13.0 INITIAL TESTS AND OPERATIONS

This chapter provides historical information on the Three Mile Island Nuclear Station Unit 1 (TMI-1) initial test program for structures, systems, components, and design features for both the nuclear and non-nuclear portions of the plant. The information provided addresses major phases of the test program, including pre-operational tests, initial fuel loading and initial criticality, low power tests, and power ascension tests, which were all performed prior to placing the plant in commercial operation. The initial testing and operation program was conducted by and for Metropolitan Edison Company, Jersey Central Power and Light Company, and Pennsylvania Electric Company, which were the owners at that time. TMI-1 was operated by Metropolitan Edison Company.

13.1 TEST PROGRAM DESCRIPTION

A comprehensive initial testing and operation program was conducted at TMI-1. This program was intended to provide adequate confidence that the structures, systems, and components will perform satisfactorily in service and that adequate records are retained. The program accomplishes this objective by testing structures, systems, and components in accordance with written procedures to demonstrate that they comply with their design codes and standards.

The Test Program applies to all unit structures, systems, and components necessary to conduct commercial operation, and is initiated when they are turned over for construction tests from the Construction Manager, and is concluded when the direct responsibility for the unit is transferred from the GPU Project Manager to the Met-Ed Generation Department for normal commercial operations.

The program's objectives are accomplished by using written test procedures to demonstrate that the unit's structures, systems, and components comply with applicable codes and standards and perform, both separately and collectively, in compliance with their design criteria for normal and safety related functions.

13.1.1 ADMINISTRATIVE PROCEDURES (TESTING)

The test program was conducted in a planned and systematic fashion and in accordance with procedures and policies contained in the Three Mile Island Nuclear Generating Station Test Manual and individual Test Instructions.

Testing of the unit's structures, systems, and components was conducted in accordance with written test procedures. The completed test procedures, including data sheets, shall be retained as proof that the test results are satisfactory.

Changes to the test program shall be made as necessary to improve the program or to incorporate modifications to existing technical or regulatory requirements that affect testing. Changes to the instruction shall be approved by organizations originally approving the instructions prior to implementing the changes.

Only tests listed in the Master Test Index (MTX) are to be performed as part of the test program and these tests will only be conducted when they are authorized by the approved Test Plan.

13.1.1.1 Test Procedures

Test procedures contain the technical content of the test program. Design requirements and test requirements are translated into test procedures which are used to demonstrate the ability of structures, systems, or components to comply with the requirements. Design requirements and test requirements are contained in documents such as Architect Engineer (AE) or Nuclear Steam Supply System (NSSS) Test Specifications, FSAR, commitments to the regulatory agencies, equipment technical manuals, and applicable codes and standards. Test results are recorded in test procedures and are reviewed and approved to ensure that test requirements have been satisfactorily met. Changes or exceptions to test procedures are reviewed and approved by individuals from the same organizations that originally approved the procedure. Exceptions (i.e., procedure changes that do not change scope or intent of the procedure) are recorded in the procedure and must be approved after the test has been performed. Any changes that affect the scope or the intent of the procedure must be approved prior to test performance. Four types of test procedures shall be used in the Unit 1 Test Program. Their descriptions are as follows:

a. Individual Test Procedures

These procedures are prepared especially to demonstrate the system's or unit's ability to comply with test requirements. Data are recorded for evaluation and proof of satisfactory test performance.

b. Functional Verification Procedures

These procedures are prepared to demonstrate the ability of certain systems and components to operate normally within established parameters and to obtain required test data. Functional Verification Procedures use Met-Ed's operating procedures to provide the necessary test steps. The Functional Verification Procedure may require minor deviations from the operating procedure to allow tests of various features, such as hi-low level alarms and automatic switching.

c. Generic Test Procedures

These procedures are used to perform construction tests and checkouts. They may be used to develop checklists and procedures for inspection, alignment, checkout, and preliminary operation of systems and components. These procedures require that data be obtained for evaluation of test results.

d. Special Procedures

These procedures are used to perform tests and operations that are not contained in Generic Test Procedures, Individual Test Procedures, or Functional Verification Procedures, e.g., chemical cleaning and charcoal filter testing.

13.1.1.2 Test Index

The Test Index contains a description of the start-up testing to be performed on Unit 1. The Test Index also contains the MTX that lists all the structures and systems and their assigned test procedures. The MTX assigns safety related classifications to the structures and systems

and assigns a safety related category to the test procedures. Only tests that are listed in the MTX will be performed unless specifically authorized by the GPU Test Superintendent.

The Test Index shall also contain a section to provide scopes for individual test procedures. The scope shall consist of a description of the test's objectives, the source of test requirements, and source of acceptance criteria.

13.1.1.3 Prerequisite Lists

The prerequisite list contains all items that must be satisfactorily completed or in an appropriate state of readiness to support the start of major events. As a minimum, a prerequisite list shall be prepared for each test program milestone event. The list shall be periodically updated and reviewed prior to commencing the associated event.

13.1.1.4 Test Schedules

The test schedule provides the sequence for test performance over a certain designated period of time. The schedule provides the means for conducting an orderly test program and for keeping management informed of testing progress.

13.1.1.5 Test Manning Assignments

The Test Manning Assignments provide a listing of stations to be manned by appropriate personnel during the conduct of complex tests. Test Manning Assignments during the conduct of complex tests remain in effect until released by the Shift Test Engineer in charge of the test.

