reheat/Extraction Steam
Auxiliary Steam and Condensate Recovery
Turbine, Turbine Oil, Gland Seal and Cylinder heating Systems
Auxiliary Feedwater System
Steam Dump Systems
Steam Generator Blowdown System
Generator and exciter, Gas and Seal Oil Systems
Turbine Generator, Control and Logic
Condensate System
Feedwater System
Drain and Vent Systems
Turbine Plant Cooling Water System
Instrument and Service Air
Service Water
Amertap
Compressed Gas
Fire Protection
Secondary Process Instrumentation and Control
Secondary Sampling
Intake Cooling Water System
Circulating Water System
Intake Systems
Water Treatment Plant

Reactor Control and Protection

Rod Control
Rod Position Indication
Excore Nuclear Instrumentation
Incore Instrumentation
Safeguards
Bus Stripping and Sequencer
Reactor Protection Logics
Misc. Control Diagrams
Misc. Protection Logics
EWD's
Overpressure Mitigation System
RCS Level Indication and Head Vent
Containment Level and Sump Level Indication
Safety Valve Monitoring System
Subcooled Margin Monitor
Technical Support Center and Instruments
Fire Monitoring
Plant Data Processor
Communications Systems
10 CFR 50 Appendix I Instruments
Post Accident Sampling System
Post Accident Monitoring Systems (PAMS)
Safety Parameter Display System (SPDS)
Metal Impact Monitoring System

8.6.8 Operating Procedures Training

1. Topics

The following procedures will give the student a knowledge of normal, off-normal and emergency procedures which relate to multiple plant systems. The student will be required to have a basic understanding of these procedures and a knowledge of all immediate actions:

0202.1	0208.12	20000	20109
0202.2	0208.13	20001	20110
0204.2	0208.14	20002	20111
0205.1	1004.3	20003	20112
0205.2	1008.2	20004	20113
0208.1	1008.3	20005	20125
0208.3	1008.4	20006	20126
0208.4	1008.6	20101	20201
0208.5	1008.7	20102	
0208.6	1508.2	20103	
0208.7	2608.1	20104	
0208.8	3208.1	20105	
0208.9	4004.2	20106	
0208.10	4004.4	20107	
0208.11	4008.1	20108	

Additionally the Emergency Plans and portions of Technical Specifications not previously covered will be discussed.

8.6.9 Administrative Procedures and Requirements

1. Topics

RCO Position Description
Shift Duties and Responsibilities
Shift Turnover
Operating Logs
Use of Procedures
In-Plant Equipment Clearance Orders
Jumper and Disconnected Lead Log
Control of Valves, Locks and Switches
Equipment Out of Service Log
Instrumentation Out of Service Log
Reportable Occurrences
Reports required by Technical Specifications and 10 CFR
Shutdown Rate Guidelines
Notification of Significant Events to NRC
Procedure Review, Revision and On The Spot Changes
Quality Assurance and Quality Control
Document Quality Control
Radioactive Releases
Plant Modifications
Interface with Division and Systems
Licensed Operator Requalification Program

8.6.10 Recent Operating Experiences

1. Topics

This classroom segment is designed to bring the candidate up to date on recent operating experiences and lessons learned at Turkey Point and other nuclear power plants. It also should aid the candidate with current plant operating conditions prior to his Control Room on-shift training.

8.6.11 Mitigating Core Damage and Transient Analysis

1. Topics

Integrated Plant Transient Response

- Startups
- Shutdowns
- Up Power Transients
- Down Power Transients
- Runbacks
- Trips
- Rod Drops
- Loss of RCP's
- Loss of Pressurizer Spray Control
- Uncontrolled Boron Addition/Dilution Accidents
- Loss of Normal Feedwater
- Cooldown Accidents
- Load Rejections
- BOL, EOL Considerations

Accident Analysis

- LOCA's
- Steamline Breaks
- Steam Generator Tube Ruptures with Steamline Breaks
- Multiple Steam Generator Tube Ruptures
- Feedwater Line Breaks
- Anticipated Transients without Scram (ATWS)
- Natural Circulation Cooldown
- Inadequate Core Cooling
    - LOCA without Safety Injection
    - Complete Loss of Feedwater
    - Complete loss of all A.C.
- FSAR Chapter 14
- Fault Trees
    - Critical Safety Functions
- Incore Instrumentation for:
    - Determining extent of core damage and geometry changes
    - Determining peak temperatures
    - Print out of core data

Excore Data for:
Determination of voids and void location
Vital Instrumentation
Instrumentation response in accident environment
Modes of Failure
Indication Reliability
Alternate Parameter Measuring Methods for:
RCS parameters
Letdown Flow
Pressurizer Level
Primary Chemistry
Expected Chemistry results with severe core damage
Expected isotopic breakdown for core on clad damage
Long term corrosion effects
Radiation Monitoring
Process and Area Monitor Response to Core Damage
Use of detectors to determine extent of core damage
Determination of inside containment dose rates from outside readings
Gas Generation
Sources
Hydrogen Problems
Oxygen Problem

8.6.12 Final Review

1. Discussion:

Review will consist of classroom instruction with a great deal of class participation. All previously covered topics will be reviewed with emphasis placed on selected topics as determined by the Hot License Instructor. The following methods of class participation should be used by the instructor.

