CHAPTER 13

INITIAL TESTS AND OPERATIONS
[Historical Information

13.1 TESTS PRIOR TO REACTOR INITIAL FUELING]

A comprehensive testing program ensured that equipment and systems performed in accordance with the design criteria prior to fuel loading. As the installation of individual components and systems was completed, they were tested and evaluated according to predetermined and approved written testing techniques, procedures, or check-off lists. Initial operating test procedures were prepared and written by WEDCO or Westinghouse, using, as a basis, the test objectives stated in Table 13.1-1, the proposed Technical Specifications, the Plant Manual, and manufacturers' technical manuals. The procedures were written to simulate, as closely as possible, actual plant operating conditions, based on the above documents and on the engineer's experience in the startup and operation of other similar nuclear power plants.

After a procedure was written, it was distributed within WEDCO and Westinghouse for review and comment by cognizant and knowledgeable personnel. When this review was completed and all comments were resolved, the procedure was submitted to Con Edison (the Joint Test Group support group) for review and comment. When the Con Edison support group completed its review, an informal meeting was held between WEDCO and Con Edison to resolve Con Edison's comments. Comments that were resolved were incorporated in the procedure. Unresolved comments were forwarded to the Joint Test Group in writing for final resolution. The Joint Test Group resolved all previously unresolved comments and incorporated them in the procedure, if appropriate. After all comments were resolved, the Joint Test Group approved the procedure for performance.

The Joint Test Group provided the final resolution to any unresolved comments and approval of the procedure for performance.

The initial operating procedures were developed in accordance with the Technical Specifications (see Section 12.3). They were available for on-site NRC Staff review approximately three months prior to core loading.

Field and engineering analyses of the test results were made to verify that systems and components performed satisfactorily and recommended corrective actions, when necessary. If during performance of an operational test procedure, it was found that the system or equipment tested failed to meet the design and/or performance criteria, the cognizant WEDCO engineer and/or Con Edison Supervisor evaluated the deficiency and recommended a system or equipment modification or a change in the operational procedure. In either event, an evaluation of this recommendation was made by responsible personnel and a decision made as to the resolution of the deficiency. System or equipment modifications required the approval of the cognizant WEDCO or Westinghouse NES engineering group. Procedural changes required the approval of the Joint Test Group.

In all cases of system or equipment modification, or of procedural changes, the original test criteria were met.

The program included tests, adjustments, calibrations, and system operations necessary to assure that initial fuel loading and subsequent power operation could be safety undertaken. In general, the types of tests were classified as flush, hydrostatic, functional, and operational. Functional tests verified that the system or equipment was capable of performing the function for which it was designed. Operational tests involved actual operation of the system and equipment under design or simulated design conditions.

Whenever possible, tests were performed under the same conditions as experienced under subsequent station operations. During system tests for which unit parameters were not available and could not be simulated, the systems were operationally tested as far as possible without these parameters. The remainder of the tests were performed when the parameters became available. Abnormal unit conditions were simulated during testing when such conditions did not endanger personnel or equipment, or contaminated clean systems.

A listing of test objectives to be satisfied prior to initial reactor fueling is contained in Table 13.1-1. Additional information on pre-operational testing of specific components and systems is contained in Inspection and Tests sections of Chapters 3 through 11. Acceptance criteria for pre-operational tests were given in the procedure covering the specific test. In the case of pre-operational testing of safety related equipment, the acceptance criteria conformed to the basic safety requirements of the FSAR.

The Indian Point 3 preoperational testing program was reviewed and approved by NRC as stated in the Safety Evaluation Report (9/21/73). In supplements 2 and 3 to the safety evaluation, NRC stated that a recommendation had been issued by the Office of Inspection and Enforcement to the effect that preoperational and startup testing of Indian Point 3 had been satisfactorily completed. Records of test results are maintained at the plant site (see Section 12.4).

During preoperational testing, Consolidated Edison Company of New York was the operator for Indian Point 3. Thus, the test program discussed in this Chapter was performed by Consolidated Edison with the technical assistance of WEDCO (see Section 1.6) and was witnessed by personnel from the Authority. For a discussion on the relationship between the Authority and Consolidated Edison, and for a history of the license transfer activities, refer to Section 1.1 and 1.6.

TABLE 13.1-1

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
1. Electrical System.	To ensure continuity, circuit integrity, and the correct and reliable functioning of electrical apparatus. Electrical tests are performed on transformers, switchgear, turbine-generators, motors, cables, control circuits, excitation switchgear, d-c systems, annunciator systems, lighting distribution switchboards, communication systems and miscellaneous equipment. Special attention is directed to the following tests: (a) High voltage switchgear breaker interlock test. (b) Station loss of voltage auto-transfer test. (c) Emergency power transfer test. (d) Tests of protective devices. (e) Equipment automatic start tests. (f) Exciter check for proper voltage build up. (g) Insulation tests.
2. Voice Communication System	To verify proper communication between all local stations, and to balance and adjust amplifiers and speakers.
3. Service Water System	To verify, prior to critical operations, that the system supplies adequate flow through all heat exchangers, and meets the specified requirements when operated in the safeguards mode.
4. Fire Protection System	To verify proper operation of the deluge system.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
5. Compressed Air System	To verify leak tightness of the system, proper operation of all compressors, the manual and automatic operation of controls at design set-points, design air dryer cycle time and moisture content of discharge air, and adequate air pressure to each controller served by the system.
6. Reactor Coolant System Cleaning	To flush and clean the reactor coolant and related primary systems to obtain the degree of cleanliness required for the intended service.
7. Cold Hydrostatic Tests	To verify the integrity and leak tightness of the Reactor Coolant System and auxiliary primary systems with the performance of a hydrostatic test at the specified test pressure.
8. Ventilation Systems	To verify proper operability of fans, controls, and other components of the Containment Ventilation System, the Control Building and auxiliary building ventilation systems.
9. Condensate and Feedwater System	To verify valve and control operability and set-points. Functional testing of feedwater system is performed when the Main Steam System is available. Flushing and hydrostatic tests are performed where applicable.
10. Auxiliary Coolant Systems	To verify component cooling flow to all components, and to verify proper operation of instrumentation, controllers, and alarms. Specifically, each of three systems; i.e., Component Cooling System, Residual Heat Removal System and Spent Fuel Pit Cooling System, is tested to ensure:

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	(a) All manual and remote operated valves are operable manually and/or remotely.
	(b) All pumps perform their design functions satisfactorily.
	(c) All temperature, flow, level, and pressure controllers function to control at the required set-point when supplied with appropriate signals.
	(d) All temperature, flow level, and pressure alarms provide alarms at the required locations when the alarm set-point is reached and cleared when the reset point is reached.
	(e) Adequate flow rates are established through the principal heat exchangers.
11. Boron Recycle System	To verify valve and control operability and set-points, flushing and hydrostatic testing as applicable. Functional testing is performed when a steam supply and heat tracing is available.
12. Chemical and Volume Control System	To verify the following:
	(a) All manual and remotely operated valves are operable manually and/or remotely.
	(b) All pumps perform satisfactorily during various plant conditions.
	(c) All temperature, flow, level and pressure controllers function properly during various plant conditions.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	(d) All temperature, flow, level and pressure alarms provide alarms at the required locations when the alarm set-point is reached and clear when the reset point is reached.
	(e) The reactor makeup control regulates blending, dilution, and boration as designed.
	(f) The design seal water flow rates are attainable at each reactor coolant pump.
	(g) Chemical Addition Subsystem functions properly.
13. Safety Injection System	To verify prior to critical operation, system response to control signals and sequencing of the pumps, valves, and controllers as specified in the system description and the manufacturers' technical manuals; and to check the time required to actuate the system after a safety injection signal is received. More specifically that:
	(a) All manual and remotely operated valves are operable manually and/or remotely.
	(b) Each pair of valves installed for redundant flow paths operates as designed.
	(c) All pumps perform their design functions satisfactorily.
	(d) The proper sequencing of valves and pumps occurs on initiation of a safety injection signal.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	(e) The fail position on loss of power for remotely operated solenoid valves is as specified.
	(f) Valves requiring initiation signals to operate do so when supplied with these signals.
	(g) All level and pressure instruments are properly calibrated and provide alarm and indication at the required location(s).
	(h) The time required to actuate the system is within the design specifications.
14. Containment Spray System	To verify, prior to critical operation, system response to control signals and sequencing of the pumps, valves, eductor and controllers as specified in the system description and the manufacturers' technical manuals; and to check the time required to actuate the system after a containment high-high pressure signal is received. More specifically, see the test objective listing for the Safety Injection System.
15. Fuel Handling System*	To show that the system is capable of providing a safe and effective means of transporting and handling fuel from the time it reaches the station until it leaves the station. In particular, the tests are designed to verify that:
	(a) The major structures required for refueling, such as the reactor cavity, refueling canal, new fuel and spent fuel storage, and

*NOTE: Tests conducted with a dummy fuel element.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	decontamination facilities, are in accordance with the design intent.
	(b) The major equipment required for refueling such as the manipulator crane, Fuel handling tools and the spent fuel transfer system, operates in accordance with the design specifications.
	(c) Auxiliary equipment and instrumentation function properly.
16. Radiation Monitoring Systems	To verify the calibration, operability, and alarm set-points of all area radiation monitors, air particulate monitors, gas monitors and liquid monitors which are included in the process Radiation Monitor System and the Area Radiation Monitor System.
17. Reactor Control and Protection System	To verify calibration, operability, and alarm settings of the Reactor Control and Protection System; to test its operability in conjunction with other systems.
	For example, attention is directed to the following tests:
	(a) Reliable functioning of protection system logic and instrumentation
	(b) Reliable functioning of annunciator circuits
	(c) Setpoints
	(d) System operating parameters
	(e) Inservice testing features

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
18. Nuclear Instrumentation System	To ensure that the instrumentation system is capable of monitoring the reactor leakage neutron flux from source range through 120 percent of full power and that protective functions are operating properly. In particular, the tests are designed to verify that: (a) All system equipment, cabling, and interconnections are properly installed. (b) The source range detector and associated instrumentation respond to neutron level changes, and that the source range protection (high flux level reactor trip) as well as alarm features and audible count rate operate properly. (c) The intermediate range instrumentation operates properly, the reactor protective and control features such as high level reactor trip and high level rod stop signals operate properly, and the permissive signals for blocking source range trip and source range high voltage off operate properly. (d) The power range instrumentation operates properly; the protective features such as the overpower trips, permissive and dropped-rod functions operate with the required redundancy and separation through the associated logic matrices; and the nuclear power signals to other systems are available and operating properly. (e) All auxiliary equipment such as the startup rate channel, recorders, and indicators operate properly.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	(f) All instruments are properly calibrated and all set points and alarms are properly adjusted.
19. Radioactive Waste System	To verify satisfactory flow characteristics through the equipment, to demonstrate satisfactory performance of pumps and instruments, to check for leaktightness of piping and equipment, and to verify proper operation of monitors, alarms and controls prior to critical operation. More specifically that:
	(a) All manual and automatic valves are operable.
	(b) All instruments/controllers operate to control system at required values.
	(c) All alarms are operable at required locations.
	(d) All pumps perform their design function satisfactorily.
	(e) All pump indicators and controls are operable at required locations.
	(f) The waste gas compressors operate as specified.
	(g) The gas analyzer operates as specified.
	(h) The waste evaporator operates as specified.
20. Sampling System	To verify that a quantity of representative fluid can be obtained safely from each sampling point. In

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	particular the tests are designed to verify that: (a) All system piping and components are properly installed. (b) All remotely and manually operated valving operates in accordance with the design specifications. (c) All sample containers and quick-disconnect couplings function properly.
21. Emergency Power System	To demonstrate that the system is capable of providing power for operation of vital equipment under power failure conditions. In particular, the tests are designed to verify that: (a) All system components are properly installed. (b) Each emergency diesel (and logic system) functions according to the design intent under emergency conditions. (c) The emergency units are capable of supplying the power to vital equipment as required under emergency conditions. (d) All redundant features of the system function according to the design intent
22. Charcoal Filter Tests	To verify filter efficiency of the installed elements prior to critical operation.
23. Hydrogen Recombiner	Verification of ignition and attainment of normal operating temperatures prior to critical operation.

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
24. Containment Isolation and Isolation Valve Seal Systems	To verify the capability for reliable operation and demonstrate the manual and automatic operation of the system prior to critical operation. Demonstrate the operation and proper sequence of isolation valve closure and seal water addition. Demonstrate the functioning of Isolation Valve Seal Water System independent of other systems. Demonstrate the operation and system response time induced by an isolation signal. Manual valves will be manipulated to assure proper operation of the seal gas injection portion of the system.
25. Containment Penetration and Weld Channel Pressurization System	To verify air system and nitrogen backup system integrity, operate valves, check flowmeters and pressure gauges as required to ensure system meets design specifications.
26. Reactor Containment High Pressure Test	To verify prior to critical operation, the structural integrity and leaktightness of the containment.
27. Hot Functional Tests	Using pump heat, the Reactor Coolant System is tested to check heatup and cooldown procedures to demonstrate satisfactory performance of components that are exposed to the reactor coolant temperature; to verify proper operation of instrumentation, controllers and alarms, and to provide design operating conditions for checkout of auxiliary systems. The Chemical and Volume Control System is tested to determine that water can be charged at rated flow against normal Reactor Coolant System pressure; to check letdown flow against design rate for each pressure reduction station; to determine

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	the response of the system to changes in pressurizer level; to check operation of the reactor makeup control; to check operation of the excess letdown and seal water flowpath; and to verify proper operation of instrumentation controls and alarm.
	The Sampling System is tested to determine that a specified quantity of representative fluid can be obtained safely and at design conditions from each sampling point.
	Vibration measurements are performed at first of a kind plants with extensive instrumentation (e.g., Indian Point 2). After initial verification, vibration monitoring is accomplished by an internals inspection after the hot functional testing.
	The Component Cooling System is tested to evaluate its ability to remove heat from systems normally containing radioactive fluid and other special equipment, under varied service water conditions to verify component cooling flow to all components and to verify proper operation of instrumentation controllers and alarms.
28. Pressurizer Level/Pressure Control System	To ensure that the system is capable of monitoring the full range of pressurizer pressure/level and to verify alarms and setpoints. Also to verify that the system in conjunction with the Chemical and Volume Control System controls pressurizer level.
29. Rod Position Indication System	To check the systems response to test signals and to verify correct indicating and control functions prior to criticality. After fuel loading and

TABLE 13.1-1
(Cont.)