13.1.1.6 Test Plan

The Test Plan provides a short-range schedule to authorize performance of specific tests. The Test Plan is issued at various intervals determined by testing activity and shall state the period for which it is valid. A new test plan will normally be issued before the validation date is past in order to ensure a continuation of testing. Tests shall be performed when contained in the valid test plan.

The Test Plan is reviewed and approved at scheduled Test Planning Meetings.

13.1.1.7 Test Instructions

Test Instructions provide procedures for the administrative control of the Test Program. A list of Test Instructions is contained in Table 13.1-1

13.1.2 ADMINISTRATIVE PROCEDURES (MODIFICATIONS)

The administrative procedures used for incorporating system modifications or procedure changes are contained in the Test Instructions.

13.1.3 TEST OBJECTIVES AND PROCEDURES

The Test Program is divided into three test phases: (1) Construction, (2) Preoperational, and (3) Fuel Loading and Initial Operation. A description of each phase and its objectives follows.

13.1.3.1 Construction Test Phase

The construction test phase starts when the system, or partial system, is turned over to the GPU Startup Engineer and is completed when all assigned construction tests have been satisfactorily performed and the system accepted by Met-Ed for tests, operations, and maintenance.

The objective of construction tests is to demonstrate that structures, systems, and components comply with applicable engineering drawings, codes, and standards and to verify that the installed systems and components operate properly and are ready to support further operations and testing.

Construction tests consist of:

a. Fluid System Hydrostatic Tests

These tests are performed to demonstrate that the system complies with the acceptance criteria contained in applicable codes and standards.

b. Fluid System Cleanliness Flushes

The tests are performed to clean the system and to demonstrate that the cleanliness requirements have been satisfactorily obtained.

c. Electrical System Checkouts

1) Power Distribution

These checkouts demonstrate that the electrical distribution system complies with applicable plans, specifications, codes, and standards.

2) Control Circuits and Systems

These checkouts demonstrate that the individual electrical control circuits and systems function as designed.

3) Protective Devices

These checkouts demonstrate by operation under simulated conditions that the electrical system's protective devices function as designed.

d. Installed Instrumentation Checkouts

These checkouts demonstrate that the instrumentation is properly aligned, calibrated, and capable of performing its designed function.

e. Preliminary Operation Tests

The preliminary operational tests are performed to determine if there is any major deficiency in the systems or components. This run-in period provides reasonable assurance that the system or component operates properly and is able to support further tests and operations. These tests and checkouts include items such as: lubrication, setting of limit switches, and setting of torque limiting devices.

13.1.3.2 Preoperational Test Phase

The preoperational test phase starts when a system, or partial system, is turned over to Met-Ed from the GPU Nuclear Start-up Engineer and ends at the start of initial fuel loading.

This phase consists of functional tests and verifications that demonstrate the component's ability to perform its design function and of operational tests that demonstrate the system's ability to operate as designed under actual or simulated conditions. These tests are performed on integrated systems or on an individual system basis. Table 13.1-2 contains a listing of safety related tests that will be performed during preoperational and initial start-up test phases.

a. Hot Functional Testing

Hot functional tests will be performed during the preoperational phase. These tests demonstrate the ability of the Reactor Coolant System and associated auxiliary systems to operate properly at operating pressure and temperature. Table 13.1-3 contains a listing of tests that will be performed during the hot functional test phase.

b. Vibration Surveillance Program

The first-of-a-kind reactor internals vibration surveillance program will be conducted on the prototype internals at Oconee. This program meets the requirements of Safety Guide No. 20 for Prototype Internals. The program includes vibration survey tests, analyses and description of forcing functions, vibration analyses of the reactor internals, prediction of responses, vibration measurements during hot functional testing, data analysis, acceptance criteria, and post-testing inspection of the reactor internals.

The TMI-1 vibration surveillance program will comply with the USNRC Reg. Guide No. 1.20 for Reactor Internals. The program consists of a detailed internals inspection both prior to and following hot functional testing. In addition, the internals are subjected to at least 10^7 cyclic stresses during HFT by running two or more reactor coolant pumps at hot, pressurized conditions for at least 278 hours.

13.1.4 FUEL LOADING AND INITIAL OPERATION

The initial startup phase starts with initial fuel loading and ends upon completion of the power escalation test program. Table 13.1-4 contains a list of tests that will be performed during the initial startup phase. This phase consists of:

a. Initial Fuel Loading

Following the satisfactory completion and data evaluation of required preoperational tests and review of other initial fuel loading prerequisites, the Test Working Group will allow fuel loading to commence.

An Initial Fueling Supervisor appointed by the GPU Project Manager will be responsible for supervising the initial fuel operations.

Fuel will be loaded into the reactor in accordance with a step-by-step written procedure. This procedure, which contains a number of safety precautions and operating limitations, includes the following items:

1) A sequence of loading temporary detectors, sources, control rods, and fuel assemblies to maintain shutdown margin requirements.

2) Conditions under which fuel loading may continue after any step.

3) Identification of responsibility and authority.

4) During any reactivity changes, a minimum of two detectors will be operating and indicating the neutron level after the source has been inserted. At all other times, at least one detector will indicate the neutron level.

5) Two completely independent plots of reciprocal neutron multiplications as a function of the parameter causing reactivity change will be maintained.

6) Reactivity effects for each fuel assembly addition will be checked before the fuel assembly is released by the fuel-handling grapple.