Instructor Lectures
Quizzes
Lectures by Students
Questions and Answers Written by the Student
Self Study and Study Teams
Student Walkthru's

2. Simulator

(1) Content

1. Control Room Familiarization

2. Routine Startup and Shutdown Evolutions

3. Transcient/Casualty Training:

Reactor Trips
Runbacks
Turbine/Generator Trips

Feedpump Trips
Failed Steam Generator Feed Regulating Valve
Steam Dump Failures
Loss of Condenser Vacuum
Loss of Instrument Air
Pressurizer Level/Pressure Control Failures
Boron/Dilution Make-up Malfunctions
Dropped Rod(s)/Control Rod Out of Alignment
Control Rod Drive Failure
Loss of NIS Channel
Loss of Protective Channels
Various Instrument Failures
Emergency Boration
High RCS Activity
Loss of Component Cooling
Reactor Coolant Pump Seal Failures
Loss of RHR
Loss of all (Normal and Emergency) Feedwater
Loss of Coolant Flow
Natural Circulation
Loss of Coolant Accidents
- Small Leaks
- Large Leaks
- MHA

Main Steam Line Breaks
Feedline Breaks
Steam Generator Tube Ruptures
Anticipated Transients without Scram (ATWS)
Multiple Failures

4. NRC Evaluations

Startup Certification
Casualty Drills

3. On-Shift Training

The purpose of on-shift training is to aquaint the student with each watch stations duties and responsibilities, with particular emphasis on the RCO duties. These periods on shift will provide the student with time to become familiar with systems and normal and off-normal evolutions. The student will be expected to trace out systems and become experts in instrument and equipment location. The N.O. and T.O. on-shift periods are primarily intended for this purpose. The qualification sign off manual will be extensively utilized during these periods. Reference to the qualification manual (Appendix B) will guide the student to specific evolutions and topics that will maximize familiarity and experience in on-shift operations. On-shift training will be broken into the following phases:

On-Shift Nuclear Operator Phase:

Duties and Responsibilities of the Nuclear Operator
Tracing and becoming familiar with primary systems
Interfacing with RCO and Nuclear Watch Engineer
Completing appropriate portions of qualification manual

On-Shift Turbine Operator Phase:

Duties and Responsibilities of the Nuclear Turbine Operator
Tracing and becoming familiar with secondary systems
Interfacing with RCO and Nuclear Watch Engineer
Completing appropriate portions of qualification manual

On-Shift Health Physics Phase

Duties and Responsibilities of the Radiation Protection Man
Become proficient with the various instruments used by the RPM
Complete appropriate portions of qualification manual

On-Shift Control Room Phase

Duties and Responsibilities of the RCO
Gain a proficiency in Control Room operations
Interfacing with balance of on-shift personnel, maintenance departments, division, systems and various other departments
Complete appropriate portions of qualification manual

8.7 Course Instruction

8.7.1 Classroom

The hot license training instructor will perform the majority of the classroom instruction, however in various topics, specialized instructors may be utilized. All instruction pertaining to plant safety systems, integrated responses, transient and simulator courses shall require the instructor to have a current SRO license. Those who teach in specialized areas such as thermodynamics, heat transfer, fluid flow, materials science, basic reactor theory and math, as examples, need only demonstrate compentence in their given field to the training supervisor.

8.7.2 Simulator

Instruction during this phase may be provided by either the simulator facility, the Turkey Point Training Staff or both. This will be determined jointly by the Hot License Training Instructor and the Training Supervisor.

8.7.3 On-Shift Training

The Nuclear Plant Supervisor and Nuclear Watch Engineer are responsible for the training of personnel assigned to their shift. Students who are on-shift for training will ultimately report to the NPS. However, the students will usually be under the direct supervision of the qualified and/or licensed operator. Depending on the phase, the NO, RPM, NTO or RCO will be responsible for ensuring that the student is involved actively in all occurring plant evolutions, he will additionally be responsible for training the student in operating procedures and practices as related to systems under his cognizance. The student is, of course, ultimately responsible for his training and must strive to obtain the most from his training time on-shift. Any problems or deficiencies shall be reported to the Hot License Instructor immediately.