OBJECTIVES OF SYSTEM TESTS PRIOR TO INITIAL REACTOR FUELING

System Tests	Test Objective
	after the position indication coils are installed, a calibration and complete operational check is performed by operating individual control rod drive mechanisms.
30. Reactor Thermocouple Instrumentation	To check and calibrate the system and compare thermocouple readings with other temperature instrumentation indications.
31. Turbine Unit Cooling System	To establish correct cooling to unit components, to demonstrate satisfactory performance of pumps, instruments, alarms, and controls, and to establish system tightness integrity.
32. Primary and Secondary System Safety and Relief Valves	To test pressurizer and steam generator safety and relief valves to ensure each valve is operable.
33. Turbine Steam Seal and Blowdown Systems	To verify valve and control operability and setpoints, flush and hydrostatic test where applicable, inspect for completeness and integrity. Functional test is performed when a steam supply is available prior to initial turbine roll.
34. Turbine and Turning Gear Tests	To demonstrate satisfactory operation of systems prior to initial turbine roll.
35. Containment Atmosphere Sampling System	To verify, prior to criticality, the operability of the system.
36. Boric Acid Batching and Transfer	To check procedures and components used in batching and transfer operations prior to criticality.
37. Containment Air Recirculation Cooling & Filtration System	To verify operability of system and components prior to criticality.
38. Post Accident Containment Venting System	To verify operability of system and components prior to criticality.

13.2 FINAL STATION PREPARATION [Historical Information]

Fuel loading began when all prerequisite system tests and operations as defined in the detailed core loading procedures were satisfactorily completed and the facility operating license was obtained. Upon completion of fuel loading, the reactor upper internals and pressure vessel head were installed and additional mechanical and electrical tests were then performed. The purpose of this phase of activities was to prepare the system for nuclear operation and to establish that all design requirements necessary for operation were achieved. The core loading and post loading tests are described below.

13.2.1 Core Loading

The overall responsibility and direction for initial core loading was exercised by the Con Edison's Indian Point 3 Chief Engineer assisted by the Operations Engineer. The overall process of initial core loading was, in general, directed from the operating floor of the containment structure. Standard procedures for the control of personnel and the maintenance of containment security were established prior to fuel loading. Westinghouse provided technical advisors to assist during the initial core loading operation.

The as-loaded core configuration was specified as part of the core design studies conducted well in advance of station startup and as such were not subject to change at startup.

The core was assembled in the reactor vessel, submerged in water containing enough dissolved boric acid to maintain a core effective multiplication factor (k_{eff}) of 0.90 or lower with all rods inserted. The refueling cavity was dry during initial core loading. Core moderator chemistry conditions (particularly, boron concentration) were prescribed in the core loading procedure document and were verified periodically by chemical analysis of moderator samples taken prior to and during core loading operation.

Core loading instrumentation consisted of two permanently installed source range (pulse type) nuclear channels and two temporary incore source range channels plus a third temporary channel which could be used as a spare. The permanent channels were monitored in the Control Room by licensed station operators; the temporary channels were installed in the containment structure and monitored by licensed station personnel. At least one permanent channel was equipped with an audible count rate indication. Both plant channels displayed neutron count rate on strip chart recorders. The temporary channels indicated on rate meters. Minimum count rates of two counts per second, attributable to core neutrons, are required on at least two of the four available nuclear channels at all times following installation of the first core source.

Two primary neutron sources (Pu-Be) were introduced into the core at the appropriate specified points in the core loading program to ensure a neutron population large enough to adequately monitor the core.

Fuel assemblies together with inserted components (control rod assemblies, burnable poison inserts, source spider, or thimble plugging devices) were placed in the reactor vessel one at a time according to a previously established and approved sequence which was developed to provide reliable core monitoring with minimum possibility of core mechanical damage. The core loading procedure documents included a detailed tabular check sheet which prescribed and verified the successive movements of each fuel assembly and its specified inserts from its initial position in the storage racks to its final positions in the core. Multiple checks were made of component serial numbers and types at successive transfer points to guard against possible inadvertent exchanges or substitutions of components.

An initial nucleus of eight fuel assemblies, the first of which contained an activated neutron source, was the minimum source-fuel nucleus which permitted subsequent meaningful inverse count rate monitoring. This initial nucleus was determined by calculation and previous experience to be markedly subcritical $(k_{eff} = 0.90)$ under the required conditions of loading.

Each subsequent fuel addition was accompanied by detailed neutron count rate monitoring to determine that the just loaded fuel assembly did not excessively increase the count rate and that the extrapolated inverse count rate ratio was not decreasing for unexplained reasons. The results of each loading step were evaluated by an individual holding a senior reactor operator license and Westinghouse technical advisors before the next prescribed step was started.

Criteria for safe loading required that loading operations stop immediately if:

1) The neutron count rates on all responding nuclear channels doubled during any single loading step after the initial nucleus of eight fuel assemblies was loaded.
2) The neutron count rate on any individual nuclear channel increased by a factor of five during any single loading step.

An alarm in the containment and Control Room was coupled to the source range channels with a set-point at five times the current count rate. This alarm automatically alerted the loading operation to an indication of high count rate and required an immediate stop of all operations until the incident was evaluated by an individual holding a senior reactor operator license and the Westinghouse technical advisors.

Core loading procedures specified alignment of fluid systems to prevent inadvertent dilution of the reactor coolant, restricted the movement of fuel to preclude the possibility of mechanical damage, prescribed the conditions under which loading could proceed, identified the chains of responsibility and authority and provided for continuous and complete fuel and core component accountability.

13.2.2 Post Loading Tests

Upon completion of core loading, the reactor upper internals and the pressure vessel head were installed and additional mechanical and electrical tests were then performed to initial criticality. An operational leak test was conducted after completion of filling and venting.

Mechanical and electrical tests were performed on the control rod drive mechanisms. These tests included a complete operational checkout of the mechanisms. Checks were made to ensure that the control rod assembly position indicator coil stacks were connected to their position indicators. Similar checks were made on control rod drive mechanism coils.

