LIC-95-0045

ENCLOSURE

FORT CALHOUN STATION UNIT NO. 1

SIMULATION FACILITY PERFORMANCE TESTING REPORT

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Omaha Public Power District
Fort Calhoun Station

Simulator Certification Renewal Submittal

Owner:	Omaha Public Power District
Operator:	Omaha Public Power District
Manufacturer:	Westinghouse Electric Corporation
Reference Plant:	Fort Calhoun Station, Unit 1
NSSS Vendor:	Combustion Engineering
Turbine Generator Vendor:	General Electric
Rating:	1500 MWth
Date Available for Training:	June 16, 1990
Initial Certification Date:	February 13, 1991

Uncorrected Test Failures

The Certification program for the Fort Calhoun Station Simulator provides for the periodic performance of Certification Tests. Tests are performed either once per year, once per four years, or at special frequencies. The results of these tests are reviewed by a subject matter expert (SME) who places the test into one of three possible categories.

1. **Category 1**
   Test Completed satisfactorily

2. **Category 2**
   Test Completed with deficiencies requiring correction, but not significant enough to impact test objectives

3. **Category 3**
   Test Failed. Complete retest required

No tests are currently classified as Category 3; therefore, there are no uncorrected test failures requiring plans for remedy of failures. Some tests are classified as category 2 and are being addressed in accordance with the normal work planning and tracking system.

Performance Testing Completed

Test Number: 14.3.3

Test Name: VERIFICATION OF SPARE COMPUTER TIME

Description: This test verifies that the simulator is capable of running with enough spare duty cycle to provide real time simulation.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: Simulator duty cycle was measured for steady state and severe transient conditions. The first test initializes into 100% power conditions, Emergency Response Facilities (ERF) computer operating and no non-real time tasks active. The test was run for 15 minutes. Peak and steady state values for duty cycle were collected.

The next two tests were multiple malfunction tests MM-1 and MM-3, which were selected as worst case, expending a maximum of calculation time, thus ensuring any less severe scenarios would not exceed spare time limits.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.4.4

Test Name: ELECTRICAL BUS TESTS

Description: This test verifies that the simulated plant electrical bus loads are connected to the correct bus.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The simulated Electrical Distribution System was verified correct by the following methods. A database inspection was performed, and it was verified that all bus loads were connected to the correct bus.

The simulator was then run, each bus in turn deenergized, and it was verified that the components supplied by that bus deenergized by spot checking the loads.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.4.5

Test Name: PLANT AIR TESTS

Description: This test verifies that simulated air supplied components are connected to the correct air header.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: Simulated air system loads were verified correct by the following methods. A database inspection was performed, and it was verified that all air loads were connected to the correct header.

The simulator was then run, each air header was in turn depressurized and it was verified that the components supplied by that header went to their failed positions by spot checking the loads.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.1

Test Name: REACTOR COOLANT SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the reactor coolant system (RCS), the following surveillances were performed:

Pressurizer level instruments
PORV block valves operation
Low temperature-over pressure (LTOP) system
RCS leak rate test
Subcooled margin monitor

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The pressurizer level instruments surveillance tests the pressurizer level control channels. By varying the pressurizer level transmitter signals, a check of the entire level control system was performed including all charging pump and pressurizer heater on and off signals, and all associated alarms.

The power operated relief valve (PORV) block valve test stroked each PORV's block valve, and verified the proper operation and position indication of the valves.

The low temperature-over pressure (LTOP) test was conducted by verifying the logic circuit indicators were enabled and the appropriate annunciators actuated.

The RCS leak rate testing used the appropriate plant procedures to perform a water inventory balance.

The subcooled margin monitor surveillance tested the A & B subcooled margin monitors and the A & B qualified safety parameter display system (QSPDS) calculations of P_{sat}, T_{sat}

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance procedures for the RCS.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.4

Test Name: CHEMICAL AND VOLUME CONTROL SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the chemical and volume control system (CVCS)

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: Various CVCS containment isolation, safety related and non-safety related valves were stroked and compared to Fort Calhoun Station Unit 1 stroke time criteria. Various CVCS pumps were operated during the performance of surveillance tests, and their performance compared to the acceptance criteria of the tests performed.

The results of the above surveillance showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station inservice surveillance test for the CVCS.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.5

Test Name: SAFETY INJECTION SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the safety injection system (SIS), The following surveillances were performed:

Safety injection valves in-service testing
Safety injection/containment spray pumps and valves
Shutdown cooling valve interlock test

Initial Conditions: BOL, 100% Power, Equilibrium Xenon
BOL, Cold Shutdown, RCS drained

Test Precis: For the safety injection valves in-service test, category A, B, and C safety related safety injection valves were stroked to verify operability. Valve stroke times were verified to be within the allowable band.

The safety injection/containment spray pumps and valves test was performed. Safety related valves were time stroked to verify operability. High and low pressure safety injection pump inservice inspections were performed on all safety injection pumps. Safety injection tank check valve test was performed

The shutdown cooling (SDC) valve Interlock test was performed. SDC suction valve controls, annunciators, automatic actions and overrides were tested and verified to actuate in response to varying the pressure transmitter inputs.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the safety injection system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.6

Test Name: COMPONENT COOLING WATER SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the component cooling water (CCW) system, the CCW pump inservice test surveillance was performed.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: Each component cooling water pump was run for five minutes, then suction and discharge pressure, and indicated pump flow rate were recorded. Total pump head was calculated, and compared to head versus flow pump curve for that pump.

The results of the above surveillance showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station inservice surveillance test for the component cooling water system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.16

Test Name: AUXILIARY FEEDWATER SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the auxiliary feedwater (AFW) system, the following surveillances were performed:

Auxiliary feedwater pumps inservice inspection
Automatic initiation of auxiliary feedwater

Initial Conditions: BOL, 100% Power, Equilibrium Xenon
BOL, Cold Shutdown, RCS Drained

Test Precis: Auxiliary feedwater motor driven pump FW-6 and turbine driven pump FW-10 were run for an inservice inspection.

Steam generators RC-2A and RC-2B, auxiliary feedwater initiation and override logic testing was performed.

Logic matrices were then tested. In each matrix, the actuation alarm, emergency safeguards feature indicating lamp and matrix actuation relays were verified to actuate and reset.

Functional testing verified auxiliary feedwater valves opening, pump starts, and auxiliary feedwater flow to the steam generators. Emergency safeguards features actuation system logic lamps and annunciators were verified to actuate. Operator overrides and reset of the initiation were verified.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the auxiliary feedwater system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.1.17

Test Name: RAW WATER SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the raw water system (RWS), the following surveillances were performed:

Raw water system valve actuation
Raw water valves inservice testing

Initial Conditions: BOL, 100% Power

Test Precis: The raw water system valve actuation test was performed. This test verified the ability to isolate any portion of the raw water system from the control room.

The raw water valves inservice quarterly test was performed.

The raw water inservice pump monthly test was performed. Pump differential pressures, currents and check valve operabilities were verified.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the raw water system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.1

Test Name: REACTOR CORE TESTING

Description: To verify that operator conducted surveillance testing can be performed on the reactor core, the reactivity anomalies surveillance was performed.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: This test analyzed for reactivity deviations by performing a reactivity balance.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the reactor core.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.2

Test Name: CONTROL ROD DRIVE SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the control rod drive mechanism (CRDM) system, the following surveillances were performed:

Control element assemblies
Secondary CEA position indicating, interlocks, alarms, and display system

Initial Conditions: BOL, RCS Hot Shutdown, Borated

Test Precis: The control element assemblies test verified CEA drive system interlocks, and alarms. The regulating group withdrawal prohibit, shutdown group insertion permissive, and regulating group upper and lower sequential permissives, were tested for trippable and non-trippable CEAs. The reactor protection system high power and high startup rate pre-trip rod withdrawal prohibit was tested. A reactor trip test was performed to verify all full length CEAs inserted. The manual individual exercise of CEAs was performed by inserting and withdrawing each regulating group and shutdown CEA 6 inches.

Secondary CEA position indicating, interlocks, alarms, and display system testing was performed. Single CEA deviation, regulating group withdrawal prohibit, shutdown group insertion permissive, group out of sequence, and overlap, permissives, annunciators and setpoints were tested.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the CRDM System.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.5

Test Name: CONTAINMENT VENTILATION SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the containment ventilation system, the following surveillances were performed:

Containment air cooling and filtering system
Containment hydrogen monitors
Ventilating air valves inservice testing

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: Containment air cooling units were run, with the operational check of cooling unit dampers performed. Fan current and damper stroke times were satisfactory.

Containment hydrogen monitors were placed in service.

Containment pressure relief valves were time stroked shut, and closing times were verified to be within the allowable band. Containment radiation monitor isolation valves were time stroked shut and closing times were verified to be within the allowable band.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.9

Test Name: DIESEL GENERATING SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the diesel generating system, the diesel start and diesel fuel oil transfer pump surveillance was performed.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The emergency diesel generators' responses to auto start signals were tested. The operation of the diesel fuel oil transfer pumps was tested.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the emergency diesel generator system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.10

Test Name: INPLANT ELECTRICAL DISTRIBUTION SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the inplant electrical distribution system, the following surveillances were performed:

13.8 KV emergency power
DC transfer switches

Initial Conditions: BOL Cold Shutdown, RCS drained

Test Precis: This test verified that 13.8 KV emergency power was capable of performing its design function following the simultaneous loss of 345 KV, and 161 KV, off-site AC power and the failure of both on-site diesel generators (i.e., limited station blackout).