8.8 NRC License Examination:

The license examination is detailed in 10 CFR 55, basically it is in four segments:

1. Startup Certification
2. Casualty Examinations
3. Written Examination
4. Oral Examination

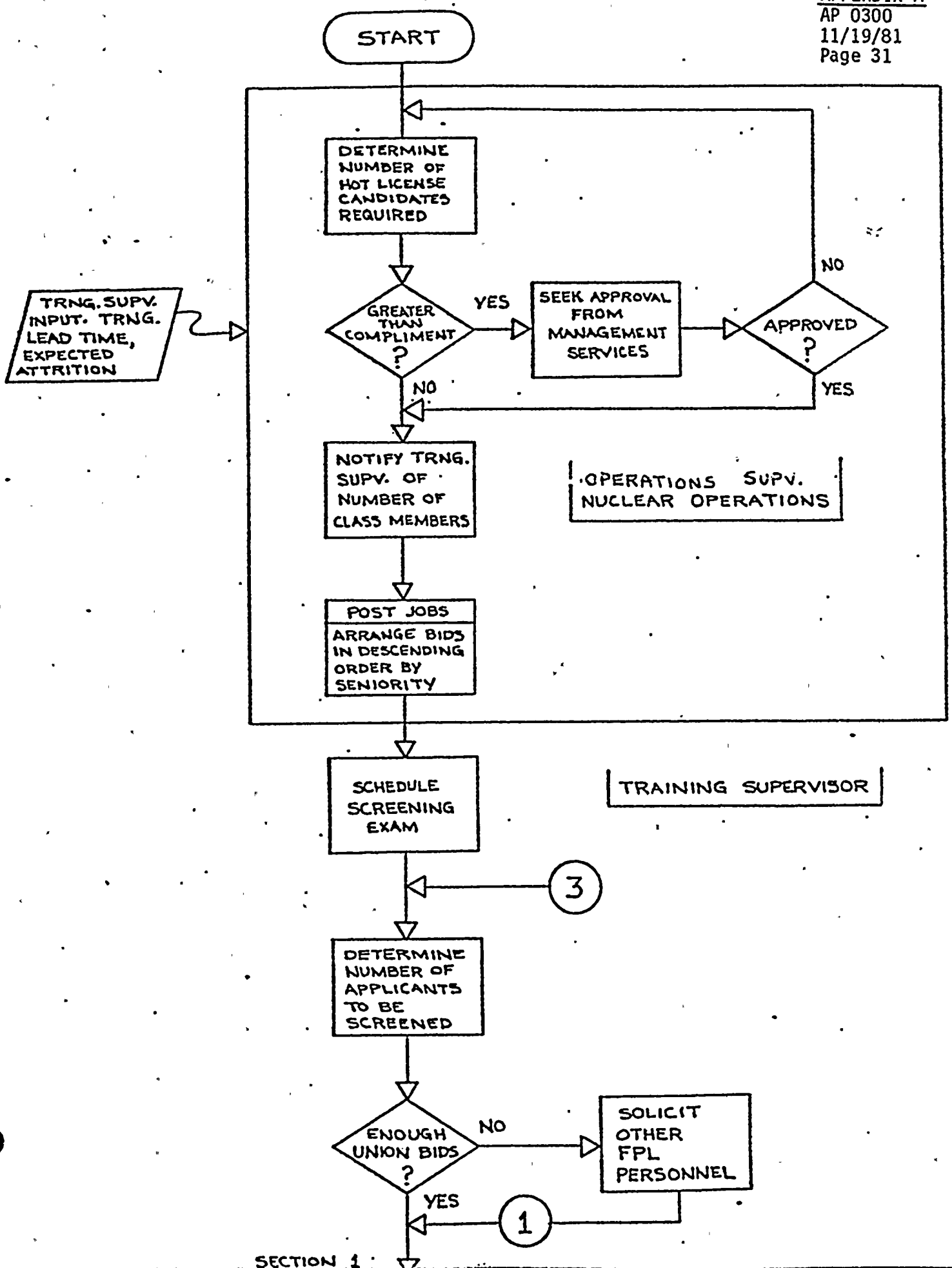
No candidate will be allowed to sit for the NRC examination without satisfactorily completing all phases of the hot license training program. Successful passing of the Turkey Point hot license course is no guarantee of successfully passing the NRC examinations, therefore, some provision must be made in the event the candidate is denied a license.