Tests were performed on the reactor trip circuits to test manual trip operation and actual control rod assembly drop times were measured for each control rod assembly. By use of dummy signals, the Reactor Control and Protection System was made to produce signals for the various unit abnormalities that required tripping.

At all times that the control rod drive mechanisms were being tested, the boron concentration in the coolant-moderator was maintained (approximately 2000 ppm boron) such that criticality could not be achieved with all control rod assemblies out.

Following core loading and prior to initial criticality, individual pump flows were verified with all pumps running and with temperature and pressure at normal operating conditions. Core flow was verified to be equal to or greater than design flow from measurements of reactor coolant pump power and coolant temperature. Flow coastdown characteristics were also determined for each loop for various combinations of pump stoppage.

13.3 INITIAL TESTING IN THE OPERATING REACTOR [Historical Information]

After satisfactory completion of fuel loading and final precritical tests, nuclear operation of the reactor began. This final phase of startup and testing included Initial Criticality, Low Power Testing and Power Level Escalation. The purpose of these tests was to establish the operational characteristics of the unit and core, to verify design prediction, to demonstrate that license requirements were met, and to ensure that the next prescribed step in the test sequence could be safely undertaken. A brief description of the testing is presented in the following sections. Table 13.3-1 summarizes the tests which were performed from initial core loading to rated power. A detailed report is contained in the "Startup Test Report – Indian Point Nuclear Generating Unit No. 3" submitted to NRC by letter dated November 26, 1976 and supplemented by letter on July 11, 1977.

13.3.1 Initial Criticality

Initial criticality was established by sequentially withdrawing the shutdown and control groups of control rod assemblies from the core, leaving the last withdrawn control group inserted far enough in the core to provide effective control when criticality was achieved, and then slowly and continuously diluting the heavily borated reactor coolant until a self-sustaining chain reaction was achieved, in which case the self-sustaining chain reaction was then achieved by control rod withdrawal.

Successive stages of control rod assembly group withdrawal and of boron concentration reduction were monitored by observing changes in neutron count rate as indicated by the regular source range nuclear instrumentation as functions of control rod assembly group position and, subsequently, of primary water addition to the Reactor Coolant System during dilution.

Primary safety reliance was based on inverse count rate ratio monitoring as an indication of the nearness and rate of approach to criticality of the core during control rod assembly group withdrawal and during reactor coolant boron dilution. The rate of approach was reduced as the reactor approaches extrapolated criticality to ensure that effective control was maintained at all times.

Written procedures specified alignment of fluid systems to allow controlled start and stop and adjustment of the rate at which the approach to criticality could proceed, indicated values of core conditions under which criticality was expected, and specified allowable deviations in expected values.

13.3.2 Low Power Testing

A prescribed program of reactor physics measurements was undertaken to verify that the basic static and kinetic characteristics of the core were as expected and that the values of the kinetic coefficients assumed in the safeguards analysis were indeed conservative.

The measurements were made at low power and primarily at or near operating temperature and pressure. Measurements included verification of calculated values of control rod assemblies group reactivity worths, of isothermal temperature coefficient under various core conditions, of differential boron concentration reactivity worth and of critical boron concentrations as functions of the coefficient of control rod assembly group configurations. In addition, measurements of the relative power distributions were made. Concurrent tests were conducted on the instrumentation including the source and intermediate range nuclear channels.

Detailed procedures were prepared to specify the sequence of tests and measurements that were conducted and conditions under which each was performed ensuring both safety of operation and the relevancy and consistency of the results obtained. If significant deviations from design predictions existed, unacceptable behavior was revealed, or apparent anomalies developed, the testing was suspended and the situation reviewed by Con Edison to determine whether a question of safety was involved, prior to resumption of testing. Significant deviations were determined by concurrent agreement between Con Edison personnel and Westinghouse technical advisors.

13.3.3 Power Level Escalation

When the operating characteristics of the reactor and unit were verified by the preliminary zero power tests, a program of power level escalation in successive stages brought the unit to its full rated power level. Both reactor and unit operational characteristics were closely examined at each stage and the relevance of the safeguards analysis verified before escalation to the next programmed level.

Reactor physics measurements were made to determine the magnitudes of reactivity effects, control rod assembly group differential reactivity effects, control rod assembly group differential reactivity worth and relative power distribution in the core as functions of power level and control rod assembly group position.

Secondary system heat balances ensured that the several indications of power level were consistent and provided bases for calibration of the power range nuclear channels. The ability of the Reactor Control and Protection System to respond effectively to signals from primary and secondary instrumentation under a variety of conditions encountered in normal operations was verified.

At prescribed power levels the response characteristics of the reactor coolant and steam system to dynamic stimuli was evaluated. The responses of system components were measured for 10% reduction of load and recovery, 50% reduction of load and recovery, turbine trip, and trip of a single control rod assembly.

Adequacy of radiation shielding was verified by gamma and neutron radiation surveys inside the containment and throughout the station site.

The sequence of tests, measurements and intervening operations were prescribed in the power escalation procedures together with specific details relating to the conduct of the several tests and measurements. The measurement and test operations during power escalation was similar to normal operations.

In order to monitor performance, the following analytical results were needed before power escalation was undertaken:

1) Expected values for local power ratios in each of the in-core flux detector thimbles.

2) Expected values for relative power in each fuel assembly and in individual fuel rods of interest in various control group configurations.

3) Expected values of nuclear peaking factors.

4) Combined power and programmed temperature reactivity defect as a function of primary power level at expected boron concentrations.

5) Equilibrium xenon reactivity defect as a function of primary power level.

6) Identification and integral reactivity worth of the most significant single RCC assemblies in the control group, when fully withdrawn, with various operating control rod configurations.

7) Identification and integral reactivity worth of the most significant single RCC assemblies.

Other conditions that were met before commencement of the Power Escalation Test Program were as follows:

1) The following plant conditions were established:
    a) The Low Power Reactor Physics Test Program was successfully completed as prescribed. Experimental values for low power reactivity parameters were produced and were available for guidance in the elevated power program.
    b) Discrepancies between analytically predicted and experimentally measured values of reactivity parameters were identified and appropriate revisions were made in the values of expected primary coolant boron concentrations and RCC group positions listed in the Power Escalation Test Sequence.
    c) The Reactor Coolant System and all required components of the Secondary Coolant System were fully assembled, mechanically tested and ready for service as required.
    d) All control, protection and safety systems were fully installed; all required pre-operational tests were satisfactorily completed and all components were ready for service as required.
    e) The reactor coolant was at required temperature, pressure, lithium and boron concentration.
    f) Demineralizer water was available in adequate quantity for extensive boron dilution.

g) Concentrated boric acid solution was available in sufficient quantity to permit increases in main coolant boron concentration as required.

h) All special equipment and instrumentation required for the Power Escalation Test Program were installed and calibrated and were available for service as specified.

i) Thermocouple correction constants derived from the hot, isothermal calibrations.

j) Reactor coolant flow coastdown measured and found acceptable.