7) The reactivity effect for the next fuel addition will be estimated before the next fuel assembly is inserted.

8) The boron concentration in the reactor vessel, spent fuel pool, and Reactor Coolant System will be maintained at a value to ensure the required subcritical margin at all times.

9) The valve alignment of auxiliary systems connected to the Reactor Coolant System will be checked periodically to prevent dilution of the reactor coolant boron concentration.

10) Chemical analysis and water level monitoring will be conducted to ensure that inadvertent dilution of the boron concentration in the reactor coolant has not occurred.

11) Communication between Control Room and fuel handling areas will be maintained.

12) Plant radiation monitoring systems as required for fuel loading will be in operation.

13) Health physics and chemistry monitoring services will be provided.

14) Throughout the entire loading process, two persons, working independently, will verify fuel assembly identification and location within the core.

15) If an unexpected event or response occurs, loading will be suspended until the reason has been determined and an adequate evaluation made.

16) Two licensed Reactor Operators (one Senior Reactor Operator) as well as one additional experienced startup representative will be present at the facility whenever fuel is moved into the reactor vessel.

b. Preparations for Initial Criticality

Upon completion of the initial fuel loading, pre-startup checks will be completed prior to the approach to initial criticality. Reactor Coolant Flow Test and Reactor Coolant Flow Coastdown Test will be conducted under hot, pressurized reactor conditions to determine the flow characteristics of the Reactor Coolant System after reactor core installation.

c. Initial Criticality and Zero Power Physics Tests

A written procedure will be used as the controlling document for taking the primary system from a filled and vented condition following fuel loading through the zero power physics test program to a zero power, hot condition. This will be a step-by-step procedure that will list or reference all appropriate limits and precautions (including technical specifications). It will incorporate or reference applicable steps in unit operating procedures that have been modified and approved for use during the zero power test program. The modified operating procedure steps will be blended with the zero power test program to produce a preplanned, orderly, organized test sequence. The step-by-step procedure ensures a safe, well-controlled test program. In cases where performance of a particular step or series of steps involves a significant safety consideration, a precautionary note will precede the step or steps.

d. Power Escalation Tests

TP 800/21, Unit Startup and Power Escalation Test Procedure, will be the controlling document for taking the unit from a zero power, hot condition through the various power test plateaus up to commercial operation at licensed power. This will be a step-by-step procedure that either incorporates or references applicable steps in normal approved unit operating procedures required to increase power from one test plateau to another and maintain steady-state power at each test plateau. The normal operating procedure steps will be blended with the power escalation test program to produce a preplanned, orderly, organized test sequence. The step-by-step procedure ensures a safe, well controlled test program. All appropriate limits and precautions (including technical specifications) will be listed or referenced in the applicable operating procedures, individual power escalation test procedures, or in the controlling document itself. In cases where performance of a particular step or series of steps involves a significant safety consideration, a precautionary note will precede the step or steps in the controlling document.

13.1.5 ADMINISTRATIVE PROCEDURES (SYSTEM OPERATION)

Upon acceptance of a system by Met-Ed for test and operations, the system will be operated in accordance with its normal operating procedure. The operating procedure will be revised as necessary during this period and a final approved procedure issued.

Selected emergency operating procedures will be performed during the test program. Those emergency procedures which are not possible to perform will be dry run by the station staff.

TABLE 13.1-1
(Sheet 1 of 1)

LIST OF TEST INSTRUCTIONS

TI-1	Repair Removal Authorization
TI-2	Test Plan
TI-3	Briefing and Dry Run
TI-4	Control of Test Records
TI-5	System Turnover
TI-6	Test Schedules
TI-7	GPU Startup Problem Report
TI-8	Unusual Occurrences
TI-9	Conduct of Test
TI-10	Prerequisite List
TI-11	Test Index
TI-12	Not used
TI-13	Test Interface Instructions
TI-14	Training and Qualifications of Test Personnel
TI-15	Not used
TI-16	Not used
TI-17	Shift Test Engineer's Log
TI-18	Test Procedure Documents
TI-19	Control of Test Equipment

TABLE 13.1-2
(Sheet 1 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
SP 2	Filter Efficiency Tests
MCP-15	Hanger Hot Setting Determination
SP 53.10	Reactor Vessel Head Service Structure Temperature Profile Determination
SP 102.6	Fire Protection System Checkout
TP 120/3	Fuel Handling System Integrated Functional Test
TP 150/2	Reactor Building Structural Integrity Test
TP 150/3	Initial Reactor Building Leak Rate Test (ILRT)
TP 150/4	Post Accident Hydrogen Purge System Functional Test
TP 151/1	Reactor Building Isolation Valve Leak Test
TP 153/3	Fluid Block System Functional Test
TP 153/4	Fluid Block System Actuation Time Determination
TP 154/3	Penetration Pressurization Operational Test
TP 160/2	R. B. Emergency Cooling Water System
TP 160/3	Reactor Building Purge System Functional Test
TP 160/4	R. B. Fans Functional Test
SP 166.2	Plant Test Panel Pre-op. Alignment
TP 172/2A	Control Building Ventilation Functional Test Part A - Compressed Air System
TP 172/2B	Control Building Ventilation System Functional Test - Part B - Control Building Chilled Water System
TP 172/2C	Control Building Ventilation System Functional Test Section C: Control Building Heating and Ventilation System
TP 180/3	Fire Service System Functional Test
TP 200/1	Reactor Internals Vent Valve Inspection Test
TP 200/4	Reactor Coolant System Hydrostatic Test