DC transfer switch testing verified the proper transfer from the normal to emergency power supply for transferable inplant 125 vdc control busses.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the inplant electrical distribution system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.13

Test Name: DIESEL GENERATOR SEQUENCER TESTING

Description: To verify that operator conducted surveillance testing can be performed on the D.G. sequencers, the automatic load sequencers surveillance was performed.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: This test verified the AC and DC engineered safeguards sequencer circuits and time setpoints. The ERF computer was used to capture the timer times for the equipment receiving a timer operate signal. Actuation signal times were verified to be within the allowable band.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the D.G sequencers.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures?: No

Did this test reveal any exception to ANSI/ANS-3.5-1985-1985? No

Test Number: 14.5.1.2.15

Test Name: REACTOR PROTECTIVE SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the reactor protective system (RPS), the following surveillances were performed:

- RPS normal operation
- RPS thermal margin/low pressure/T_{cold}
- Reactor coolant flow
- Thermal margin/low pressure channels
- High pressurizer pressure channels
- Steam generator level channels
- Steam generator pressure channels
- High containment pressure channels
- Turbine loss of load channels
- Manual trip channels
- RPS logic units
- Axial power distribution channels

Initial Conditions: BOL, 100% Power, Equilibrium Xenon
BOL, RCS Hot Shutdown, Borated
BOL, Cold Shutdown, RCS Drained

Test Precis: Reactor protective system normal operation performed a switch alignment and lamp illumination verification.

The thermal margin/Low pressure/T_{cold}, channel check and calibration, was performed. This test ensured the four RPS channels T_{cold} were in the allowable band.

The reactor coolant low glow, alarm and trip channel check was performed. This test verified the four RPS channels' RCS low flow pre-trip and trip logic actions, and annunciator setpoints for four pump operation to be in the allowable band.

The thermal margin/Low pressure channels, alarm and trip channel check and calibration, was performed.

Calculations using ΔT power, nuclear power, $T_{cold\ cal}$, internal tilt, and correction factors, were performed for each channel. Testing verified the four RPS channels' thermal margin pre-trip and trip logic actions, and annunciator setpoints to be in the allowable band.

The high pressurizer pressure channels, alarm and trip channel check, was performed. This test verified the four RPS channels' high pressurizer pressure pre-trip and trip logic actions, and annunciator setpoints to be in the allowable band.

The steam generator level channels, alarm and trip channel check, was performed. This test verified the four RPS channels for each steam generator's level low pre-trip and trip logic actions, and annunciator setpoints to be in the allowable band.

The steam generator pressure channels, alarm and trip channel check, was performed. This test verified the four RPS channels for each steam generator's pressure and asymmetric steam generator low pre-trip and trip logic actions, and annunciator setpoints to be in the allowable band.

The turbine loss of load channels, shutdown alarm and trip channel check, was performed. This test verified that with the turbine off line, the four RPS channels' turbine loss of load trip logic actions, subsequent trip, and annunciations, occurred at 15% nuclear power.

The high containment pressure channels, alarm and trip channel check, was performed. This test verified the four RPS channels for high containment pressure trip logic actions, and annunciation.

The manual trip channels, shutdown alarm and trip channel check, was performed.

The RPS logic units, operation of logic networks and clutch power contactors, was performed. RPS power supplies were tested for nominal voltage, current and ground indications. Each trip unit for each matrix coincidence trip logic combination was tested to actuate. Each matrix trip circuit was in turn, tested to trip each matrix relay, its clutch power supply, load contactor and actuate indicating lamps.

The axial power distribution channels, alarm and trip channel check and calibration was performed. This test verified the high power trip and also verified the four RPS channel's Internal and external axial power distribution, pre-trip and trip logic actions, and annunciator setpoints to be in the allowable band.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the reactor protective system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.2.16

Test Name: ENGINEERED SAFEGUARDS SYSTEMS TESTING

Description. To verify that operator conducted surveillance testing can be performed on the engineered safeguards system (ESF), the following surveillances were performed:

- Pressurizer pressure low signal
- Safety injection actuation
- Containment pressure high signal
- Containment spray logic
- Safety injection refueling water tank (SIRWT) low level signal
- Steam generator low pressure signal
- Recirculation actuation logic
- Offsite power low system

Initial Conditions: BOL, 100% Power, Equilibrium Xenon
BOL, Cold Shutdown, RCS Drained

Test Precis: The pressurizer pressure low signal (PPLS), alarm and trip channel check, was performed. This test verified the four RPS channels' pressurizer pressure low trip actions, indications and reset setpoints to be in the allowable band. The PPLS and blocking logic calibration refueling test was performed. This test was a functional check of the integrated ESF signals and resulting equipment actuation signals initiated by low pressurizer pressure transmitter signals. The PPLS block (override) actuation and annunciators were verified operable.

The safety injection actuation signal test was performed. This test was a functional check of the train A integrated ESF signals and resulting equipment actuation signals. Train A PPLS, CPHS, SIAS, CIAS, VIAS lockout relays, containment isolation valves and ERF computer printouts were verified to actuate.

The containment pressure high signal (CPHS), operation check was performed. The CPHS matrix logic was verified to deenergize by actuating pressure switch pairs. The CPHS calibration refueling surveillance was performed. This test was a functional check of the train A CPHS signal and resultant relay actuation signals initiated by high containment pressure transmitter inputs. CPHS, SIAS, CIAS, and VIAS relays were verified to actuate.

The containment spray logic signal train A test was performed as a sub test of the safety injection actuation Test. This test verified the operability of the PPLS and CSAS relays. The containment spray actuation test was performed. PPLS, CPHS, SIAS, CIAS, VIAS lockout relays, breakers, and containment isolation valves were verified to actuate.

The safety injection refueling water tank (SIRWT) low level signal monthly channel check was performed. The matrix lamps were verified to deenergize by failing SIRWT level bistables. The SIRWT low level signal refueling surveillance was performed. This test was a functional check of the train A SIRWT low level circuitry and resulting relay actuation signals initiated by SIRWT level bistables. Matrix lamps and STLS relays were verified to actuate.

The steam generator low pressure signal (SGLS), indication and trip channel check was performed. This test verified the four RPS channels' steam generator pressure low trip actions, indications and reset setpoints to be in the allowable band. The SGLS and blocking logic calibration refueling test was performed. This test was a functional check of the ESF train A signals and resulting equipment actuation signals initiated by low steam generator pressure transmitter signals. SGLS alarm, lockout relays and valve actuations were verified to occur. The SGLS Block (override) and attendant annunciators were verified to be operable during each actuation.

The recirculation actuation logic (RAS) channel check was performed as a sub test of the safety injection actuation Test. This test verified the operability of the RAS relays, overrides, matrix lamps and isolation valves. The RAS logic and switch refueling test was performed. CPHS, SIAS, CIAS, VIAS, STLS and RAS lockout relays, breakers, and containment isolation valves were verified to actuate.

The offsite power low system (OPLS) channel check was performed. This test verified the individual operability of OPLS annunciators, matrix relay and sequencer indications for incoming transformers, busses and switchgear. The OPLS matrix refueling check was performed. This test was a functional check of OPLS matrix signals and resulting breaker actuations, crossties, load shed and equipment actuation signals initiated by test switch operation.

The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the engineered safeguards system.

Simulator Response Assessment: Plant data and best estimate

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.2.17

Test Name: NUCLEAR INSTRUMENTATION SYSTEM TESTING

Description: To verify that operator conducted surveillance testing can be performed on the nuclear instrumentation system (NIS), the following surveillances were performed:

Power range safety channels
Wide range logarithmic channels
Rod drop indication

Initial Conditions: BOL, 100% Power, Equilibrium Xenon
BOL, Cold Shutdown, RCS Drained

Test Precis: The power range safety channels adjustment check and calibration was performed. This test compared plant computer calculated core power to RPS delta T and nuclear instrumentation power, and recalibrated those powers to calculated power as required. The power range safety channels monthly test was performed for each channel. Variable over power pre-trip and trip setpoints were verified with respect to linear and delta T power. Linear power upper and lower sub channels, linear power pre-trip and trip were verified.

The wide range logarithmic channels functional check was performed. The high DPM (start up rate of change) pre-trip and trip functions were verified to actuate

The rod drop indication check was performed. The results of the above surveillances showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the nuclear instrumentation system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.1.2.18

Test Name: INCORE NUCLEAR INSTRUMENTATION TESTING

Description: To verify that operator conducted surveillance testing can be performed on incore instrumentation, the core exit thermocouples surveillance was performed.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The core exit thermocouple (CET), channel check was performed. This test verified minimum QSPDS channel A & B valid quadrant CET operability criteria.

The results of the above surveillance showed the simulator capable of performing within the acceptance criteria of the Fort Calhoun Station surveillance testing for the incore nuclear instrumentation system.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.1

Test Name: ROD WORTH TESTS

Description: This test verifies that the control rod worths match the reference plant Technical Data Book values.

Initial Conditions: BOL, reactor critical at approximately 1 MW, below point of adding heat
MOL, reactor critical at approximately 1 MW, below point of adding heat

EOL, reactor critical at approximately 1 MW, below point of adding heat

Test Precis: All models are frozen with the exception of RFLUX2, RAUXIL, RXCTAH and NIS.

The rod worths for each regulating group were determined by inserting each group and compensating for the reactivity insertion by dilution to maintain criticality.

The data collected were plotted using the same axis as the curves in the Technical Data Book, and the curves were compared.

The shutdown groups were measured in the same way, but the curves were not generated, as there are no curves in the Technical Data Book with which to compare. Total group worths were compared to the Technical Data Book specifications.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.2

Test Name: BORON WORTH TESTS

Description: This test verifies that the boron worths match the reference plant Technical Data Book values.

Initial Conditions: BOL, reactor critical at approximately 1 MW, below point of adding heat
MOL, reactor critical at approximately 1 MW, below point of adding heat

EOL, reactor critical at approximately 1 MW, below point of adding heat

Test Precis: All models are frozen with the exception of RFLUX2, RAUXIL, RXCTAH and NIS.

The boron worths for each core age were determined by running the program CORETEST, which was developed by Westinghouse Electric Inc. for use during factory acceptance testing of the Fort Calhoun Simulator.

The results of CORETEST were compared to the technical data book values.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.3

Test Name: ISOTHERMAL TEMPERATURE COEFFICIENT

Description: This test verifies that the isothermal temperature coefficient (ITC) matches the reference plant Technical Data Book value.

Initial Conditions: BOL, reactor critical at approximately 1 MW, below point of adding heat

Test Precis: All models are frozen with the exception of RFLUX2, and RXCTAH.

The core inlet and outlet enthalpies were then set to their initial conditions plus 2 btu/lbm and the resultant change in core reactivity was observed.