2) A pre-test check-off list indicating the required status of all systems and auxiliary equipment affecting the Power Escalation Test Program was available. The pre-test check-off list included, as a minimum, provisions for verification and certification of all items specified in Condition 1, above.

3) Test procedures suitable for executing the Power Escalation Test Sequence, were available for distribution to all personnel concerned with the Power Escalation Test Program.

4) The procedure, schedule and personnel assignments and responsibilities were thoroughly discussed with and were understood by the operations and test personnel.

13.3.4 Post Startup Surveillance and Testing Requirements

Post startup surveillance and testing requirements were designed to provide assurance that essential systems, which included equipment components and instrument channels, were always capable of functioning in accordance with their original design criteria. These requirements can be separated into two categories:

a) The system must be capable of performing its function, i.e., pumps delivered at design flow and heat, and instrument channels responded to initiating signals within design calibration and time responses,

b) Reliability was maintained at levels comparable to those established in the design criteria and during early station life.

The testing requirements, as described in the Technical Specifications, established this reliability and, in addition, provided the means by which this reliability is continually reconfirmed. Verification of operation of complete systems and individual checks of components and instrumentation are made at intervals specified in the Technical Specifications.

The techniques used for the testing of instrument channels included a pre-operational calibration which confirmed values obtained during factory test programs. These reconfirmed calibrations values became the reference for recalibration maintenance at refueling intervals during station life. Periodic testing, as defined in the Technical Specifications, includes the insertion of a predetermined signal that trips the channel bistable. Indication of the operation is confirmed and recorded.

Testing of components was initiated through manual actuation. If response times were important, they were measured and recorded. The capability to deliver design output was checked by instrumentation and compared against design data. Allowable discrepancies were established in the Technical Specifications. The component was operated sufficiently long to allow equalization of operating temperatures in bearings, seals, and motors. Checks were made on these parameters. The component was surveyed for excessive vibration. Readings were recorded.

Con Edison determined that testing in accordance with the above described program provided a realistic basis for determining maintenance requirements and, as such, ensures continued system capabilities including reliability equal to that established in the original criteria.

13.3.5 Augmented Core Physics Program

Consolidated Edison was a participant in an augmented core physics program which was developed by Westinghouse. The purpose of the program was to obtain additional confirmation of the nuclear design bases for peaking factor calculations by conducting incore flux measurements under non-steady state conditions and, therefore, allowing operation at the license application rating of 3025 MWt.

There were two phases to the program: one consisting of additional startup testing, and the second consisting of additional, periodic, at power, Cycle I testing. Details of this test program were documented in WCAP-8576 *, which was filled with the Nuclear Regulatory Commission Division of Reactor Licensing on August 25, 1975. Consolidated Edison performed those tests designated in WCAP-8576 for Indian Point 3.

*NOTE: WCAP-8576, "Augmented Startup and Cycle I Physics Program," August 1975, K. A. Jones, C. C. Little, W. B. Henderson, Non Proprietary.

Table 13.3-1

INITIAL TESTING SUMMARY

Test	Conditions	Objectives	Acceptance Criteria
Control Rod Assembly Drop Tests	a) Cold, Shutdown b) Hot, Shutdown	To measure the drop time of control rod assemblies under full flow and no flow conditions	Droptime less than value assumed in Chapter 3.
Theromcouple/RTD Intercalibration	Various Temperatures during system heatup at zero power	To determine in-place isothermal correction constants for all core exit thermocouples and reactor coolant RTD's	Sensors showing excessive deviations from average are to be removed from service
Nuclear Design Check Tests	Normal control group configurations at hot, zero power	To verify that nuclear design predictions for endpoint boron concentration, isothermal temperature coefficient and power distribution are valid	Technical Specification limiting values
RCC Control Group Calibration	All control rod assembly groups at hot, zero power	To verify that nuclear design predictions for control rod assembly group differential worths are valid.	Technical Specification limiting values.
Loss of Flow Tests	a) Prior to initial criticality b) Hot, Shutdown	To verify that design calculations of pressure drop and reactor coolant flow based on the reactor coolant pump performance curve are valid and to measure flow coastdown following reactor coolant pump stoppages	FSAR limiting values used in Loss-of-Flow Accident Analyses
Power Coeffiecient Measurement	0 percent to 100% of rated power	To verify that nuclear design predictions for differential power coefficients are valid	FSAR Criteria Applicable

Table 13.3-1
(Cont.)

INITIAL TESTING SUMMARY

Test	Conditions	Objectives	Acceptance Criteria
Automatic Control System Checkout	Approximately 35 percent of rated power	To verify control system response characteristics for the: a) Steam generator level control sytstem b) Control rod assembly automatic control system c) Turbine control system	Safety Analysis Report criteria applicable
Power Range Instrumentation Calibration	During static and/or transient conditions at the following percentages of rated power: 35 percent 50 percent 75 percent 90 percent 100 percent	To verify all power range instrumentation consisting of power range nuclear channels, incore flux mapping system, incore exit thermocouple system, and reactor coolant RTD's are responsive to changes in reactor power distribution and to intercalibrate the several systems	Calibrate instruments to agree with thermal power measurements
Load Swing Test	10 percent steps at the following percentages of rated power: 35 percent 75 percent 100 percent	To verify control systems performance as evidenced by plant parameter variations	Plant parameter variations are within acceptable limits
Turbine Trip	50% (rated power) 100% (rated power)	To verify control systems performance as evidenced by plant parameter variations	Plant parameter variations are within acceptable limits

TABLE 13.3-1
(Cont.)

INITIAL TESTING SUMMARY

Test	Conditions	Objectives	Acceptance Criteria
Generator Trip	Load Rejection from the following percentages of rated power: 50 percent 100 percent	To verify control systems performance as evidenced by plant parameter variations and to verify effectiveness of L. P. Steam Dump Systems	Plant parameter variations are within acceptable limits. Projected turbine overspeed does not exceed turbine design overspeed value for full load trip conditions
Pressurizer Spray Effectiveness Test	Hot, shutdown	To verify that pressurizer pressure is reduced at the required rate by pressurizer spray actuation	Acceptable rate of pressure decrease
Minimum Shutdown Verification	Hot, zero power	To verify the nuclear design prediction of the minimum shutdown boron concentration with one "stuck" control rod assembly	Verify stuck control rod assembly shutdown criteria
Static Control Rod Assembly Drop Test	50 percent of rated power	To verify that a single control rod assembly inserted fully or part way below the control bank results in hot channel factors below design values	FSAR limiting values for dropped rod analysis
Step Load Reduction Test	Reduction from 75 percent to 25 percent of rated power 50 percent reduction from 100 percent of rated power	To verify control systems performance as evidenced by plant parameter variations	Plant parameter variations are within acceptable limits

Table 13.3-1
(Cont.)