TABLE 13.1-2
(Sheet 2 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
TP 200/11A	Reactor Coolant Pump Flow Test Part A - Cold, No Core
TP 200/11C	Reactor Coolant Pump Flow Test Part C - Hot, No Core
TP 200/11D	Reactor Coolant Pump Flow Test Part D - Hot, With Core
TP 200/12A	Reactor Coolant Flow Coastdown Test Part A - Cold, No Core
TP 200/12B	Reactor Coolant Flow Coastdown Test Part B - Cold, With Core
TP 200/12C	Reactor Coolant Flow Coastdown Test Part C - Hot, No Core
TP 200/12D	Reactor Coolant Flow Coastdown Test Part D - Hot, With Core
TP 201/2	Core Flooding System Functional Test
TP 201/5	Core Flood Flow Test
SP 201.19	Reactor Coolant Pump Vibration Test
TP 202/3	Makeup and Purification System Functional Test
TP 202/7	Makeup and Purification System E. S. Test
TP 203/1	Decay Heat Removal System B. W. S. T. Functional Test
TP 203/4	Decay Heat Removal System Functional Test
TP 203/7	Decay Heat Removal System E. S. Test
TP 204/3	Reactor Building Spray System Functional Test
TP 230/3	Liquid Waste Disposal System - Transfers To and From the Reactor Coolant and Miscellaneous Waste Evaporator Feed Tanks
TP 230/4	Liquid Waste Disposal System - Start-up, Operation, and Transfers From the Reactor Coolant, and Miscellaneous Waste Evaporators
TP 230/8	Solid Waste Disposal System Test
TP 231/3	Gaseous Waste Disposal System Functional Test
TP 240/3	Intermediate Cooling System Functional Test
TP 251/1	Reactor Building Sump, Auxiliary Building Sump and Compartment Leak Detector Functional Test

TABLE 13.1-2
(Sheet 3 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
SP 254.33	Turbine Generator Initial Operation
TP 256/3	Instrument and Control Air System Functional Test
TP 256/4	Loss of Instrument Air Test
TP 263/4	Decay Heat River Water System Functional Test
TP 264/4	Decay Heat Closed Cooling System Functional Test
TP 266/4	Nuclear Service River Water Functional Test
TP 267/4	Nuclear Service Closed Cooling Water System Functional Test
TP 271/4	Main and Auxiliary Steam System Functional Test
TP 273/3	Emergency Feedwater Turbine and Motor-Driven Pumps Functional Test
TP 301/2	Nuclear Instrumentation Detector Cabling and Response Tests
TP 301/3A	Nuclear Instrumentation Pre-Op. Calibration (Source Range)
TP 301/3B	Nuclear Instrumentation Pre-Op. Calibration (Intermediate Range)
TP 301/3C	Nuclear Instrumentation Pre-Op. Calibration (Power Range)
TP 301/3D	Determination and Setting of Detector Voltages
TP 305/1A	Reactor Protection System Initial Power Application
TP 305/1B	Reactor Protection System Preoperational Calibration
TP 305/2	Reactor Protection System Response Time
SP 330/1	Control Rod Drive Pre-Op. Calibration
TP 330/2	CRD Control System Operational Test
TP 330/3	Control Rod Drive Mechanism Functional Test
TP 330/3A	Post Core Load CRDM Functional Test
TP 330/4	Integrated CRD System Test
TP 330/5	CRD Trip Test
TP 360/1A	Process Radiation Monitor Calib. and Functional Test for Portable Atmospheric Monitors

TABLE 13.1-2
(Sheet 4 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
TP 360/1B	Process Radiation Monitor Calibration and Functional Test for Fixed Atmospheric Monitors
TP 360/1C	Process Radiation Monitor Calibration and Functional Test for Liquid Monitors
TP 360/2	Area Radiation Monitoring Calibration and Functional Test
TP 401/1	Diesel Generator Startup Test
TP 401/3	Station Battery Discharge and Charge Test
TP 500/3	Initial Radiochemistry Test
TP 600/1	Unit Heatup Test
TP 600/3	Soluble Poison Concentration Control Test
TP 600/4	Makeup and Purification System Operational Procedure
TP 600/5	Nuclear Chemical Addition and Sampling System Operational Test
TP 600/6A	Liquid Waste Disposal System Operational Test
TP 600/7	Intermediate Cooling System Operational Test
TP 600/10	RCS Hot Leakage Test
TP 600/11	Emergency Feed System and OTSG Level Control Test
TP 600/13	Pressurizer Operation and Spray Flow Test
TP 600/14	Pipe and Component Hanger Hot Deflection and Inspection Test
TP 600/15	Non-Nuclear Instrumentation Hot Operation and Calibration
TP 600/17	Control Rod Drive Operational Test
TP 600/20	Loss of Electrical Power Test (Without E. S.)
TP 600/21	Integrated E. S. Actuation Test
TP 600/23	Reactor Protection System Functional Test
TP 600/24	Unit Cooldown Test