The reactivity change divided by the enthalpy change (directly convertible to a temperature change of 1.6 °F) results in the isothermal temperature coefficient.

Simulator Response Assessment: Plant Procedures and Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.4

Test Name: POWER COEFFICIENT TEST

Description: This test verifies that the power coefficient matches the reference plant Technical Data Book value.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: All models are frozen with the exception of RFLUX2, NIS and RXCTAH.

Boron concentration is held constant as power is decreased by control rod insertion.

The core inlet and outlet enthalpies are maintained at the proper values manually as power is reduced. When 10% power is reached, the rod worth curves are used to compute the total reactivity inserted to determine the power defect. The result is compared to the Technical Data Book values.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.5

Test Name: XENON TESTS

Description: This test verifies that the Xenon concentration matches the reference plant Technical Data Book values.

Initial Conditions:
BOL, 100% Power Equilibrium Xenon
BOL, 80% Power Equilibrium Xenon
BOL, 50% Power Equilibrium Xenon
BOL, 30% Power Equilibrium Xenon
MOL, 100% Power Equilibrium Xenon
MOL, 80% Power Equilibrium Xenon
MOL, 50% Power Equilibrium Xenon
MOL, 30% Power Equilibrium Xenon
EOL, 100% Power Equilibrium Xenon
EOL, 80% Power Equilibrium Xenon
EOL, 55% Power Equilibrium Xenon

Test Precis: The simulator was initialized into each initial condition listed and the Xenon concentration was compared to the Technical Data Book.

The simulator was tripped from 100% power MOL and Xenon plotted for 48 hours run time. The data collected were plotted and compared to the Technical Data Book curve.

A Xenon oscillation was initiated by dropping and then recovering a control rod. It was then verified that the Xenon oscillation produced could be damped by the use of control rods.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.2.6

Test Name: ESTIMATED CRITICAL POSITION TESTS

Description: This test verifies that the estimated critical positions could be predicted within the tolerance of the Technical Data Book.

Initial Conditions: BOL, 100% Power Equilibrium Xenon
MOL, 100% Power Equilibrium Xenon
EOL, 100% Power Equilibrium Xenon

Test Precis: The simulator was initialized into each initial condition listed, tripped and restarted after calculating an Estimated Critical Conditions Worksheet. The results of the worksheets and simulator performance were compared to the Technical Data Book.

Simulator Response Assessment: Plant procedures and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number:	14.5.3.1
Test Name:	NORMAL OPERATIONS TEST
Description:	This test verifies the simulator capable of simulating real time plant operations of Fort Calhoun Station Unit 1.
Initial Conditions:	BOL, 100% Power, Equilibrium Xenon
Test Precis:	This test was performed with operating procedures and operating Instructions, using local operator actions (LOAs), where appropriate, and non-applicable plant specific tasks (notifications, approvals, manual valve lineups, etc.) annotated as not applicable (N/A). The test was begun with a normal station shutdown to refueling conditions. Boration rates and amounts were verified to be consistent with plant references and operator experience. Following shutdown cooling (SDC) initiation, a subsequent cooldown and drain down of the pressurizer to mid-loop conditions was conducted. Pressurizer refill and bubble formation were completed. Pressurizer heatup rate and bubble formation were verified to be consistent with operator experience. A plant heatup to normal operating pressure and temperature (NOP & NOT) was performed. Reactor coolant pump heat was used and verified to be consistent with plant data, and operator experience. A dilution to reactor criticality was performed with dilution rate and amounts verified to be consistent with plant references and operator experience. Nuclear instrumentation response to the dilution and criticality was also verified to be consistent with operator experience. The point of adding heat response was verified to be consistent with plant references and operator experience. Turbine warm-up and synchronization were performed. The rate of condenser vacuum rise was verified to be consistent with the vacuum pump(s) in service. The main turbine warm up and roll was verified to be consistent with plant references and operator experience. An increase in power to 100% was conducted and the feedwater pump capacity was verified to be consistent with plant references and operator experience.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.2.1

Test Name: STEADY STATE DRIFT TEST AT 100% POWER

Description: This test verified the simulator computed values for 100% power were stable and met ANSI/ANS-3.5-1985 specifications.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 100% power steady state configuration, with controls in automatic, and acquiring data every three (3) minutes for one hour.

Personnel monitored plant parameters on the instructor control CRT, on the control boards and on the simulator ERF. Following the test, captured data were examined for deviations.

Simulator Response Assessment: Plant Data

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.2.2

Test Name: STEADY STATE DRIFT TEST AT 80% POWER

Description: This test verified the simulator computed values for 80% power were stable and met ANSI/ANS-3.5-1985 specifications.

Initial Conditions: BOL, 80% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into an 80% power steady state configuration, with controls in automatic, and acquiring data every three (3) minutes for one hour.

Personnel monitored plant parameters on the instructor control CRT, on the control boards and on the simulator ERF. Following the test, captured data were examined for deviations.

Simulator Response Assessment: Plant Data

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.2.3

Test Name: STEADY STATE DRIFT TEST AT 55% POWER

Description: This test verified the simulator computed values for 55% power were stable and met ANSI/ANS-3.5-1985 specifications.

Initial Conditions: BOL, 55% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 55% power steady state configuration, with controls in automatic, and acquiring data every three (3) minutes for one hour.

Personnel monitored plant parameters on the instructor control CRT, on the control boards and on the simulator ERF. Following the test, captured data were examined for deviations.

Simulator Response Assessment: Plant Data

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.2.4

Test Name: STEADY STATE DRIFT TEST AT 30% POWER

Description: This test verified the simulator computed values for 30% power were stable and met ANSI/ANS-3.5-1985 specifications.

Initial Conditions: BOL, 30% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 30% power steady state configuration, with controls in automatic, and acquiring data every three (3) minutes for one hour.

Personnel monitored plant parameters on the instructor control CRT, on the control boards and on the simulator ERF. Following the test, captured data were examined for deviations.

Simulator Response Assessment: Plant Data

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.3.1

Test Name: STEADY STATE ACCURACY TEST AT 100% POWER

Description: This test verified the simulator computed values and meter indications for 100% power conditions.

The testing ensured critical and non critical parameters were accurate, and within tolerance when compared to Fort Calhoun Station Unit 1 at full power.

Principal mass and energy balance calculations were performed during this test.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 100% power steady state configuration, with the controls in automatic. Steam flow was then adjusted to the values given as baseline data. Main condenser vacuum, circulating water temperature, and power factor were adjusted as required to maintain the baseline value.

The plant was allowed to stabilize, then computer as well as control board instrument data collection was performed.

Personnel performed the following mass and energy balances:

Indication of reactor power based on delta T
Reactor power based on steam flow
Core thermal power calculation
Reactor coolant system leak rate calculation

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.3.2

Test Name: STEADY STATE ACCURACY TEST AT 80% POWER

Description: This test verified the simulator computed values and meter indications for 80% power conditions. The testing ensured critical and non critical parameters were accurate, and within tolerance when compared to Fort Calhoun Station Unit 1 at 80% of full power. Principal mass and energy balance calculations were performed during this test.

Initial Conditions: BOL, 80% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 80% power steady state configuration, with the controls in automatic. Steam flow was then adjusted to the values given as baseline data. Main condenser vacuum, circulating water temperature, and power factor were adjusted as required to maintain the baseline value.

The plant was allowed to stabilize, then computer as well as control board instrument data collection was performed.

Personnel performed the following mass and energy balances:

Indication of reactor power based on delta T
Reactor power based on steam flow
Core thermal power calculation
Reactor coolant system leak rate calculation

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.3.3

Test Name: STEADY STATE ACCURACY TEST AT 55% POWER

Description: This test verified the simulator computed values and meter indications for 55% power conditions. The testing ensured critical and non critical parameters were accurate, and within tolerance when compared to Fort Calhoun Station Unit 1 at 55% of full power. Principal mass and energy balance calculations were performed during this test.

Initial Conditions: BOL, 55% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 55% power steady state configuration, with the controls in automatic. Steam flow was then adjusted to the values given as baseline data. Main condenser vacuum, circulating water temperature, and power factor were adjusted as required to maintain the baseline value.

The plant was allowed to stabilize, then computer as well as control board instrument data collection was performed.

Personnel performed the following mass and energy balances:

Indication of Reactor power Based on delta T
Reactor power Based on steam Flow
Core thermal power Calculation
Reactor Coolant system leak Rate Calculation

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.3.3.4

Test Name: STEADY STATE ACCURACY TEST AT 30% POWER

Description: This test verifies the simulator computed values and meter indications for 30% power conditions. The testing ensured critical and non critical parameters were accurate, and within tolerance when compared to Fort Calhoun Station Unit 1 at 30% of full power. Principal mass and energy balance calculations were performed during this test.

Initial Conditions: BOL, 30% Power, Equilibrium Xenon

Test Precis: This test was performed by initializing into a 30% power steady state configuration, with the controls in automatic. Steam flow was then adjusted to the values given as baseline data. Main condenser vacuum, circulating water temperature, and power factor were adjusted as required to maintain the baseline value.

The plant was allowed to stabilize, then computer as well as control board instrument data collection was performed.

Personnel performed the following mass and energy balances:

Indication of reactor power based on delta T
Reactor power based on steam flow
Core thermal power Calculation
Reactor coolant system leak rate calculation

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.1

Test Name: MAXIMUM RATE POWER RAMP

Description: This test verified the ability of the simulator to respond to a maximum rate down power in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with the following systems in automatic:

- Pressurizer level control
- Pressurizer pressure control
- Letdown temperature control
- Volume control tank inlet control
- Steam generator level controls
- Steam dump and turbine bypass system control

Data collection was initiated, then in accordance with AOP-5, a rapid load reduction to 20% power was performed at a 10% per minute ramp. Manual control of control rods, letdown pressure and main turbine control valves were the only manipulations performed.

Testing resulted in the reactor still critical, with no safety valves lifted, and in 10 minutes plant parameter trends were stabilizing.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.2

Test Name: MAIN TURBINE STOP AND CONTROL VALVE TEST

Description: This test verified the ability of the simulator to respond to main turbine stop, intermediate and control valve testing in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with the following systems in automatic:

- Pressurizer level control
- Pressurizer pressure control
- Letdown temperature control
- Volume control tank inlet control
- Steam generator level controls
- Steam dump and turbine bypass system control

Data collection was initiated, then in accordance with OI-ST-10, testing of the main turbine stop valves was performed.