INITIAL TESTING SUMMARY

Testing	Conditions	Objectives	Acceptance Criteria
Axial Xenon Transient Control Test	75 percent of rated power	To demonstrate the capability of suppressing axial xenon transients by maneuvering control bank D.	Operability of plant under transient conditions without actuating runback or trip.
Pseudo Rod Ejection Test	a) Hot, Zero Power; b) > 30% of Rated Power	To measure hot channel factors with individual rods withdrawn to out of bank positions and to verify that they are within expected limits	FSAR limiting values used in Rod Ejection Accident analyses
Dynamic Control Rod Assembly Drop Test	75 percent of rated power	To verify automatic detection of dropped control rod assembly, and subsequent automatic rod withdrawawal stop and turbine cutback	Required power reduction and control rod assembly withdrawal block accomplishment.
Turbine Generator Startup Tests	Pre- and Post-Synchronization	To verify that the turbine generator unit and associated controls and trips are in working order and ready for service	Successful completion of all mechanical, electrical and control functional checks
Turbine Generator	10 percent of rated power	To veriify normal trouble free performance of the turbine generator at low power	Performance within manufacturers limitations
Acceptance Run	100 hours at rated power	To verify reliable steady state full power capability	100 hours reliable equilibrium operation at full power

Table 13.3-1
(Cont.)

INITIAL TESTING SUMMARY

Testing	Conditions	Objectives	Acceptance Criteria
Loss of Offsite Power	>10% rated power	To veriify control systems performance as evidenced by plant parameters	Unit is stabilized and all auxiliary systems are functional
Shutdown from Outside the Control Room	>10% of rated power	To verify unit can be shutdown independent of control room indication alarms and controls	Unit is successfully shut down

13.4 OPERATING RESTRICTIONS [Historical Information]

13.4.1 Safety Precautions

The measurements and test operations during zero power and power escalation were similar to normal station operations at power such that normal safety precautions were adequate.

13.4.2 Initial Operation Responsibilities

The detailed history of the Indian Point 3 operating license takeover by the Authority from Con Edison is presented in Chapter 1. Con Edison had overall responsibility for review and approval of all phases of testing. Due to the nature of the Indian Point 3 contract, close cooperation between Con Edison and Westinghouse during all phases of startup testing and initial operation was essential to insure that all procedures were executed in a safe and efficient manner. Toward this end, a Joint Test Group comprised of Con Edison and WEDCO representatives was formed. This Joint Test Group was responsible for reviewing all test procedures to determine that operations were conducted in accordance with the provisions of the facility Technical Specifications.

Each member of the Joint Test Group was supported by a group of support engineers. WEDCO and Westinghouse had onsite representatives of supporting functional groups to provide technical advice, recommendations and assistance in planning and executing the respective phases of unit startup. The staffing, training and experience of the operating organization for Indian Point 3 is described in detail in Section 12.1 of the original Final Safety Analysis Report. The chains of responsibility and authority for those of Con Edison site personnel that participated in the initial testing and operation of the facility was the same as that described in Section 12.1 of the original Final Safety Analysis Report. Additional support for testing was drawn from the on-site representatives of the various technical support groups within Con Edison. These on-site representatives, in addition to the representatives of the construction and nuclear power departments made up the Con Edison Joint Test Group support group.

If additional support was required, the Con Edison Joint Test Group obtained this from its main Engineering Office.

If WEDCO/Westinghouse required, the Con Edison Joint Test Group obtained this from the appropriate Westinghouse division.

The functioning of the Joint Test Group and the support organization was specified in "Administrative Guidelines for the Test Program," (INT-ADMIN-1.0) a joint Con Edison-WEDCO Document.

All system operations during the testing program were performed by station operators in accordance with Joint Test Group approved written procedures. These procedures included test purpose, conditions, precautions, limitations, and sequence of operations. Procedural changes were made only in accordance with "Administrative Guidelines for the Test Program."

After test completion the results were reviewed and evaluated "on-the-spot" by the Con Edison and WEDCO test supervisors. A detailed review was then performed by the on-site Joint Test Group support groups, shown on Figure 13.4-1. It was the responsibility of these groups to determine the adequacy of the test data for verification of the test's stated acceptance criteria. These test results became an integral part of the data required for systems acceptance.

Figure 13.4-1 shows the Joint Test Groups functional relationships for procedure preparation and approval for performance and the functional relationships for procedure results approval. Figure 13.4-2 gives the functional relationships for procedure performance.

The organization chart for the WEDCO Operations is given in Figure 13.4-3.

Staffing of the WEDCO Operations group was fulfilled with the intent of satisfying two major objectives. The first objective was the planning and scheduling of test procedure issue and the necessary writing, review and approval of test procedures. Concurrent with this effort, flushing and hydrostatic tests were conducted as limited by construction completion. Figure 13.4-3 shows the organization created to satisfy this objective.

The second objective was to staff and modify the organization to perform a multi-shift test program when construction was completed. This organization technically directed the test program on shift through assignment of Startup Directors. The Startup Directors were selected on the basis of proven competence and experience during the period of preliminary testing described above. They reported to the Operations Manager. In support of this on-shift test effort, the Procedures and Results Manager continued to supervise test procedure writing and revision, material coordination, technical support requirements to permit the shift testing organization to direct the test program at maximum productivity. Figure 13.4-3 also shows the organization that was created to meet these objectives.

The functions, duties and responsibilities for the positions presented in Figures 13.4-1 through 13.4-4 are discussed in the remainder of this section.

Position Title: Test Program Director, WEDCO

Primary Function:

Managed the activities of the Test Program in conduct of plant startup, including core loading, from point of construction completion through commercial operation.

Duties and Responsibilities:

1) Planned and scheduled work load, assigned work, recommended budgets, controlled expenditures, selected and trained subordinates, reviewed performance of subordinates, recommended wage or salary adjustments, reported results and unusual situations to immediate supervisors.

2) Made Decisions and Took Appropriate Action

    a) Established the Operations organization chart, initiated job descriptions and duties,hired and assigned personnel.

    b) Formulated policies and procedures to direct activities of subordinates. Ensured that policies and procedures were correctly implemented.

    c) Directed the activities of the Operations Manager and Procedures and Results Manager.

d) Determined limits of responsibilities for each department (Operations and Procedures and Results).

e) Established working relationship with other WEDCO departments (construction, engineering, financial, etc.)

f) Supervised the immediate and follow-up actions taken in the even of significant startup problems with equipment/components.

g) Supervised action, prior to plant/system acceptance, in event plant/systems were operated beyond approval limits. Evaluated need for repair/replacement and proposed methods to prevent similar problems.

3) Maintained Relationship with other Departments and Agencies

a) Requested services of chemistry, radiological control, quality assurance, etc. groups. Implemented policies of these groups with respect to operations groups responsibilities.

b) Requested services of vendors, suppliers, other Westinghouse technical and field groups. Directed their activities at the site as necessary.

c) Maintained close relationship with utility management personnel in coordination of their needs and demands with WEDCO policies and schedules.

d) Provided technical and practical information on test program to engineering and design groups to improve method, procedures and schedules.

e) Communicated with other current projects to ensure that “lessons learned” were exchanged and used to improve pace and progress.