TABLE 13.1-2
(Sheet 5 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
TP 600/28	Controlling Procedure for HFT
TP 600/29	Reactor Coolant System Thermal Expansion Functional Test
TP 600/30	HFT Checkpoints
TP 710/1	Zero Power Test
SP 710/2	Controlling Procedure for Post Fuel Load Precritical Testing
TP 800/2	NI Calibration at Power
TP 800/3	Biological Shield Survey
TP 800/5	Reactivity Coefficients at Power
TP 800/6	Turbine Bypass System Test
TP 800/7	Feedwater System Operation and Testing
TP 800/8	ICS Tuning at Power
TP 800/9	Turbine Generator Operational Testing
TP 800/11	Core Power Distribution
TP 800/12	Unit Load Steady State Test
TP 800/14	Turbine/Reactor Trip Test
TP 800/16	Reactivity Depletion vs Burnup
TP 800/17	Unit Acceptance Test
TP 800/18	Power Imbalance Detector Correlation Test
TP 800/20	Rod Reactivity Worth Measurement
TP 800/21	Unit Startup and Power Escalation Test
TP 800/22	NSS Heat Balance
TP 800/23	Unit Load Transient Test
TP 800/24	Incore Detector Testing
TP 800/30	Power Escalation Check Points

TABLE 13.1-2
(Sheet 6 of 6)

SAFETY RELATED TESTS TO BE PERFORMED DURING PREOPERATIONAL AND INITIAL START-UP TEST PHASES

Test No.	Title
TP 800/31	Pseudo Dropped Rod
TP 800/32	Loss of Offsite Power Test
TP 800/33	Pseudo Rod Ejection Test
TP 800/34	Generator Trip Test
TP 800/35	Effluent and Effluent Monitoring System Test
TP 800/36	Shutdown From Outside the Control Room as Modified for Hot Functional Testing
F 1104/6	Spent Fuel Cooling System Functional Verification
F 1104/24B	Screen House Ventilation Functional Verification (Including River Water)
F 1104/29A	Liquid Waste Disposal System Functional Verification (Reactor Coolant Cleanup Processes)
F 1104/29D	Liquid Waste Disposal System Functional Verification - Part D - Decay Heat Water Cleanup Process
F 1104/29E	Liquid Waste Disposal System Functional Verification - Part E - Bleed and Feed Processes
F 1104/29I	Liquid Waste Disposal System Functional Verification - Part I - Transfer From Reactor Coolant Drain Tank
F 1104/29J	Liquid Waste Disposal System Functional Verification - Part J - Transfers Through Reactor Drain Pump
F1104/29Y	Liquid Waste Disposal System Functional Verification - Part Y - Operation and Use of the Precoat Filters

TABLE 13.1-3
(Sheet 1 of 2)

HOT FUNCTIONAL TESTS

Test No.	Title
MCP-15	Hanger Hot Setting Determination
SP 53.10	Reactor Vessel Head Service Structure Temperature Profile Determination
SP 166.2	Plant Test Panel Pre-op. Alignment
TP 200/1	Reactor Internals Vent Valve Inspection Test
TP 200/11C	Reactor Coolant Pump Flow Test Part C - Hot, No Core
TP 200/12C	Reactor Coolant Flow Coastdown Test Part C - Hot, No Core
SP 201.19	Reactor Coolant Pump Vibration Test
TP 202/7	Makeup and Purification System E. S. Test
TP 203/7	Decay Heat Removal E. S. Test
SP 254.33	Turbine Generator Initial Operation
TP 271/4	Main and Auxiliary Steam System Functional Test
TP 330/3	Control Rod Drive Mechanism Functional Test
TP 330/4	Integrated CRD System Test
TP 500/3	Initial Radiochemistry Test
TP 600/1	Unit Heatup Test
TP 600/3	Soluble Poison Concentration Control Test
TP 600/4	Makeup and Purification System Operational Procedure
TP 600/5	Nuclear Chemical Addition and Sampling System Operational Test
TP 600/6A	Liquid Waste Disposal System Operational Test
TP 600/7	Intermediate Cooling System Operational Test
TP 600/10	RCS Hot Leakage Test
TP 600/11	Emergency Feed System and OTSG Level Control Test
TP 600/13	Pressurizer Operation and Spray Flow Test
TP 600/14	Pipe and Component Hanger Hot Deflection and Inspection Test

TABLE 13.1-3
(Sheet 2 of 2)

HOT FUNCTIONAL TESTS

Test No.	Title
TP 600/15	Non-Nuclear Instrumentation Hot Operation and Calibration
TP 600/17	Control Rod Drive Operational Test
TP 600/20	Loss of Electrical Power Test (Without E. S.)
TP 600/21	Integrated E. S. Actuation Test
TP 600/23	Reactor Protection System Functional Test
TP 600/24	Unit Cooldown Test
TP 600/28	Controlling Procedure for HFT
TP 600/29	Reactor Coolant System Thermal Expansion Functional Test
TP 600/30	HFT Checkpoints
TP 800/36	Shutdown From Outside the Control Room as Modified for Hot Functional Testing

TABLE 13.1-4
(Sheet 1 of 6)

POWER ESCALATION SEQUENCE TABLE

	Test Procedure No.				
POWER LEVEL (%)	TP 500/3	TP 710/1	SP 710/2	TP 800/2	TP 800/3
0 - 15	(ZPPT)	(ZPPT)	(Pre-ZPPT)	X	(ZPPT)
15				X	
15-25					
25	DAILY				
30					
35					
40				X	X
50					
60					
70					
76				X	
85					
95					
100				X	X

Test No.	Title
TP 500/3	Initial Radiochemistry Test
TP 710/1	Zero Power Test
SP 710/2	Controlling Procedure for Post Fuel Load Pre-critical Testing
TP 800/2	NI Calibration at Power
TP 800/3	Biological Shield Survey