Data collection was again initiated, then in accordance with OI-ST-10, testing of the main turbine intermediate valves was performed.

Testing continued with data collection, and then in accordance with OI-ST-10, tests of the main turbine intermediate valves IV-1 through 4 were performed.

Testing showed the integrated plant response to be realistic, self dampening and that station procedures could be used.

Simulator Response Assessment: Plant data and best estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.3

Test Name: INADVERTENT BORATION/DILUTION TEST

Description: This test verified the ability of the simulator to respond to a dilution and boration event at full power in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into a 100% power configuration, with the following conditions:

CEAs fully withdrawn
Pressurizer level control in auto
Pressurizer pressure control in auto
CVCS in normal operation
Steam generator level controls in auto
Steam dump and turbine bypass system control in auto

Data collection was initiated, then a continuous dilution was initiated by aligning demineralized water to the charging pump suctions and starting an additional two charging pumps.

A reactor trip on thermal margin/Low pressure (TM/LP) or variable high power trip was verified to occur. Then the dilution was secured and the plant allowed to stabilize.

The test continued following reinitialization to 100% power, and the initiation of data collection. A continuous boration was initiated by starting both boric acid pumps, aligning the discharge to the charging pump suctions and starting an additional two charging pumps.

A reactor trip on thermal margin/Low pressure (TM/LP) was verified to occur. Then the boration was secured and the plant was allowed to stabilize.

Testing showed the plant response to be realistic.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.4

Test Name: REACTOR TRIP AND RECOVERY TEST

Description: This test verified the ability of the simulator to perform a reactor trip and subsequent restart in a realistic fashion.

Initial Conditions: BOL, 80% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 80% of full rated power conditions, with the following systems in automatic:

- Pressurizer level control
- Pressurizer pressure control
- Letdown temperature control
- Volume control tank inlet control
- Steam generator level controls
- Steam dump and bypass system control

Data collection was begun, and the reactor trip pushbutton was depressed, initiating the transient. Operator control manipulations were performed to model as closely as possible the Fort Calhoun Station trip transient data being used. Following plant stabilization, simulator data and Fort Calhoun Station trip data were compared.

Using operating procedures, the reactor was started up and returned to nominal full power conditions.

Simulator Response Assessment: Plant data and Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.5

Test Name: DROPPED ROD TEST

Description: This test verified the ability of the simulator to respond to a single dropped control element assembly (CEA) in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% full rated power conditions, with the following systems in automatic:

Pressurizer level control
Pressurizer pressure control
Letdown temperature control
Volume control tank inlet control
Steam generator level controls
Steam dump and bypass system control

Data collection was initiated, and CEA 40 was dropped. Changes such as lowered nuclear instrumentation readings in the affected quadrant, core power shift, with lowered reactor coolant system temperatures were verified to occur. Following plant stabilization, data analysis showed the plant response to be realistic.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.6

Test Name: MANUAL REACTOR TRIP TEST

Description: This test verified the ability of the simulator to conform to a baseline manual reactor trip in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and the reactor trip pushbutton was depressed, initiating the transient.

Other than manual letdown pressure control, no operator control manipulations were performed. Hot standby conditions were verified maintained in automatic, and following stabilization, testing was concluded. Simulator data were then analyzed to verify acceptance criteria.

Simulator Response Assessment: Plant data and Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.7

Test Name: SIMULTANEOUS TRIP OF MAIN FEEDWATER PUMPS TEST

Description: This test verified the ability of the simulator to conform to a baseline simultaneous trip of all feedwater pumps in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and the main feedwater pumps were tripped simultaneously, initiating the transient.

Other than manual letdown pressure control, no operator control manipulations were performed. Uncomplicated reactor trip criteria were verified maintained in automatic, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.8

Test Name: SIMULTANEOUS CLOSURE OF MAIN STEAM ISOLATION VALVES TEST

Description: This test verified the ability of the simulator to conform to a baseline simultaneous closure of main steam isolation valves in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and the main steam isolation valves (MSIVs) were manually shut simultaneously, initiating the transient.

Other than manual letdown pressure control, no operator control manipulations were performed. Uncomplicated reactor trip criteria were verified maintained in automatic, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.9

Test Name: SIMULTANEOUS TRIP OF ALL RCPs TEST

Description: This test verified the ability of the simulator to conform to a baseline simultaneous trip of all reactor coolant pumps in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, the reactor coolant pumps were then tripped simultaneously, initiating the transient. Other than manual letdown pressure control, no operator control manipulations were performed. Uncomplicated reactor trip criteria were verified maintained in automatic, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.10

Test Name: TRIP ANY RCP TEST

Description: This test verified the ability of the simulator to conform to a baseline trip of any single reactor coolant pump in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and one reactor coolant pump was tripped initiating the transient. Other than manual letdown pressure control, no operator control manipulations were performed. Uncomplicated reactor trip criteria were verified maintained in automatic, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.11

Test Name: LOSS OF LOAD TEST

Description: This test verified the ability of the simulator to conform to a baseline main turbine trip in a realistic fashion.

Initial Conditions: BOL, 55% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 55% power conditions, with systems verified to be in a normal configuration. A five minute stability check was performed. Data collection was begun, and the main turbine was manually tripped, initiating the transient. Other than manual letdown pressure control, no operator control manipulations were performed. Uncomplicated reactor trip criteria were verified maintained in automatic, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Plant data and Best Estimate

Any Uncorrected Test Failures? No

ANSI/ANS-3.5-1985 Test Exception:

TRANSIENT TEST (APPENDIX B) B.2.2(6) TEST EXCEPTION

An exception to ANSI/ANS-3.5-1985 is taken for this test, due to Fort Calhoun Station Unit 1 plant configuration and operation.

Fort Calhoun Station system design criteria stipulate the automatic actuation of a turbine trip-unit trip interlock at 15% power. Station procedures require main generator synchronization at 12% power. Load is then applied to avoid a generator reverse power trip. Loading and its subsequent feedwater heater extraction steam load combine to raise power to above the level at which the loss of load trip is bypassed. Therefore, for the Fort Calhoun Station simulator, testing for main turbine trip (maximum power level which does not result in an immediate reactor trip) is not performed, as there is no power level at which this test is applicable.

Test Number: 14.5.4.12

Test Name: MAXIMUM RATE POWER RAMP TEST

Description: This test verified the ability of the simulator to conform to a baseline maximum rate power ramp in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and secondary load was rapidly lowered to 75% power, initiating the transient. Following a five minute stabilization, power was rapidly returned to 100% power. Operator control manipulations were performed. Normal full power conditions were verified, and following trend stabilization, testing was concluded. Simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.13

Test Name: LOCA WITH LOSS OF ALL OFFSITE POWER TEST

Description: This test verified the ability of the simulator to conform to a baseline maximum size reactor coolant system rupture combined with a loss of all offsite power in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and the simulator set to simultaneously insert a maximum size LOCA with a concurrent total loss of offsite power. No operator control manipulations were performed. Safety functions status checks were verified, and following stabilization, testing was concluded. The simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.14

Test Name: EXCESS STEAM DEMAND TEST

Description: This test verified the ability of the simulator to conform to a baseline maximum size unisolable main steam line rupture in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. Data collection was begun, and the simulator set to insert a maximum sized unisolable steam line rupture. No operator control manipulations were performed. Safety functions status check was verified satisfied, and following trend stabilization, testing was concluded. The simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.4.15

Test Name: SLOW RCS DEPRESSURIZATION TO SATURATION, NO HPSI TEST

Description: This test verified the ability of the simulator to conform to a baseline slow primary system depressurization to saturated conditions using a pressurizer relief valve stuck open with actuation of high pressure ECCS inhibited, in a realistic fashion.

Initial Conditions: BOL, 100% Power, Equilibrium Xenon

Test Precis: The test was performed by initializing into 100% power conditions, with systems verified to be in normal full power configuration. A five minute stability check was performed. All high pressure safety injection and non-running charging pumps were disabled, and data collection was begun. Reactor coolant pumps were tripped in accordance with plant procedures, with no other operator control manipulations performed. Safety functions status check was verified challenged, and following trend stabilization, testing was concluded. The simulator data were then analyzed to determine if the acceptance criteria were met.

Simulator Response Assessment: Best Estimate

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.1.4

Malfunction Identifier: AFW4

Test Description: Emergency feedwater storage tank leak. A variable size leak occurs on the discharge line upstream of FW-339.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 8" Line Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Precis: Following malfunction actuation, observed: auxiliary feedwater storage tank level decreased continuously. LCV-1173 opens to fill tank from condensate system; LCV-1190 opens to make up to condenser from condensate storage tank; condensate storage tank level low, auxiliary feedwater tank high-low, auxiliary feedwater tank low, emergency feedwater storage tank low-low alarms annunciate; LCV-1189 opens to fill auxiliary feedwater tank from demineralized water; waste disposal system malfunction alarm; spent regenerant tank overflows.