4) Occasional Duties or Special Assignments

a) Provided final approval of equipment/system test conduct

b) Determined adequacy of test procedure for safe and efficient conduct of test.

c) Determined preparation of plant and personnel to safely conduct test.

d) Participated in “walk-through” and oral examination of utility trainees as requested to evaluate preparation for examination.

e) Participated in planning and scheduling meetings with other responsible section managers to determine short and long range commitments.

f) Provided recommendations for and supervise such other special tasks as directed by the President.

5) Problem Solving

a) Identified schedule delays before they occurred and took action to eliminate them.

b) Evaluated schedule delays as they occurred and took action to reduce their effect.

c) Revised procedures, manuals and directives to permit continued progress in meeting commitments.

d) Resolved utility requests and demands in satisfactory manner while maintaining targeted pace and goals.

e) Resolved critical problems identified by groups and individuals under the Test Program Director's control. Assigned responsibility as necessary and determined the need for attention by higher authority.

f) Carried out testing and refueling program requirements of other Westinghouse NES design and engineering departments in coordination with their programs and schedules.

6) Decision Making

a) Determined adequacy of plant operating, testing, refueling, and training procedures and methods.

b) Determined preparation of plant and personnel to conduct testing, refueling assignments.

c) Determined and approved expenditures for materials and supplies to support activities.

d) Determined and approved expenditures for repair, modification and/or replacement of major components or systems or portions thereof.

e) Determined hiring, transferring and discharge of assigned personnel.

f) Determined need for rerates, reclassification of assigned personnel, and took action.

g) Determined necessity for above normal working hours and assigned personnel and compensated them appropriately.

<u>Position Requirements:</u>

1) Education- High School, College (B.S. or Science degree)

2) Specialized or technical knowledge and skills – Must have substantial previous experience in operation, testing and maintenance of nuclear power plants. Must have completed formal technical training and qualification in nuclear plant operation including plant and system design and construction, safeguards analysis, emergency procedures and environmental hazards. Should have previous core loading/defueling experience including criticality control and fuel handling procedures.

3) Types of work experience. Minimum number of years for each.

Plant Operation, Startup and Testing – 4 years

Related work experience in the nuclear power field such as design, engineering, safety analysis, project engineering, nuclear plant maintenance, or refueling operations.

Position Title: Operations Manager, WEDCO

Primary Function:

Managed portions of the operational activities which were required to bring a new nuclear power plant to a licensable and acceptable operating condition.

Duties and Responsibilities

1) Planned and scheduled work load, assigned work, recommended budgets, controlled expenditures, selected and trained subordinates, reviewed performance of subordinates, recommended wage or salary adjustments, reported results and unusual situations to immediate supervisors.

2) Planned the activities of operations section with regard to conduct of testing, manpower assignments, overtime compensation, control dates for start and completion of all above to properly carry out startup and acceptance of nuclear power plant.

3) Coordinated construction activities by establishing test starting dates and ensured that construction completion dates supported test and acceptance program.

4) Directed activities of startup engineers and construction personnel (foremen and craftsmen)

5) Determined engineering requirements as to system and equipment control parameters and reported inadequacies of design.

6) Supervised preparation of operational information, reviewed test results for issue to the customer and NRC to document and prove acceptability.

7) Analyzed, interpreted and made recommendations on contracts with vendors. This included attending contract negotiations meetings.

8) Supervised activities of Test Directors on shift in their direction of construction personnel, customer personnel, vendor representatives to prepare for, conduct and accept power plant systems and/or components. Resolved significant problems delaying test program, control costs, identified contractual conflicts or change, took action on all the above, when required.

9) Directed personnel in completing test program expeditiously and safely while maintaining a good working relationship with and between construction bargaining unit crafts and customer personnel.

10) Basic duties involved supervision of the initial light-off of equipment, correction of deficiencies, detailed operational testing, correcting deficiencies, integration of tested system/component into plant operation, documenting test results, concurrent training of customer personnel and acceptability of systems and plant by customer.

Problem solving in this accomplishment included review of design and engineering, supervised field corrections of deficiencies and recommended corrections to technical groups that solved problems in line with schedules and without major modifications. Vendor field service personnel were used in the field, worked under Operations Manager's direction, corrected problems to customer satisfaction within vendor contracts and warranties and on schedule. Test personnel were given liberty to satisfy test objectives using union personnel, customer personnel, technical engineering and design personnel, avoiding conflicts between groups and maintaining schedules. The length and extent of training balanced against schedules was determined and agreement reached with the customer. Finally, the degree of documentation, meeting of operational objectives, and deficiency corrections were implemented to the satisfaction of the customer.

11) Decision Making

a) Made Final Decision
- Determined need for outside assistance from technical and vendor groups.
- Committed to management and the customer with regard to test schedules made.
- Determined the need for temporary piping, wiring, power supplies, tank trucks, barges, chemicals, steam, water. Direct installation of temporary facilities to meet schedules.

b) Reviewed with Supervisor
- Determined staffing and types of personnel to support activity.
- Contributed to overall testing schedule.
- Recommended merit increases and overtime needs.
- Established commitments for other groups in support of test program and justified action to be taken by supervisor.
- Recommended operations policies, administrative policies for approval.
- Determined necessity of higher management attention in resolution of operational activities.

12) Reviewed all procedures for core loading.

13) Coordinated the efforts of WEDCO refueling personnel, craftsmen, and vendor technical personnel in support of core loading.

14) Determined the need for technical assistance to support the core loading program, obtained their services and supervised correction of problems.

<u>Position Requirements:</u>

1) Education- College (B.S. degree)

2) Specialized or technical knowledge and skills

Must have had previous experience in plant operation, refueling, testing and maintenance of nuclear power plants. Must have completed formal technical training and qualification in nuclear power plant operation.

3) Types of work experience. Minimum number of years for each:

Plant Operation – Startup & Testing: 3-5 years

Previous Supervisory Experience: 2-4 years

Design or Project Engineering experience is preferable but not mandatory.

Position Title: Procedures and Results Manager, WEDCO

Primary Function

Directed the preparation of all test procedures, coordinated the approval of procedures by other Westinghouse Divisions and with Con Edison and reviewed all test results and coordinated results review of tests with other Westinghouse Divisions. Provided written approval of all tests and pre-operational test results to Con Edison.

Duties and Responsibilities:

1) Planned and scheduled work load, assigned work, recommended budgets, controlled expenditures, selected and trained subordinates, reviewed performance of subordinates, recommended wage or salary adjustments, reported results and unusual situations to immediate supervisors.

2) Planned the activities of the procedure writers.

3) Completed test procedure approvals in accordance with the overall test schedule

4) Reviewed all test procedure results with various design groups and provided written confirmation of review approval to Con-Edison.