TABLE 13.1-4
(Sheet 2 of 6)

POWER ESCALATION SEQUENCE TABLE

POWER LEVEL (%)	Test Procedure No. TP 800/5	TP 800/6	SP 800/7	TP 800/8	TP 800/9
0 - 15		X		X	
15		X	X		X
15-25				X	
25					
30		X			
35					
40	X		X	X	X
50					
60					
70					
76	X		X	X	X
85					
95					
100	X	X	X	X	X

Test No.	Title
TP 800/5	Reactivity Coefficients at Power
TP 800/6	Turbine Bypass System Test
SP 800/7	Feedwater System Operation and Testing
TP 800/8	ICS Tuning at Power
TP 800/9	Turbine-Generator Operational Testing

TABLE 13.1-4
(Sheet 3 of 6)

POWER ESCALATION SEQUENCE TABLE

POWER LEVEL (%)	Test Procedure No. TP 800/11	TP 800/12	TP 800/14	TP 800/16	TP 800/17
0 - 15		X		20, 30, 40 and 50 effective full power days	
15	X	X			
15-25					
25		X			
30			X_T		
35		X			
40	X	X	X_R		
50		X			
60		X			
70		X			
76	X	X			
85		X			
95		X			
100	X	X			X

Test No.	Title
TP 800/11	Core Power Distribution
TP 800/12	Unit Load Steady State Test
SP 800/14	Turbine/Reactor Trip Test
TP 800/16	Reactivity Depletion vs. Burnup
TP 800/17	Unit Acceptance Test

TABLE 13.1-4
(Sheet 4 of 6)

POWER ESCALATION SEQUENCE TABLE

POWER LEVEL (%)	Test Procedure No. TP 800/18	TP 800/20	TP 800/21	TP 800/22	TP 800/23
0 - 15			X	X	
15			X	X	
15-25			X		
25		X	X	X	
30			X		
35			X	X	
40	X	X	X	X	X
50			X	X	
60			X	X	
70			X	X	
76	X	X	X	X	X
85			X	X	
95			X	X	
100		X	X	X	X

Test No.	Title
TP 800/18	Power Imbalance Detector Correlation Test
TP 800/20	Rod Reactivity Worth Measurement
SP 800/21	Unit Startup and Power Escalation Test
TP 800/22	NSS Heat Balance
TP 800/23	Unit Load Transient Test

TABLE 13.1-4
(Sheet 5 of 6)

POWER ESCALATION SEQUENCE TABLE

POWER LEVEL (%)	Test Procedure No. TP 800/24	TP 800/30	TP 800/31	TP 800/32	TP 800/33
0 - 15					
15	X	X		X_1	
15-25					
25	X				
30					
35	X				
40	X	X	X		X
50					
60					
70					
76		X	X		
85					
95					
100			X		

Test No.	Title
TP 800/24	Incore Detector Testing
TP 800/30	Power Escalation Check Points
SP 800/31	Pseudo Dropped Rod
TP 800/32	Loss of Offsite Power Test
TP 800/33	Pseudo Rod Ejection Test

TABLE 13.1-4
(Sheet 6 of 6)
POWER ESCALATION SEQUENCE TABLE

POWER LEVEL (%)	Test Procedure No. TP 800/34	TP 800/35	TP 800/36	MCP-15
0 - 15				
15		(ZPPT)(X)	X_1	X
15 - 25				
25				
30				
35				
40		X		X
50				
60				
70				
76		X		X
85				
95				
100	X	X		X

Test No.	Title
TP 800/34	Generator Trip
TP 800/35	Effluent and Effluent Monitoring System Test
SP 800/36	Shutdown from Outside Control Room As Modified for Hot Functional Testing
MCP-15	Hanger Hot Setting Determination

Where (ZPPT) = During zero power physics test
and X = 10 percent generator output
X^1 = turbine trip
X_T = reactor trip

Note: Major power plateaus are 15, 40, 76 and 100 percent full power

13.2 AUGMENTATION OF APPLICANT'S STAFF FOR INITIAL TESTS AND OPERATIONS

Met-Ed, a subsidiary of GPU, is the responsible owner and applicant for TMI-1. Met-Ed, via a service agreement, is utilizing the services of the GPU Service Corporation, which is the agent for the owners. The Design and Construction Division of the GPU Service Corporation, acting for Met-Ed, is responsible for conduct of the test program until the unit is declared commercial. The Test Program Organization for TMI-1 is shown on Figure 13.2-1.

13.2.1 ORGANIZATIONAL FUNCTIONS, RESPONSIBILITIES, AND AUTHORITIES

13.2.1.1 GPU Service Corporation (GPUSC)

a. GPU Startup and Test Department (GPU Engineering)

The GPU Startup and Test Department is responsible for the administrative and technical content of the test program. The Start-up and Test Department has assigned a Test Superintendent to the Three Mile Island nuclear project to administer the test program and act as chairman of the Test Working Group.

b. GPU Projects

GPU Projects is responsible for the overall conduct of the project, including the test program. This responsibility is carried out by the GPU Test Superintendent for the GPU Project Manager, Three Mile Island.

c. GPU Quality Assurance Department

The GPU Quality Assurance Department is responsible for the administration of the GPUSC Startup and Test Quality Assurance Plan.