Operator starts demineralized water pumps and secures makeup to the auxiliary feedwater storage tank, then verifies sump level returns to normal after tank empties.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS 3.5? No

Test Number: 14.5.5.1.5

Test Description: Auxiliary Feedwater Activation Relay Failure

Malfunction Identifier: AFW5

Test Description: Auxiliary feedwater activation relay failure

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C, D	Selection A
Energized/Deenergized	Energized
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observed: the correct channel matrix actuation relay light illuminated, along with the associated auxiliary feedwater system steam generator channel actuated alarm. Auxiliary feedwater feed valves opened and the auxiliary feedwater pumps started (both electric and steam driven). Verified auxiliary feedwater flow to both steam generators.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.2.2

Malfunction Identifier: CAS2

Test Description: Service air system leak. A variable size leak occurs on the selected service air line(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C	Selection A
Magnitude 0-100%	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: plant air pressure drop, standby compressor starts, air pressure low alarms actuate, at 80 psig service air header isolation valve PCV-1753 closes, instrument air pressure stabilizes; services air pressure fluctuates with PCV-1753. Operator isolates leak by closing manual isolation valve, then verifies that pressure stabilizes.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.2.3

Malfunction Identifier: CAS3

Test Description: Instrument air loop leak. A variable size leak occurs on the selected instrument air loop(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C	Selection B
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: air header pressure drops, standby compressor starts, air pressure low alarms actuate, operator isolates leak by closing isolation valve, then verifies that pressure recovers and stabilizes.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.2.4

Malfunction Identifier: CAS4

Test Description: Instrument air riser leak. A variable size leak occurs on the selected instrument air riser(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-J	Selection A
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: air riser pressure drops, standby compressor starts, air pressure low alarms actuate, operator isolates leak by closing manual isolation valve, then verifies that pressure recovers and stabilizes.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.3.4

Malfunction Identifier: CCW4

Test Description: Component cooling water (CCW) pump discharge header leak. A variable size leak occurs on the component cooling water pump discharge header.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 16" Line Break	Magnitude: 100%
Ramp Time 0-3600s	Ramp Time: 60 s
Delay Time 0-3600 s Mode D Direct/Remote/Conditional	Delay Time: 0 s

Test Parameters Monitored:
CCW system pressure
CCW system flow
CCW surge tank level
Reactor coolant pump seal and lube oil temperatures
Waste disposal system tank level alarms

Test Precis: Following malfunction actuation, observed: component cooling water system pressure dropped, flow increased, surge tank level alarms actuated as level decreased, auto make-up system initiated filling surge tank. Components cooled by the component cooling water system showed flow decreases and temperature increases. Waste disposal system showed an increase in inventory due to the leakage. Raw water backup cooling was initiated to the components supplied and a temperature decrease was observed as the raw water cooling was placed in service.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.3.5

Malfunction Identifier: CCW5

Test Description: Component cooling water heat exchanger tube leak. Tube failure occurs to a selectable degree in the selected heat exchanger.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C, D	Selected: A
Magnitude 0 - 100%	Magnitude 100%

Test Parameters Monitored: CCW system flow
CCW surge tank level

Test Precis: Following malfunction actuation, observed: component cooling water system pressure dropped, flow increased, surge tank level alarms actuated as level decreased, auto make-up system initiated filling. Components cooled by the component cooling water system showed flow decreases and temperature increases.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.4.1

Malfunction Identifier: CND1

Test Description: Loss of main condenser vacuum. Air leakage into the condenser causes pressure to rise.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = Vac Bkr Open	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Condensers A and B pressures
- Condensers exhaust hood temperatures
- Reactor power
- Generator megawatts

Test Precis: Following malfunction actuation, observed: condenser A vacuum decreases faster than condenser B vacuum; standby vacuum pump starts with attendant alarm annunciation; exhaust high pressure alarms annunciate; exhaust hood temperature rises, generator output decreases, reactor trips approximately 15 minutes after malfunction actuation.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.4.4

Malfunction Identifier: CND4

Test Description: Condensate pump bearing failure. The selected condensate pump(s) experiences bearing failure.

Initial Conditions: 100% Power, BOL

Options Available	Options Used:
Selection A, B, C	Selection A
Magnitude 0-100%	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Condensate pump A discharge pressure
Condensate pump FW-2A current

Test Precis: Following malfunction actuation, observe: condensate pump A current rises sharply, then decreases to 0 after pump seizes; pump trips with attendant overload trip alarm; discharge pressure decreases to 0; standby condensate pump starts normally.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.4.5

Malfunction Identifier: CND5

Test Description: Condensate cooler tube leak. Tube failure occurs to a selectable degree in the condensate cooler.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100, 100% = 10% of Tubes	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Condenser hotwell level
- Condensate storage tank level
- Condensate cooler outlet header temperature
- Stator cooler inlet temperature

Test Precis: Following malfunction actuation, observed: condensate storage tank level decreased, and heat exchanger temperature irregularities on stator coolers and hydrogen coolers. Operator isolates and bypasses condensate cooler, then verifies that stator and hydrogen cooler temperatures stabilize at higher values.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.4.8

Malfunction Identifier: CND8

Test Description: Hotwell level control failure. The hotwell level controller fails to a selectable setpoint.

Initial Conditions: 100% Power, BOL,

Options Available:	Options Used:
Selection 0-48"	Selection 48"
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Condenser hotwell level
Condensate storage tank level

Test Precis: Following malfunction actuation, observed: hotwell level increase, high level alarm annunciation level indication stabilized at 48", condensate storage tank level decreased.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.6.3

Malfunction Identifier: CRD3

Test Description: Failure of individual rod raise relay. The selected relay fails to the state selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection 1-41	Selection 1
Magnitude D, E Deenergized/Energized	Magnitude E
Ramp Time	Ramp Time 0
Delay Time 0-3600 s	Delay Time 60 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe group 4 rod 1 outward motion . Operator attempts to insert rods in manual group and manual individual modes and observes: rod deviation alarms, a rod block signal, and the withdraw lights for group 4 remain on. Rod outward motion stops when mode switch is taken to off.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.6.4

Malfunction Identifier: CRD4

Test Description: Failure of individual rod lower relay. The selected relay fails to the state selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection 1-41	Selection 1
Magnitude D, E Deenergized/Energized	Magnitude D
Ramp Time	Ramp Time 0
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, insert group 4 rods and observe: group 4 lower lights on, rod 1 position indication not changing, group 4 rods (except rod 1) inserting.

Operator selects manual Individual on rod mode selector switch and verifies that rod 1 will not insert. Operator verifies normal outward motion of rod 1

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.6.5

Malfunction Identifier: CRD5

Test Description: Stuck rod. The selected rod sticks and does not move; it may be trippable.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-J	Selection A
Magnitude T, U Trippable/Untrippable	Magnitude U
Ramp Time	Ramp Time 0
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, select manual individual on rod mode selector switch, group 4 on rod group selector switch and rod 1 on rod selector switch, then attempt to move rod 1 with the In-Hold-Out switch. Verify that rod 1 does not move.

Operator trips the reactor and observes: rod 1 does not insert, reactor power decreases normally, rod position deviation low, low-low, and reed switch alarms annunciate.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.6.6

Malfunction Identifier: CRD6

Test Description: Rod clutch failure. The selected rod falls into the core or fails to trip.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection 1-41	Selection 39
Magnitude D, E Deenergized/Energized	Magnitude D
Ramp Time	Ramp Time 0
Delay Time 0-3600 s	Delay Time 60 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Linear range lower detector (A)
Linear range lower detector (B)
Linear range lower detector (C)
Linear range lower detector (D)
Linear range upper detector (A)
Linear range upper detector (B)
Linear range upper detector (C)
Linear range upper detector (D)

Test Precis: Following malfunction actuation, observe: rod drop alarms (2), rod indication shows dropped rod, power dependent insertion limit group 4 alarms, flux decreases most on channel nearest dropped rod, and least on channel furthest from dropped rod. . Operator observes lower flux near the dropped rod on the flux map on ERF computer.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

OPPD Test Number: 14.5.5.6.7

Malfunction Identifier: CRD7

Test Description: Failure of clutch power supply. The selected power supply(ies) fails.

Initial Conditions: 100% power, BOL

	Options Available:	Options Used:
	Selection A-D	Selection A
	Delay Time 0-3600 s	Delay Time 60 s
	Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: clutch #1 power supply current decreases to 0, DC power on light extinguishes, clutch #2 power supply current increases.

Operator then clears malfunction and observes: clutch power supply currents return to normal and DC power on light illuminates.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.6.8

Malfunction Identifier: CRD8

Test Description: Rod ejection. The selected control element assembly (CEA) is ejected from the reactor vessel.

Initial Conditions: 30% Power, BOL

Options Available:	Options Used:
Selection 1-41	Selection 1
Magnitude 0-100% 100% = 2.75" Diameter Hole	Magnitude 100%
Ramp Time	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

- Pressurizer level
- Linear range lower + upper detectors
- RCS global pressure
- Containment sump level
- Containment pressure
- Containment air particulate activity
- Containment air noble gas activity
- Fuel transfer canal area monitor
- Containment operating floor area monitor
- Containment air temperature
- Containment dew point

Test Precis: Following malfunction actuation, observed: reactor coolant system temperature increases indicative of positive reactivity addition, power dependent insertion limit group 4 and rod deviation alarms; pressurizer level decreases with channel X & Y alarms; reactor coolant system pressure drops with channel X & Y alarms; letdown goes to maximum; charging pumps start; containment sump level, temperature, dew point, pressure, and radiation levels rise; reactor trip, SIAS. Operator refers to EOP-3.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.7.9

Malfunction Identifier: CVC9

Test Description: Charging line leak outside containment. A variable size leak occurs between the charging pump discharge header and FT-236.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 2" Line Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Spent regenerant tank level
Stack air particulate radiation monitor
Stack gas radiation monitor
Charging flow
Pressurizer level
Volume control tank level
SIRWT level
Regenerative heat exchanger letdown outlet temperature
Charging temperature
Letdown heat exchanger outlet temperature

Test Precis: Following malfunction actuation, observe: volume control tank level decreases; charging flow-related alarms annunciate; standby charging pumps start, discharge pressure decreases; volume control tank auto makeup starts; pressurizer level and pressure decrease; volume control tank low, and low-low level alarms annunciate and charging pump suction switches to the SIRWT; when volume control tank isolates, its level rises; waste disposal system malfunction alarm annunciates; letdown temperature rises, alarms and TCV-202 closes; CRHS and VIAS actuate, main stack and process area monitor alarms annunciate.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.8.2

Malfunction Identifier: CWS2

Test Description: Main condenser tube leak. The failure occurs to a selectable degree in the selected bundle(s).

Initial Conditions: 100% Power

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = 10% Of The Tubes	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: condenser A outlet pressure decreases and hotwell level rises, hotwell high level alarm; condensate storage tank level rises; generator megawatts decrease with no rod movement or other operator actions.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.9.2

Malfunction Identifier: DSG2

Test Description: Diesel generator fuel transfer pumps discharge leak. A variable size leak occurs on the selected diesel's fuel transfer pumps' discharge.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 1" Line Break	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation observe: fuel oil level in 300 gallon tank decreases, level rises in spent regenerant tank due to floor drain inflow.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.9.8

Malfunction Identifier: DSG8

Test Description: Diesel generator failure to start. The selected diesel generator cranks but fails to start.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, operator attempts to start DG-1 with emergency pushbutton and observes: start status light illuminates, then the diesel start fail and trouble alarms annunciate; the engine stopped status light illuminates.