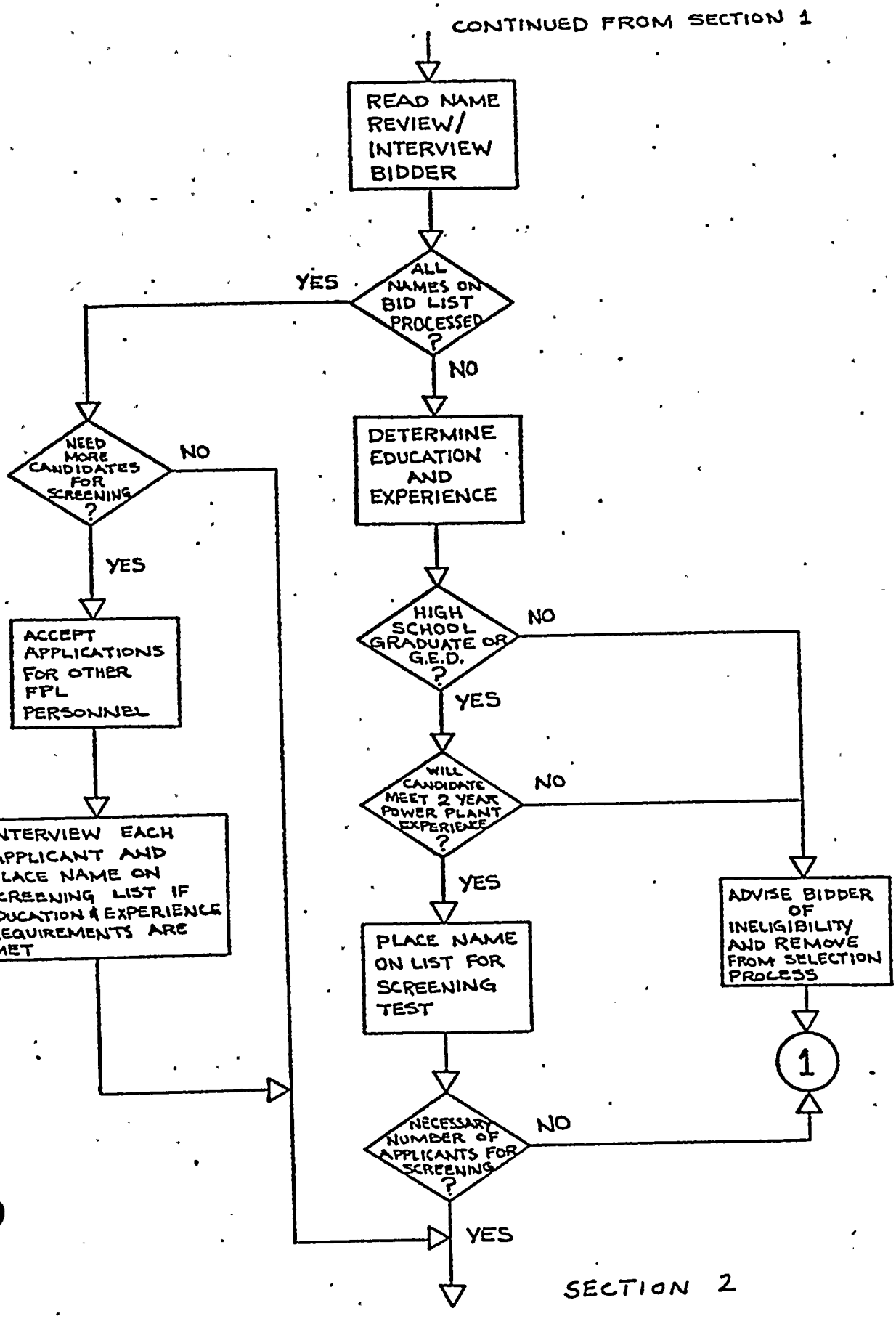
The Training Supervisor must consider a number of things before making a recommendation to the Nuclear Plant Manager who should make the final decision in this matter:

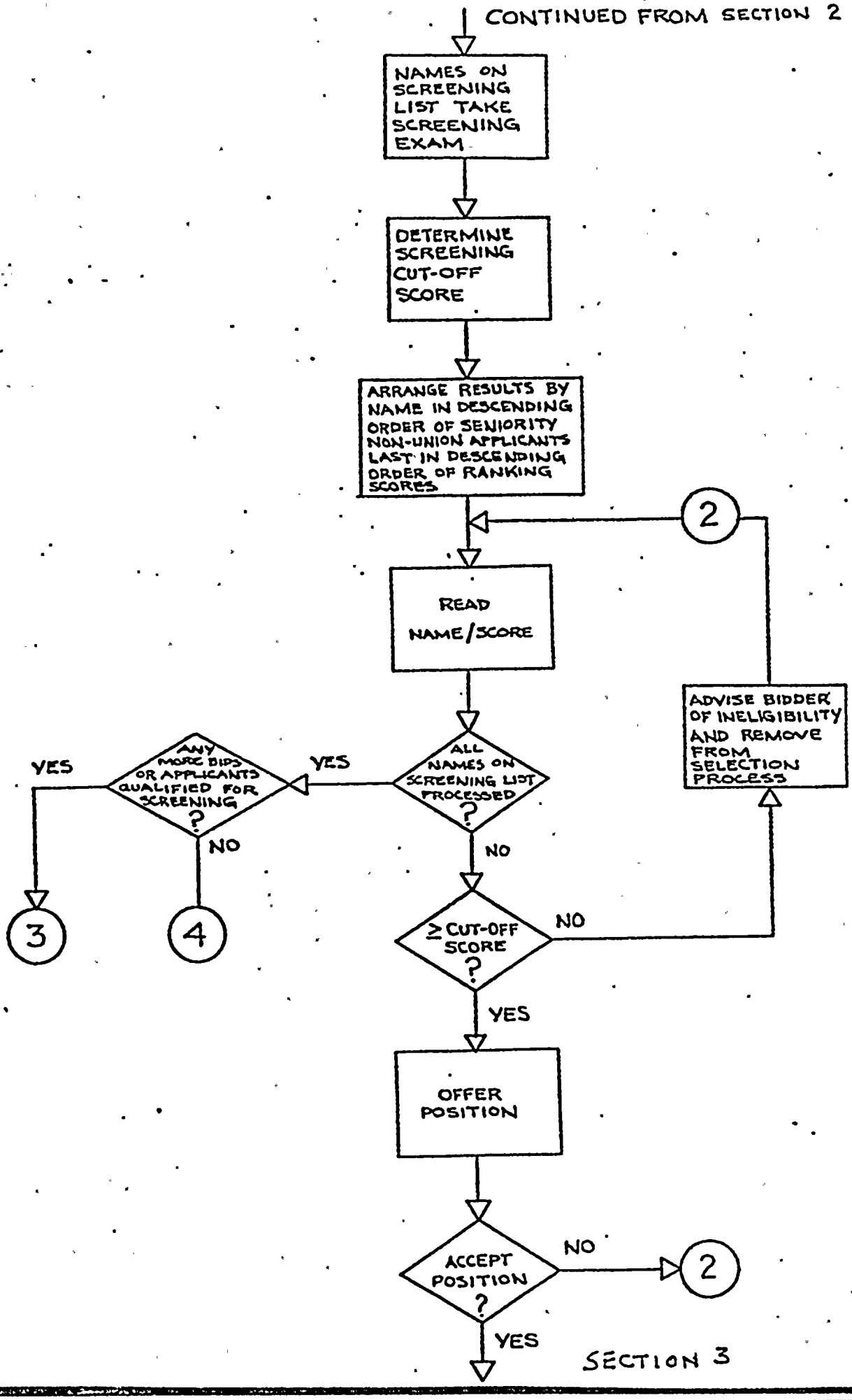
Desire of the candidate
Performance throughout the course
Attitude of candidate
Evaluation by NRC of the candidate
Nuclear Operations Departmental needs
Nuclear Training Department ability to provide additional training

If the Training Supervisor recommends to the Nuclear Plant Manager to allow the candidate to sit for another exam and he concurs, the Training Supervisor or his designee will develop a program to strengthen the candidate weaknesses. Evaluations will be made throughout the program to insure adequate progress is being made by the candidate. Re-examination will then depend on the candidates ability to pass both a written and oral comprehensive examination, and further recommendation by the Training Supervisor and Nuclear Plant Manager.