13.2.1.2 United Engineers And Constructors (UE&C)

a. Construction Division (Construction Manager)

UE&C as Construction Manager is responsible for the construction of the unit in accordance with drawings and specifications. This responsibility includes the completion of the systems, or partial systems, in a sequence that will allow efficient and orderly testing. The Construction Division provides craft support for tests and to correct deficiencies.

b. Startup Department

The UE&C Startup Department is responsible for preparation and conduct of construction-related tests and checkouts and subsequent turnover of systems/equipment to Met-Ed. The Startup Department assigns a Lead Startup Engineer and staff to conduct construction tests and checkouts under the technical and operational direction of the GPU Test Superintendent.

c. Field Quality Control Group

The UE&C Field Quality Control Group is responsible for performing the required inspection of construction tests and checkouts in accordance with Quality Control procedures and checklists.

13.2.1.3 Metropolitan Edison Company (MET-ED)

a. Station Supervisory Staff

The station supervisory staff is responsible for the operation and maintenance of systems and equipment after acceptance from the UE&C Startup Department. This responsibility includes operating systems in accordance with test procedures to perform preoperational and initial startup tests. Met-Ed assigns a voting representative to the Test Working Group.

b. Met-Ed System Engineering

Met-Ed System Engineering is responsible for the control of tests, checkouts, and the acceptance of results for all protective relays, substations, and switchgear. System Engineering is also responsible for the design review of the substation switchyards.

13.2.1.4 Gilbert Associates, Inc. (GAI)

Gilbert Associates, Inc. is the AE for Unit 1. As the AE, they are responsible for the entire design of the unit, except those portions designed by the owner, the turbine generator supplier, and the NSSS supplier. This responsibility includes incorporating those items required to support the NSSS and the Turbine Generator System. The AE assigns a voting representative to the Test Working Group.

13.2.1.5 Babcock And Wilcox, Inc. (B&W)

B&W is the NSSS supplier for Unit 1. B&W is responsible for the design and delivery of the NSSS and assigns a voting representative to the Test Working Group.

13.2.1.6 General Electric Co. (GE)

General Electric Co. supplies the turbine generator for Unit 1. They are responsible for the design and delivery of the turbine generating unit and provide a site representative to concur in test procedures for tests of the turbine generator and associated equipment and systems.

13.2.2 INTERRELATIONSHIPS AND INTERFACES

13.2.2.1 Plant Operations Review Committee (PORC)

PORC reviews safety related test procedures. This review is coordinated through the Met-Ed Station Superintendent's Test Working Group representative. A complete description of the duties and responsibilities of PORC is contained in Chapter 15 (Technical Specifications).

13.2.2.2 Test Working Group (TWG)

The TWG is the coordinating body for the Start-up Test Program. The TWG functions in such a manner as to assure that all safety related testing is conducted properly and that all test requirements are satisfactorily met. All approvals by the TWG will be indicated by all voting members' signatures.

The TWG's responsibilities include the following items:

. Approval of milestone and prerequisite lists.

. Approval of project test sequence.

. Conduct of review and approval of safety related test procedures.

. Approval of changes to safety related test procedures.

. Review and approval of test results of safety related test procedures.

. Review and approval of the scope of the test program contained in the Test Index.

The TWG membership shall consist of one member and at least one alternate member from the following organizations: GPU Startup and Test, B&W, Gilbert Associates, and Met-Ed Station Supervisory Staff. The Met-Ed Generation Department assigns a nonvoting member to the TWG to act as Test Auditor. The following is a list of the TWG membership, qualifications, requirements, and a brief description of their duties and responsibilities.

a. GPU Startup and Test Representative

The GPU Test Superintendent is the TWG chairman and a voting member. As chairman, he is responsible to convene and conduct TWG meetings, as necessary, and to achieve agreement of its voting members for the technical and administrative content of the test program.

b. Architect Engineer Representative

A senior Startup and Test Engineer and alternate shall be assigned by the AE as a TWG voting member.

He shall be responsible for the technical content of testing for that portion of the unit designed by the AE. The AE member of the TWG has received his M.S. degree in Nuclear Engineering from the University of Washington and has had eight years of experience in the commercial nuclear power field. Four of those years he was Project Engineer on a 450-MWe pressurized water reactor which involved equipment specification and procurement, fluid system design, and startup and test program resolution of design deficiencies. This also included the startup and testing of a second pressurized water reactor in Japan. The remaining four years have been spent on the TMI project in the following areas: obtaining AE design completions for startup; obtaining AE resolution for system design deficiencies; obtaining data for AE engineering

evaluations; approving field changes; coordinating design interfaces with NSSS and turbine generator vendor; and functioning as a TWG member.

c. Nuclear Steam Supply System Representative

The B&W Site Operations Manager and his alternate are assigned as a TWG voting member. He is responsible for the technical content of testing for the NSSS.

d. Met-Ed Station Supervisory Staff Representative

The Assistant Station Superintendent and alternate are assigned as TWG voting members for Unit 1. He represents the utility owner and is responsible for the proper operation of the unit. His signature, when associated with TWG approval of test procedures for safety related systems, indicates that the PORC review is complete and their comments are satisfactorily resolved. His qualifications are contained in Chapter 12.

e. Med-Ed Generation Department

The Met-Ed Generation Department shall assign a test auditor to provide independent evaluation of the action taken by the TWG. He is not a voting member, and his signature is not required on TWG test documents. His primary responsibilities are to assure that the actions taken by the TWG do not cause a deviation from the Test Manual, the technical specifications, or other requirements contained in the FSAR, warranties, or design documents. He shall report results of his review to the GPU Project Manager, GPU Startup and Testing Manager, and Met-Ed Manager - Generation.