Operator attempts to start diesel until starting air is exhausted.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.1

Malfunction Identifier: EDS1

Test Description: 4160 VAC bus fault. The selected bus(ses) is lost due to a single phase to ground fault on the bus.

Initial Conditions: 100% Power, BOL

ions Available:	Options Used:
Selection A-D	Selection C
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Breaker T1B-3B ammeter
- Breaker T1B-3C ammeter
- Transformer T1A3 current
- Bus 1B3A voltage
- Bus 1B3B voltage
- Bus 1B3C voltage
- Transformer T1A3 secondary wattage
- 4160V bus 1A3 voltage

Test Precis: Following malfunction actuation, observe: DG-1 start, breaker 1A33 trip and lockout, 86/1A33 alarm; lockout relay supervision tripped, diesel auto start demand, breaker off auto alarms; bus 1A3 voltage goes to 0; 4160 bus ground alarm comes in then clears; bus 1A3 low voltage and breaker auto trip alarms; transformer lockout relay 86-1A3-TFB picks up alarms; 4160 V bus 1A3 feeder auto trip, 480 V bus low voltage, breaker off auto, Diesel auto start demand alarms annunciate; 4160/480 V transformer voltages and currents go to 0; 4160V and 480V breakers trip with attendant alarms; power lost to busses 1A3, 1C3A, 1B3A-D, 1B3A-4A & 1B3C-4C; reactor trip with low flow alarm.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.2

Malfunction Identifier: EDS2

Test Description: 480 VAC bus fault. The selected bus(ses) is lost due to a single phase to ground fault on the bus on phase 2.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-I	Selection A
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following actuation, observe sequential 480V bus alarms followed by respective breaker tripping, then phase current and voltage go to 0. Selected 480V load breakers trip open (charging pump, ventilation, and other operating loads on bus).

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.3

Malfunction Identifier: EDS3

Test Description: 125 VDC bus fault. The selected bus(ses) is lost due to a short on the bus.

Initial Conditions: 100% Power, BOL

Options Available	Options Used:
Selection A, B	Selection A
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Paramet Monitored: Battery 1 ammeter
125V DC charger 1 ammeter
125V DC bus #1 voltmeter

Test Precis: Following malfunction actuation, observe DC Bus #1 ground alarm. After approximately 15 seconds observe: DC bus 1 ground light illuminates, battery charger feeder trips, output current goes to 0; output current goes to maximum; bus current goes to 0; inverter A, C & 1 trouble, DC bus 1 low voltage, panel AI-41A undervoltage, 125 VDC auxiliary supply not available-D2 alarms; normal source 125 VDC, battery #1 (Normal) 125 VDC, DC distribution panel 1 lights out; power loss to 125 VDC loads and control power.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.4

Malfunction Identifier: EDS4

Test Description: 120 VAC instrument bus fault. The selected bus(ses) is lost due to single phase to ground fault on the bus.

Initial Conditions: 100% Power

Options Available:	Options Used:
Selection A-F	Selection A
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 300 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: 120V AC inverter ammeter
120V AC bus A voltmeter

Test Precis: Following malfunction actuation, observe bus ground light goes bright. After approximately five minutes observe: bus feeder breaker trips, inverter output current pegs high, then goes to 0, bus voltage goes to 0, low voltage alarm annunciates, and loss of power to associated loads is experienced.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.6

Malfunction Identifier: EDS6

Test Description: 480 VAC supply transformer fault. The selected 4160/480 VAC supply transformer is lost due to a single-phase to ground fault.

Initial Conditions: 100% Power

Options Available:	Options Used:
Selection A-F	Selection A
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Transformer T1B-3A current

Test Precis: Following malfunction actuation, observe: transformer high winding temperature alarm is received, transformer feeder breaker trips, transformer output voltage and current go to zero with associated alarms, and power is lost to loads supplied.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.11

Malfunction Identifier: EDS11

Test Description: Switchyard line fault. A single phase to ground fault occurs on phase A of the selected line.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C	Selection C
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: relay 87 161 picks up causing lockout relay supervision tripped alarm; relay 86-161 trip with 161 KV alarm; relays 86-1 & 2/T1A-3 trip and DG-1 starts at idle, relays 86-1/T1A-4 & -2/T1A-4 trip, with DG-2 starting at idle and breakers 1A13 & 1A24 close with alarms; transformers T1A-4 & -3 watts, current, and voltage go to 0; T1A-1 & -2 wattage and current rise.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.11.12

Malfunction Identifier: EDS12

Test Description: Switchyard breaker fault. The selected breaker contacts weld shut or the selected breaker trip mechanism activates.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B, C	Selection A
Magnitude O, C Open, Fails To Open	Magnitude O
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe breaker 3451-4 opens with alarm. Operator opens breaker 3451-4 control switch and observes that alarm clears.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.12.1

Malfunction Identifier: EHC1

Test Description: Electrohydraulic fluid system leak. A variable size leak occurs on the electrohydraulic fluid accumulator inlet line.

Initial Conditions: 100% Power

Options Available:	Options Used:
Magnitude 0-100% 100% = Double Ended Shear	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
Hydraulic fluid level in reservoir
Fluid actuator system (FAS) fluid pressure
Hydraulic fluid pump A
Hydraulic fluid pump B

Test Precis: Following malfunction actuation, observe: electrohydraulic control fluid pressure decreases, current rises, standby pump starts with alarm and pressure decreases more slowly; hydraulic oil press low, hydraulic power unit fluid level high-low alarms; turbine and reactor trip; EHC mechanical, emergency lights illuminate, hydraulic fluid pressure light goes out; all turbine stop, control and combined intercept valves close. After 5-10 minutes, observe hydraulic fluid pressure pump A & B stopped alarms.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.12.6

Malfunction Identifier: EHC6

Test Description: Load limit potentiometer failure. The load limit potentiometer's output fails to change in the selected deadband.

Initial Conditions: 50% Power

Options Available:	Options Used:
Magnitude 0-5% Magnitude is % of potentiometer range	Magnitude 5%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following actuation, operator slowly raises load with the load limiter and observes erratic potentiometer behavior. After load is raised past deadband selected; observe smooth potentiometer operation. Then lower load and observed erratic potentiometer operation when deadband is reached again.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.13.1

Malfunction Identifier: ESF1

Test Description: Steam generator low pressure logic matrix failure. The logic matrix for the selected train(s) fails to the selected condition(s).

Initial Conditions: 100% Power, EOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude T, F T= On (ACT), F=Off	Magnitude T
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe indications of SGLS & SGIS actuation; reactor trips, reactor coolant system temperature response tracks main steam safety valve cycling, pressurizer level response follows T_{ave}, (program setpoint), pressurizer pressure and level alarms annunciate. Feedwater controller level alarms annunciate, steam generator pressures rise, steam generator levels decrease, steam generator feedwater and steam flows go to 0, feedwater pump discharge pressure rises and suction flow decreases, feedwater recirculation valves open. Condensate pumps discharge low flow alarms annunciate. Observe the following: reactor coolant system temperature and pressure stabilize at temperature corresponding to main steam safety valve setpoints, steam generator levels decrease, auxiliary feedwater actuation system actuation with appropriate alarms and actions. Observe proper auxiliary feedwater flow to steam generators. Verify proper cycling of auxiliary feedwater valves and attendant alarms as steam generator levels vary between actuation and reset setpoints.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.13.2

Malfunction Identifier: ESF2

Test Description: Containment high pressure logic matrix failure. The logic matrix for the selected train(s) fails to the selected condition(s).

Initial Conditions: 100% Power, BOL

Options available:	Options Used:
Selection A, B	Selection A
Magnitude T, F T= On (ACT), F=Off	Magnitude T
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: CPHS, SIAS, and 480V load shed actuate with associated alarms and indications; SGIS actuates with associated valve closures and alarm annunciation; reactor trip alarms. Diesel generators start, load sequencers S1-1 & S2-2 actuate with associated alarm annunciation; CIAS and VIAS actuate with associated alarms.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.13.5

Malfunction Identifier: ESF5

Test Description: Pressurizer low pressure logic matrix failure. The logic matrix for the selected train(s) fails to the selected condition(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude T, F T= On (ACT), F=Off	Magnitude T
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: PPLS actuates with associated alarm annunciation; SIAS, diesel generator start, and CIAS signals received, sequencers S1-1 and S2-2 actuate.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.13.10

Malfunction Identifier: ESF10

Test Description: Safety injection actuation signal failure. The actuation signal for the selected train(s) fails to the selected condition(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude T, F T= On (ACT), F=Off	Magnitude T
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: SIAS will actuate with annunciation on panels AI-30A/B and the ERF. Valves will go to their accident positions, 480V load shed will initiate and emergency boration will commence. SIAS actuation will also cause VIAS actuation.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? N

Test Number: 14.5.5.13.12

Malfunction Identifier: ESF12

Test Description: OPLS logic matrix failure. The logic matrix for the selected train(s) fails to the selected condition(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude T, F T = On (ACT), F=Off	Magnitude T
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: 86A/OPLS trips with alarm; breakers 1A13 & 1A33 trip, DG-1 starts and accelerates to 900 rpm, bus 1A3 load sheds; breakers 1A24 & 1A44 trip, DG-2 starts and accelerates to 900 rpm, bus 1A4 load sheds; supply breakers to MCC-3B2, -3B3, -3C-4C-1 deenergize; associated loads trip.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.14.2

Malfunction Identifier: FDW2

Test Description: Main feedwater header leak. A variable size leak occurs on the main feedwater header.