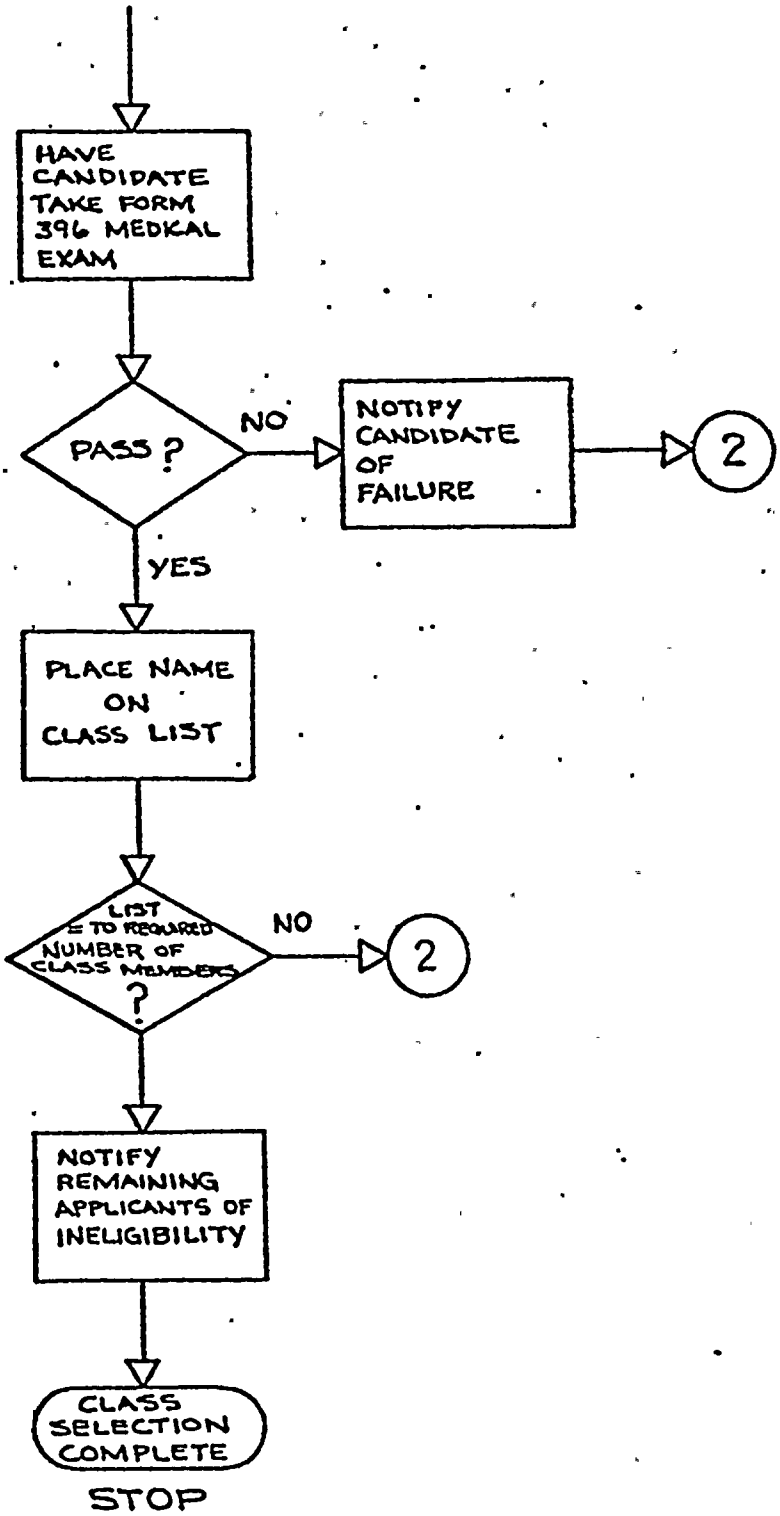
APPENDIX A


START
DETERMINE NUMBER OF HOT LICENSE CANDIDATES REQUIRED
TRNG. SUPV. INPUT. TRNG. LEAD TIME, EXPECTED ATTRITION
GREATER THAN COMPLIMENT ?
YES
SEEK APPROVAL FROM MANAGEMENT SERVICES
APPROVED ?
NO
YES
NO
NOTIFY TRNG. SUPV. OF NUMBER OF CLASS MEMBERS
OPERATIONS SUPV. NUCLEAR OPERATIONS
POST JOBS
ARRANGE BIDS IN DESCENDING ORDER BY SENIORITY
SCHEDULE SCREENING EXAM
TRAINING SUPERVISOR
3
DETERMINE NUMBER OF APPLICANTS TO BE SCREENED
ENOUGH UNION BIDS ?
NO
SOLICIT OTHER FPL PERSONNEL
YES
1