5) Decision Making

    a) Made decision on adequacy of test procedures.
        - Requested engineering review of specific procedures.
        - Submitted test results to selected engineering groups for review and concurrence.
        - Scheduled review meetings with Con Edison.

    b) Reviewed with Supervisor
        - Determined staffing and types of people to support activity.
        - Contributed to overall test schedule.
        - Recommended merit increases and overtime needs.
        - Established commitments for other groups in support of test program and justified action to be taken by supervisor.
        - Requested higher management attention in resolution of procedural and test results problem.

Position Requirements

1) Education – College (B.S. Degree)

2) Specialized or technical knowledge and skills

   Must have had previous experience in plant operation, testing and maintenance of nuclear power plants. Must have had completed formal technical training and qualification in nuclear power plant operation.

3) Types of work experience. Minimum number of years for each:

   Plant Operation – Startup & Testing: 3-5 years

   Previous Supervisory Experience: 2-4 years

Position Title: Startup Engineers, WEDCO

Primary Function:

Acted as cognizant engineer for assigned systems in startup of Indian Point 3. Responsibilities included test procedure research, writing, resolution of comments, final issue and test conduct.

Duties and Responsibilities:

1. Followed system through construction phase, reported on status and remained familiar with field changes or other problems affecting testing.

2. Conducted research into design objectives, system parameters in sufficient detail to write test procedures.

3. Wrote test procedures.

4. Assisted management in obtaining Con Edison approval of procedures.

5. Resolved comments and issued final approved test procedures.

6. Conducted system tests in accordance with approved procedures

7. Resolved testing problems, coordinated activities of test personnel, identified significant problems of delay, inability to meet test objectives, personnel or plant safety to supervision.

8. Contacted and interfaced with vendors, architect-engineers, and Westinghouse.

9. Worked with Construction Group to ensure systems were ready for testing. Also ensured that needed repairs or modifications, resulting from tests, were made.

10. Provided interface with the customer in rendering technical assistance during the conduct of tests by customer operating personnel.

11. Responsible for detailed review of procedures and ensured personnel safety and equipment safety in the writing and carrying out of tests.

12. Followed the test program during the various stages of plant completion.

Position Requirements:

Education and Experience Requirements – College Degree in Engineering, Physics or other Science. Alternate to degree shall be high school graduate with minimum of two years experience in nuclear plant testing, operations, training construction or direct support of these nuclear activities.

Position Title: Refueling Engineer

Primary Function:

Ensured that fuel was handled properly in accordance with approved procedures. Responsible for correct operation, positioning and monitoring of the incore loading instrumentation. Concurred in the insertion of each fuel assembly into the reactor.

Duties and Responsibilities:

1) Coordinated the efforts of WEDCO refueling personnel, craftsmen and Con Edison personnel in the conduct of core loading.

2) Determined the need for technical assistance to support the program and assisted in supervising correction of problems.

3) Assisted in maintaining a daily log of actual core loading activities.

4) Observed and ensured the proper operation of the fuel handling equipment sequencing, inspections and orientation of fuel assemblies from storage to installation of fuel into the reactor vessel.

5) Responsible for the supervision and coordination of all fuel handling operations, necessary data acquisition and analysis relating to reactivity control.

6) Authorized the movement of each fuel assembly.

7) Observed and ensured the proper sequencing of fuel handling and final material inspection of fuel assemblies prior to installation.

8) Designated the location and position of all fuel assemblies in the core.

9) Kept Manager of Operations informed of progress, identified critical needs, made recommendations to safely and satisfactorily completed core loadings.

Position Requirements:

Education and Experience – College Degree in Engineering, Physics or other Science or equivalent experience. Participated in core loading preparations and training program at Indian Point 3.

Position Title: Startup Directors

Primary Function:

Provided technical supervision of testing evolutions carried out on shift.

Duties and Responsibilities:

1) Ensured that testing was carried out in accordance with approved test procedures.

2) Evaluated, approved, or obtained higher level approval, of necessary revisions to test procedures.

3) Ensured systems/components were operated and maintained in accordance with good engineering practices to ensure personnel safety.

4) Coordinated the efforts of various participating groups (Operations, Con Edison, construction crafts or foremen, vendors, Westinghouse NES personnel, etc.) to effectively and safely carry out assigned tests.

5) Maintained log of activities to ensure good communications between personnel on crew and between shifts.

6) Notified cognizant authorities of problems: significant delays, personnel or plant safety, satisfaction of test or design objectives, need for assistance.

Position Requirements:

1) Education & Experience – College Degree in engineering or science field or equivalent experience. Participated in IPP test procedures research, writing, review and issue. Participated in IPP pre-operational flushing and hydro test program as cognizant systems test engineer. Participated in other operations, testing, startup programs such as those conducted at other turnkey sites, shipyards, Naval Reactor facilities, which involved nuclear reactors and steam equipment.

Position Title: Lead Refueling Engineer

Primary Function:

Ensured that fuel was handled in accordance with approved procedures. Responsible for correct operation, positioning and monitoring of the incore loading instrumentation. Concurred in the insertion of each fuel assembly into the reactor.

Duties & Responsibilities:

1) Coordinated the efforts of WEDCO refueling personnel, craftsmen and Con Edison personnel in conduct of core loading.

2) Determined the need for technical assistance to support the program and assist in supervising correction of problems.

3) Assisted in maintaining a daily log of actual core loading activities.

4) Observed and insured the proper operation of the fuel handling equipment sequencing, inspections and orientation of fuel assemblies from storage to installation of fuel into the reactor vessel.

5) Responsible for supervision and coordination of all fuel handling operations, necessary data acquisition and analysis relating to reactivity control.

6) Authorized the movement of each fuel assembly.

7) Observed and insured the proper sequencing of fuel handling and final material inspection of fuel assemblies prior to installation.

8) Designated the location and position of all fuel assemblies in the core.

9) Kept Manager of Refueling informed of progress, identify critical needs, made recommendations to safely and satisfactorily complete core loadings.

Position Title: Refueling Engineers

Primary Function:

Directed preparation and conduct of core loading at Indian Point 3, as required by Refueling Manager and/or Lead Refueling Engineer.

Duties and Responsibilities:

1) Planned and assisted in scheduling of core loading task to meet critical date established by overall schedule.

2) Assisted in training of refueling personnel via lectures, study programs and use of tools, cranes, etc.

3) Coordinated the efforts of WEDCO refueling personnel, craftsmen and Con Edison personnel in conduct of core loading.

4) Determined the need for technical assistance to support the programs and informed the Lead Refueling Engineer of this need.

5) Assisted in maintaining a daily log of preparatory and actual core loading activities.

6) Observed and insured the proper fuel handling operations, sequencing inspections and orientation of fuel assemblies from storage to installation of fuel into the reactor vessel.

7) Responsible for observing fuel handling operations and obtained necessary data and control of reactivity.

8) Kept Lead Refueling Engineer informed of progress, identified critical needs, made recommendations to safely and satisfactorily complete core loadings.

Position Requirements:

1) Education & Experience - College Degree in Engineering, Physics or other Science equivalent experience. Participated in core loading preparations and training program at Indian Point 3.