Initial Conditions: 50% Power

Options Available:	Options Used:
Magnitude 0-100% 100% = 18" Diameter Break	Magnitude 50%
Ramp Time 0-3600 s	Ramp Time 600 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Main feedwater pump(s) suction flow
- Main feedwater pump(s) discharge pressure
- Steam generator levels
- Main feedwater header flows

Test Precis: Following actuation, observe: heater 6 A/B outlet, feedwater pump discharge pressures decrease; feedwater pump suction flow rises; steam generator feedwater flows and levels decrease; feedwater control steam generator low alarms annunciate, turbine building sump high level alarms annunciate, reactor trip.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.14.3

Malfunction Identifier: FDW3

Test Description: Main feedwater line leak upstream of the flow control valve. A variable size leak occurs on the selected feed line(s) between the flow element and the flow control valve.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 16" Diameter Break	Magnitude 10%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Steam generator levels
Main feedwater flows
Feedwater regulating valves' positions

Test Precis: Following malfunction actuation, observe: steam generator RC-2A feedwater flow rises, level decreases, feedwater regulating valve A position increases, low level alarm annunciates, steam generator B level decreases slower than steam generator A, steam generator A low level causes reactor trip.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.14.5

Malfunction Identifier: FDW5

Test Description: Main feedwater line leak inside containment. A variable size leak occurs on the selected feed line(s) downstream of the check valve.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 16" Diameter Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
Steam generator steam/feedwater flows
A steam generator level/pressure
RCS pressure and temperatures
Containment pressure and sump level

Test Precis: Following malfunction actuation, observe: steam generator feedwater flow rises, steam generator RC-2A pressure & level decrease; steam generator RC-2A low level alarm annunciates; reactor trips; steam generator low level, low pressure channel pre-trip & trip alarms annunciate. steam generator 2A steam flow, pressure and level decrease to 0 and SGIS actuates as steam generator boils dry. Containment sump high level alarm annunciates. RCS temperature & pressure, and pressurizer level decrease; SIAS actuates at 1600 psia.

Containment high pressure alarms annunciate and CPHS actuates.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.16.1

Malfunction Identifier: FWH1

Test Description: Feedwater heater tube leak. Tube failure occurs to a selectable degree in the selected heater(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-L	Selection K (6A)
Magnitude 0-100% 100% = 10% Of Tubes	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Steam generator transmitted levels (NR)
Condenser steam pressure
Gross generator electrical power output (MW)
Heater 6A level control
Heater 5A level control
Second stage extraction pressure
Heater 6A drain temperature.

Test Precis: Following malfunction actuation, observe: heater 6A level and extraction pressure rising, drain temperature decreases; heater 5A level rises rapidly; steam generator level decreasing and feedwater flow rising; hotwell level rising, heater 6A extraction valve closes, and condenser vacuum decreasing due to 6A high level dump; standby vacuum pumps start; heater 6A high-low level alarm; generator megawatts decrease.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.17.1

Malfunction Identifier: GEN1

Test Description: Voltage regulator failure. The voltage regulator changes the output voltage to the setpoint selected.

Initial Conditions : 100% Power

Options Available:	Options Used:
Selection A, B A=Auto Regulator, B=Manual	Selection A
Magnitude 80-120% 100% = Rated Voltage	Magnitude 120%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Generator field ammeter
- Power factor meter
- Generator output imaginary power (MVARS)
- Main generator current
- Generator field voltage meter

Test Precis: Following malfunction actuation, observe: generator picks up more reactive load; leading power factor rises; voltage regulator transfer voltage rises; field current and voltage, and generator output current rise with field overvoltage alarm. After 10 seconds, voltage regulator trips to manual mode with alarm; parameters effected return to pre-malfunction conditions, except the voltage regulator transfer volt meter.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.17.4

Malfunction Identifier: GEN4

Test Description: Field breaker failure. The field breaker fails to the position selected.

Initial Conditions: Approximately 12% reactor power, turbine at 1800 RPM

Options available:	Options Used:
Magnitude O, C Open, Closed	Magnitude O
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, operator starts up generator and observes: field breaker does not close, field breaker mismatch light illuminates, and exciter field breaker tripped alarm annunciates. Operator returns field breaker control switch to OFF and observes that above alarms and indications return to normal.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.18.1

Malfunction Identifier: MSS1

Test Description: Main steam line leak inside containment. A variable size leak occurs on the selected steam line inside containment.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 28" Diameter Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Steam generator wide range levels
Total containment pressure
RCS global pressure
Steam generator steam pressures
Containment temperature
Wide range cold leg temperatures
Wide range hot leg temperatures
Auxiliary feedwater flows to steam generators
Feedwater flows to steam generators
Steam line flows to main steam header

Test Precis: Following malfunction actuation, observe: steam generator RC-2A steam pressure drops, steam temperature and flow decrease; RC-2B, main steam, and turbine first stage pressure and temperature decrease; steam generator levels and RCS temperature decrease; T_{ref}/T_{avg} deviation alarms annunciate; RCS pressure decreases with alarms; pressurizer heaters energize; letdown flow decreases to minimum; pressurizer level channel X & Y alarms; steam generator low level alarms; containment pressure rises with alarms; reactor trips, CPHS, SIAS, VIAS, CIAS, SGLS, AFWS all actuate with alarms, actions, and indications; containment sump level rises with attendant alarms. Following AFWS, operator verifies no auxiliary feedwater flow to steam generator RC-2A; RC-2B level recovers, RC-2B pressure rises to main steam safety valve setpoint.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.18.3

Malfunction Identifier: MSS3

Test Description: Main steam line leak outside containment (non- isolable). A variable size leak occurs on the selected steam line outside of containment.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 28" Diameter Break	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 600 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Steam generator pressures and levels
RCS temperatures and pressure
Charging and letdown system pressures and flows

Test Precis: Following malfunction actuation, observe: steam generator RC-2A steam pressure, temperature, and flow decrease; RC-2B pressure and temperature decrease, flow rises; main steam and turbine first stage pressure decrease; RC-2A level swells, then decreases with low level alarm; RC-2B level, RCS temperature and pressure decrease; T_{ref}/T_{avg} deviation and pressurizer pressure channel X & Y alarms; pressurizer backup heaters energize; TM/LP pre-trip and trip, subcooled margin low, high power pre-trip and trip alarms; reactor trip; pressurizer SI signal low-low alarms; PPLS actuation , and ERF indications; pressurizer level drops, letdown flow goes to minimum, high-low channel X & Y alarms, standby charging pumps start; volume control tank level decreases with suction switch over to SIRWT, VCT low-low level alarms; pressurizer low-low channel X & Y alarms, backup heaters de-energize; SIAS, VIAS, CIAS, SGLS, and AFWS actuations with actions and alarms; auxiliary feedwater flow to RC-2B; reactor coolant pumps cavitate; pressurizer and RC-2B levels recover; RC-2B pressure rises to main steam safety valve setpoint. Operator stops reactor coolant pumps when cavitation is observed

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.18.5

Malfunction Identifier: MSS5

Test Description: Main steam isolation valve (MSIV) failure. The selected MSIV(s) fails closed.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: steam generator RC-2A steam pressure increases; reactor coolant system temperatures increase due to loss of heat sink. Pressurizer pressure and level increase, pressurizer spray valves open. Reactor trip due to ASGT.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.18.6

Malfunction Identifier: MSS6

Test Description: Main steam line to turbine driven auxiliary feedwater pump (TDAFWP) leak. A variable size leak occurs on the selected line(s) supplying the TDAFWP between the stop valve & check valve.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 2" Diameter Break	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe the FW-10 red light on and the auxiliary oil pump stops. when steam driven pump is supplied from unaffected steam line. Operator closes HC-1045B and observes FW-10 red light off, recirculation valves open, FW-10 running alarm clears, recirculation flow = 0. (pump stops). Operator opens HC-1045B, resets trip latch and YCV-1045, then observes: FW-10 red light on then off, recirculation valve opens, FW-10 running alarm.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.18.7

Malfunction Identifier: MSS7

Test Description: Main steam header leak. A variable size leak occurs on the common main steam header.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 36" Diameter Break	Magnitude 10%
Ramp Time 0-3600 s	Ramp Time 600 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- RCS pressure
- Generator megawatts
- Steam generator steam flows

Test Precis: Following malfunction actuation, observe steam generator and main steam header pressures decrease. Generator megawatts decrease, RCS cold leg temperatures decrease as steam generator steam flows increase. Turbine building sump level increases. RCS T_{ave} decreases, reactor power increases. Condensate storage tank level decreases.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.19.2

Malfunction Identifier: NIS2

Test Description: Wide range power supply failure. The selected power supply for the selected channel(s) fails.

Initial Conditions: Cold Shutdown Conditions, BOL

Options Available:	Options Used:
Selected Channel A - H	Selected Channel: A
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test . recis: Selected drawer power on light goes out, all indications go to zero, high voltage meter goes to zero, nuclear Instrumentation channel inoperative annunciator alarms, extended range circuit deenergizes.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.19.7

Malfunction Identifier: NIS7

Test Description: Power range power supply failure. The high voltage power supply for the selected channel(s) fails.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-F	Selection E
Delay Time 0-3600 s	Delay Time 60 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: high voltage detector meter fails to 0, bistable trip light illuminates, nuclear instrumentation channel inoperative alarm, upper and lower power level meters fail to 0, rod drop bistable trip with alarms, level 1 trip light goes out, power on light remains lit.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.20.4

Malfunction Identifier: PRS4

Test Description: Pressurizer steam space leak. A variable size leak occurs from the upper head of the pressurizer.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 8" Diameter Hole	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Containment pressure
RCS global pressure

Test Precis: Following malfunction actuation, observe: pressurizer pressure decreases, level increases, backup heaters energize; charging flow, containment pressure, temperature, activity, dew point, and sump level rise.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.20.5

Malfunction Identifier: PRS5

Test Description: Pressurizer power operated relief valve (PORV) failure. The selected PORV(S) fails to the position selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Fail Position 0-100%	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Total containment pressure
RCS global pressure
Pressurizer level
Pressurizer quench tank level
Pressurizer quench tank pressure
Containment temperature