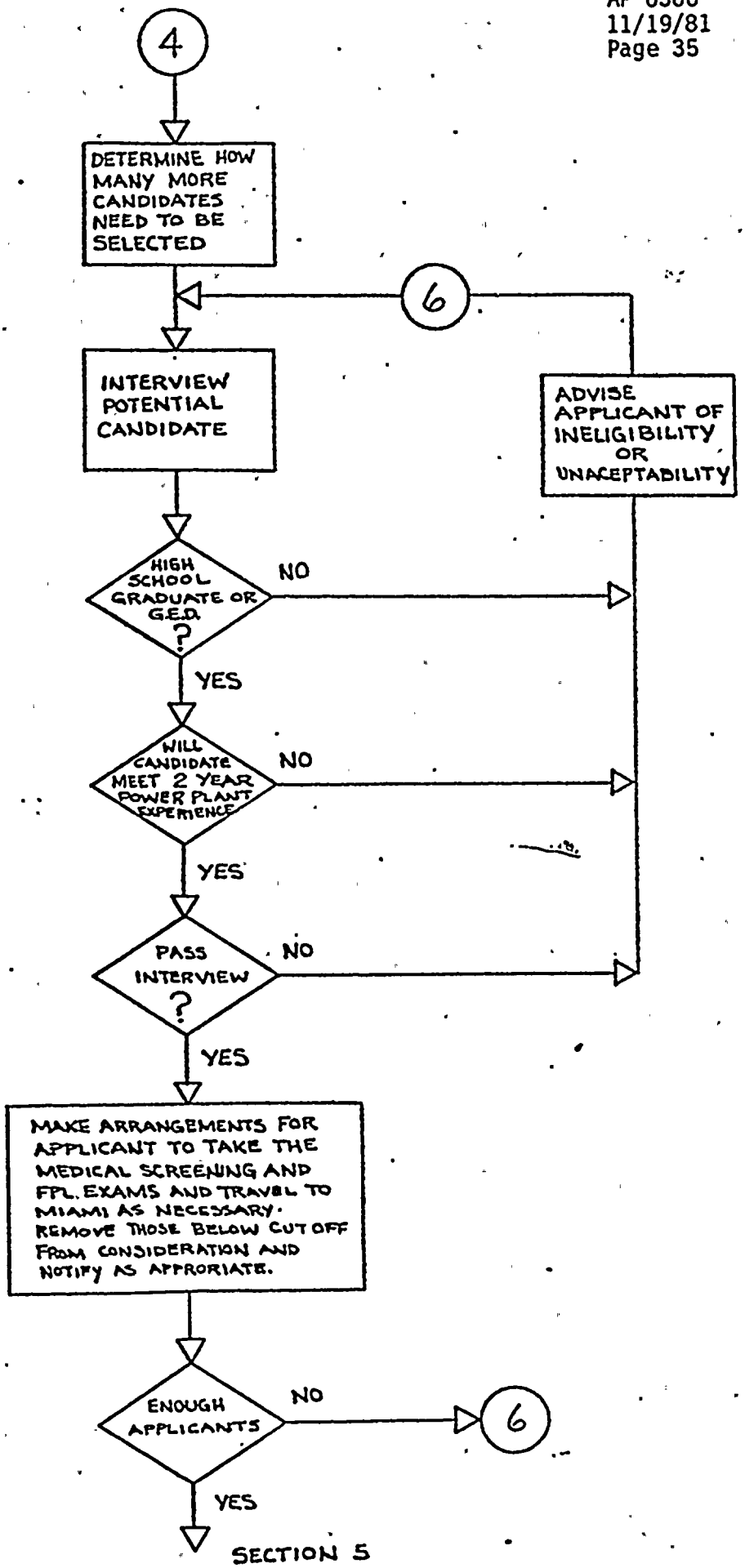

CONTINUED FROM SECTION 1
READ NAME REVIEW/ INTERVIEW BIDDER
ALL NAMES ON BID LIST PROCESSED ?
YES
NO
NEED MORE CANDIDATES FOR SCREENING ?
NO
YES
ACCEPT APPLICATIONS FOR OTHER FPL PERSONNEL
INTERVIEW EACH APPLICANT AND PLACE NAME ON SCREENING LIST IF EDUCATION & EXPERIENCE REQUIREMENTS ARE MET
DETERMINE EDUCATION AND EXPERIENCE
HIGH SCHOOL GRADUATE OR G.E.D. ?
NO
YES
WILL CANDIDATE MEET 2 YEAR POWER PLANT EXPERIENCE ?
NO
YES
ADVISE BIDDER OF INELIGIBILITY AND REMOVE FROM SELECTION PROCESS
1
PLACE NAME ON LIST FOR SCREENING TEST
NECESSARY NUMBER OF APPLICANTS FOR SCREENING ?
NO
YES
SECTION 2