13.2.2.3 Designer, Owner, Tester (DOT)

This group is established to review and approve the technical content of test procedures that are not appropriate for TWG approval. This group consists of representatives from GPU Startup and Test, the designer (B&W or GAI), and the Met-Ed Station Supervisory staff. DOT-approved test procedures do not require PORC review.

The DOT representatives' duties and responsibilities for non safety related systems are similar to those assigned to TWG members for safety related systems.

13.2.3 PERSONNEL FUNCTIONS, RESPONSIBILITIES, AND AUTHORITIES

13.2.3.1 GPU Test Superintendent

He is responsible to the GPU Startup and Test Manager for technical content and to the TMI Project Manager for the administration of the test program. He is chairman of DOT and TWG. He assigns a representative of GPU Start-up and Test to be a voting member of Test Planning Meetings.

13.2.3.2 GPU Assistant Test Superintendent

He is responsible to the GPU Test Superintendent for planning, scheduling, and conducting all preoperational and initial start-up testing. Other duties are assigned by the GPU Test Superintendent.

13.2.3.3 GPU Shift Test Engineer (STE)

He is responsible to the GPU Assistant Test Superintendent for conduct and inspection of preoperational and initial startup tests in accordance with test instructions and test procedures. He directs the conduct of tests through the Met-Ed Shift Foreman.

13.2.3.4 GPU Technical Engineer

He is responsible to the GPU Test Superintendent for the preparation of all test procedures, except construction tests. This includes scheduling the review and approval of procedures to support the test schedule.

13.2.3.5 GPU Cognizant Test Engineer

He is responsible to the GPU Technical Engineer for preparation of test procedures in accordance with test instructions and applicable test requirements. He may assist the Shift Test Engineers in conducting tests.

13.2.3.6 Met-Ed Assistant Station Superintendent

He is responsible to the Met-Ed Station Superintendent for the proper operation and maintenance of the unit during the preoperational and initial startup test phase. He has been designated as the Met-Ed member of the TWG and DOT for Unit 1. He shall assign a member of the station staff to be a voting member of test planning meetings.

13.2.3.7 Met-Ed Supervisor Of Operations

The Supervisor of Operations for Unit 1 is responsible to the Met-Ed Assistant Station Superintendent for the operation of the unit during the preoperational and initial startup phase. He is responsible to operate systems and components in accordance with approved operating procedures and perform tests in accordance with approved test procedures.

3.2.3.8 Met-Ed Shift Foreman

He is responsible to the Met-Ed Supervisor of Operations for directing the operation of systems and equipment after acceptance by the utility owner. He directs the operation of unit systems and equipment in accordance with approved operating and test procedures. He orders test steps contained in approved test procedures to be performed when requested by the GPU Shift Test Engineer during performance of preoperational and initial startup testing.

13.2.3.9 UE&C Lead Start-up Engineer

He is responsible to the GPU Test Superintendent for preparation of construction test procedures and conduct of construction tests and checkouts, in accordance with those procedures. He is responsible for scheduling construction tests to provide a consistent interface sequence with the preoperational test phase and assigns a Start-up Engineer to attend and participate as a voting member in the test planning meetings. He acts as test program liaison with the Construction Manager for providing craft support of test and correction of deficiencies.

13.2.3.10 NSSS Site Operations Manager

He provides advice and consultation for test and test-related matters for the NSSS and is the B&W Project Manager's onsite representative for test-related matters. His responsibilities include the following:

a. Provision of test specifications prepared by B&W to GPU and preparation of designated test procedures as requested by the GPU Project Manager, and providing them to the GPU Test Superintendent for incorporation into the test program.

b. Responsibility for the technical content of testing relating to the NSSS.

c. Scheduling technical assistance from within the NSSS or its vendors, as required.

d. Attending and participating as a voting member of the Test Planning Meeting.

e. Attending and participating as a voting member of the TWG and DOT.

f. Coordinating the implementation of approved B&W related field changes with the GPU Test Superintendent for systems under test control.

g. Responsibility for obtaining resolution of design and operational problems associated with testing or operation of systems and equipment within the NSSS scope of supply.

13.2.3.11 Turbine Generator Supplier Site Representative

He provides test requirements for test procedures associated with the turbine generator and concurs with those procedures prior to test performance.

13.2.3.12 Architect Engineer - Startup Test Engineer

He provides engineering liaison service for the test program and that portion of the unit designed by the AE. In addition, he shall have the following responsibilities:

a. Provides test procedures as requested by GPU Project Manager and submits them to the GPU Test Superintendent for incorporation into the test program.

b. Responsible for the technical content of balance-of-plant testing.

c. Attends and participates as a voting member in test planning meetings.

d. Participates as a voting member of TWG and DOT.

e. Responsible for obtaining resolutions of design problems associated with the test and operation of systems within the AE's design scope. When requested by the GPU Test Superintendent, he also obtains resolutions for design problems associated with test and operation of equipment purchased to specifications provided by the AE.

f. Coordinates the implementation of approved AE related field changes with the GPU Test Superintendent for systems under test control.

13.2.3.13 Met-Ed Test Auditor

He is responsible for auditing and reporting action taken by TWG as discussed in Item e. of Subsection 13.2.2.2.