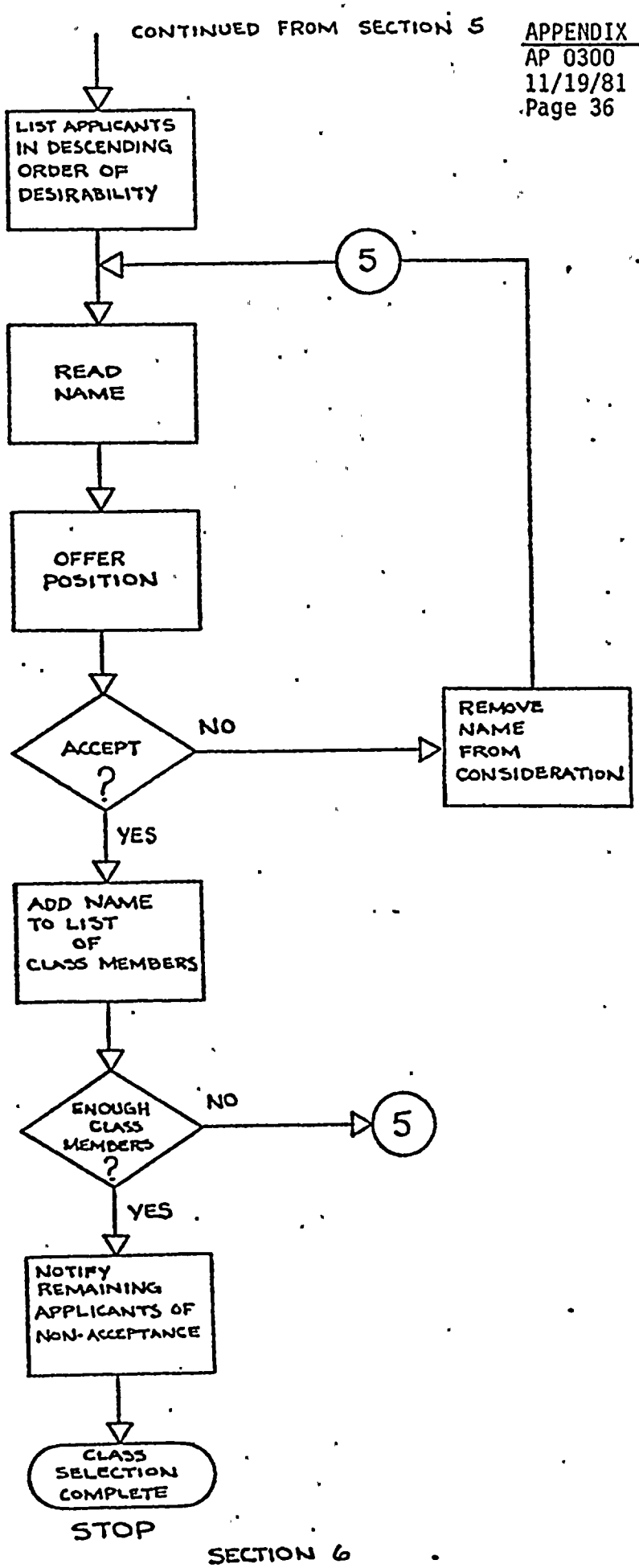

CONTINUED FROM SECTION 2
NAMES ON SCREENING LIST TAKE SCREENING EXAM
DETERMINE SCREENING CUT-OFF SCORE
ARRANGE RESULTS BY NAME IN DESCENDING ORDER OF SENIORITY NON-UNION APPLICANTS LAST IN DESCENDING ORDER OF RANKING SCORES
2
READ NAME/SCORE
ALL NAMES ON SCREENING LIST PROCESSED ?
YES
ANY MORE BIDS OR APPLICANTS QUALIFIED FOR SCREENING ?
YES
NO
NO
ADVISE BIDDER OF INELIGIBILITY AND REMOVE FROM SELECTION PROCESS
3
4
≥ CUT-OFF SCORE ?
NO
YES
OFFER POSITION
ACCEPT POSITION ?
NO
2
YES
SECTION 3

CONTINUED FROM SECTION 3



SECTION 4


4
DETERMINE HOW MANY MORE CANDIDATES NEED TO BE SELECTED
6
INTERVIEW POTENTIAL CANDIDATE
ADVISE APPLICANT OF INELIGIBILITY OR UNACEPTABILITY
HIGH SCHOOL GRADUATE OR G.E.D. ?
NO
YES
WILL CANDIDATE MEET 2 YEAR POWER PLANT EXPERIENCE
NO
YES
PASS INTERVIEW ?
NO
YES
MAKE ARRANGEMENTS FOR APPLICANT TO TAKE THE MEDICAL SCREENING AND FPL. EXAMS AND TRAVEL TO MIAMI AS NECESSARY. REMOVE THOSE BELOW CUT OFF FROM CONSIDERATION AND NOTIFY AS APPRORIATE.
ENOUGH APPLICANTS
NO
6
YES
SECTION 5


CONTINUED FROM SECTION 5
LIST APPLICANTS IN DESCENDING ORDER OF DESIRABILITY
5
READ NAME
OFFER POSITION
ACCEPT ?
NO
REMOVE NAME FROM CONSIDERATION
YES
ADD NAME TO LIST OF CLASS MEMBERS
ENOUGH CLASS MEMBERS ?
NO
5
YES
NOTIFY REMAINING APPLICANTS OF NON-ACCEPTANCE
CLASS SELECTION COMPLETE
STOP

SECTION 6