Test Precis: Following malfunction actuation, observe: acoustic monitor and alarm indicate PORV is open; pressurizer pressure decreases; PORV discharge temperature rises and alarm annunciates; pressurizer goes "solid" and depressurization rate rises, high-low level channel X & Y TM/LP pre-trip, and subcooled margin low alarms annunciate; reactor trips on TM/LP with alarms; pressurizer low-low pressure alarms; PPLS actuates; pressurizer quench tank pressure, temperature and level rise with attendant alarms, rupture disc blows at 75 psig with rapid pressure drop; containment pressure, dew point, temperature, activity and sump level rise.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.20.9

Malfunction Identifier: PRS9

Test Description: Pressurizer level instrumentation tap leak. A variable size leak on the pressurizer instrument tap.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = 1" Diameter Hole	Magnitude 20%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: RCS global pressure
Pressurizer pressure

Test Precis: Following malfunction actuation, observe: pressurizer pressure decreases to lower limit, low-low pressure alarms, channel A TM/LP trip with (3) alarms, PPLS matrix lights change state. Operator bypasses trip unit and verifies yellow light on.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.21.1

Malfunction Identifier: RCP1

Test Description: Reactor coolant pump (RCP) lube oil cooler leak. A variable size leak occurs between component cooling water and the lube oil systems of the selected reactor coolant pump upper lube oil cooler.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = 10% of tubes	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

RCP upper oil reservoir level
RCP speed
RCP lower thrust bearing temperature
RCP upper thrust bearing temperature
RCP upper bearing temperature
Lube oil cooler flow
RCP reverse flow switch
Vibration

Test Precis: Following malfunction actuation, lube oil leaks into the component cooling water system. Observe: component cooling water from RCP-3A lube oil cooler high temperature alarm; lube oil flow and reservoir level decrease with attendant alarms; reactor coolant pump bearing temperatures rise; lube oil levels fluctuate; reactor coolant pump high vibration alarm; reactor coolant pump trips with attendant alarm; reactor trip.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.21.3

Malfunction Identifier: RCP3

Test Description: Reactor coolant pump (RCP) guide bearing failure. The selected bearing(s) fails.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-H	Selection B
Magnitude 0-100%	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- RCP speed (RPM)
- RCP upper guide bearing temperature
- RCP current
- RCP vibration

Test Precis: Following malfunction actuation, observe: RCP-3A upper guide bearing temperature rises with attendant alarm, RCP-3A high vibration alarm, pump seizes. Reactor trips due to low RCS flow.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.21.9

Malfunction Identifier: RCP9

Test Description: Reactor coolant pump (RCP) lower seal failure. The lower seal on the selected RCP(s) fails.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = Complete Seal Fail	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

RC-3A controlled bleed-off pressure
RC-3A middle seal pressure
RC-3A upper seal pressure
RC-3A seal bleedoff temperature
RCP 3A main header flow

Test Precis: Following malfunction actuation, observe: RCP-3A middle seal inlet pressure rises from 1400 to 2100 psia with attendant ERF alarm; upper seal inlet and outlet pressures and seal bleedoff flow may rise, seal leakage high flow alarm annunciates.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.22.1

Malfunction Identifier: RCS1

Test Description: RCS loop leak. A variable size leak occurs on the selected RCS loop(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-H	Selection C
Magnitude 0-100% 100% = Line Diameter	Magnitude 10%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Reactor vessel mixture level
HPSI flow indication
LPSI flow indication
Pressurizer level
SI-6AB/C/D level Indication
SIRWT level
Pressurizer pressure
Wide range containment pressure
Containment air temperature
Core exit thermocouple

Test Precis: Following malfunction actuation, observe: RCS pressure drops rapidly with low pressure channel X & Y alarms; TM/LP pre-trip and subcooled margin low alarms; reactor trips on TM/LP with attendant alarms and indications. Operator verifies reactor trip response, then observes: (4) pressurizer low-low pressure alarms; PPLS actuation with attendant alarms and actions; pressurizer level drops rapidly with channel X & Y alarms, reactor vessel decreases; pressurizer backup heaters de-energize; containment pressure rises with attendant alarms; CPHS actuation with attendant actions and alarms; reactor coolant pumps cavitate; safety injection tanks inject with attendant alarms; containment activity rises and CRHS actuates with attendant alarms and actions; SIAS, VIAS, CIAS, CSAS, SGIS actuate with attendant alarms and actions;

containment sump/water level rises with attendant alarms; containment dew point rises; HPSI/LPSI pressure and flows; containment spray flow causes containment pressure decrease; SIRWT level decreases with alarms and actions; RAS actuates with alarms and actions.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.22.3

Malfunction Identifier: RCS3

Test Description: Fuel failure. Fuel rods fail causing the reactor coolant system activity to increase.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-2%	Magnitude 2%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: CCW header radiation monitor

Test Precis: Following malfunction actuation, observe rising RCS activity. Operator inserts a letdown heat exchanger tube leak and observes that the component cooling water radiation monitor signal rises rapidly and process radiation high alarm annunciates.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.24.1

Malfunction Identifier: RPS1

Test Description: Failure of interposing relay. The selected interposing relay(s) fails to the position selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude D, E Deenergized, Energized	Magnitude D
Ramp Time	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe that the interposing relays de-energize causing a half-trip as indicated by: control power ground, PS1 & PS3 AC trouble, AC on, and DC on lights extinguish; M1 coil voltage goes to 0, trip channel 1 light comes on; output ammeters for PS1 & PS3 decrease, output current meters for PS2 & PS4 rise.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.24.2

Malfunction Identifier: RPS2

Test Description: Reactor protection system (RPS) power supply failure. The selected ladder logic power supply(ies) fails.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-L	Selection A
Ramp Time	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: power supply light on RPS power supply drawer goes out, AB-1 & -2 matrix relays de-energize and status lights go out, a half-trip will occur with attendant indications.

Operator performs surveillance test on high pressurizer pressure channels for selected channel, but does not bypass trip unit; and observes TU-8A trip 2 & 3 lights illuminate, but trip 1 light does not.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.24.3

Malfunction Identifier: RPS3

Test Description: Failure of axial power distribution (APD) positive limit calculator. The selected axial power distribution positive limit calculator fails.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-L	Selection A
Selected Output Range 50-150% of Normal Output	Selected 50%
Ramp Time	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: APD positive limit meter decreases by selected output range. Operator places the meter input selector switch to the positive limit position and verifies that RPS voltmeter reads the same as the value selected for the malfunction.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.25.2

Malfunction Identifier: RRS2

Test Description: Main feedwater master controller failure. The steam generator level input for the selected master level controller(s) fails to the selected value.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% Percent of Input Value	Magnitude 50
Ramp Time	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: main feedwater controller output responds in the proper direction based upon the difference in the magnitude selected and the steam generator level (original input signal).

Operator switches selected controller to manual and raises steam generator level while observing low level alarm clears.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.25.7

Malfunction Identifier: RRS7

Test Description: Steam dump quick opening solenoid valve failure. The quick opening solenoid valve fails to the position selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-E	Selection A
Magnitude D, E Deenergized, Energized	Magnitude E
Delay Time 0-3600 s	Delay Time
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: TCV-909-1 red light on; TCV-909-2, -3, -4 green lights on; steam generators RC-2A and RC-2B steam flows and levels rise; reactor to turbine power mismatch as nuclear power rises and turbine power decreases.

Operator closes air to solenoid for TCV-909-1 and observes: green indication light on, RC-2A and RC-2B steam flows decrease, reactor to turbine power mismatch disappears, generator megawatts return to normal.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.26.3

Malfunction Identifier: RWS3

Test Description: Raw water supply line break. A variable size leak occurs on the selected raw water line downstream of the flow element.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 16" Pipe Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
CCW heat exchanger temperatures
Raw water system pressure
Letdown heat exchanger outlet temperature
Containment cooler outlet temperatures
Raw water system header flows

Test Precis: Following malfunction actuation, observe: raw water supply flow rises, supply header low pressure alarm annunciates, component cooling water heat exchanger outlet temperature rises, raw water supply pressure decreases, raw water-cooled loads heat up, waste disposal trouble alarm annunciates.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.27.2

Malfunction Identifier: SDC2

Test Description: Shutdown cooling heat exchanger inlet header leak. A variable size leak occurs on the shutdown cooling heat exchangers' inlet header between SI-169 & SI-170.

Initial Conditions: COLD S/D, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 12" pipe break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Shutdown cooling flow
- Pressurizer level
- RCS temperatures
- RCS pressure

Test Precis: Following malfunction actuation, observe: shutdown cooling flow and pressure, and pressurizer level decrease; waste disposal system Malfunction alarm; CRHS, and VIAS actuation with attendant alarms and indications; high activity and radiation levels and alarms; RCS temperature rises; pressurizer pressure and temperature decrease along saturation curve.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.30.1

Malfunction Identifier: SGN1

Test Description: Steam generator tube rupture. Tube failure occurs to a selectable degree in the selected steam generator(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A, B	Selection A
Magnitude 0-100% 100% = 10 tubes	Magnitude 10%
Ramp Time 0-3600 s	Ramp Time 0 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:

Steam generator feedwater flows
Steam generator A wide range level
Pressurizer wide range pressure
Steam generator wide range pressures
RCS global pressure
Steam generator A pressure in level reference leg
Condenser off gas radiation
RCS hot leg temperature
VCT level wide range hot leg temperature

Test Precis: Following malfunction actuation, observe: pressurizer level and pressure decrease, backup heaters energize; high-low, then low-low channel X & Y level alarms annunciate, backup heaters trip, pressurizer off-normal channel X & Y alarms; condenser off-gas radiation rises; letdown flow stops; steam generator RC-2A level and pressure rise, feedwater flow decreases; RC-2A high level alarm; reactor trip; steam generator blow down monitor alarms; PPLS, SIAS, CIAS, and VIAS actuate with alarms and indications; pressurizer level rises due to safety injection flow, then backup heaters energize, RCS pressure rises to 1300 psia where leak flow and SI flow are balanced.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.30.2

Malfunction Identifier: SGN2

Test Description: Reference leg leak. A variable size leak occurs at the top of the selected reference leg(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = 3/8" line break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: Steam generator RC-2A control channel level indicator level rises, feedwater regulating valve closes, reducing flow; RC-2A actual level decreases with low level alarm; RC-2A pressure drops with attendant alarms and channel A ASGT trip; containment dew point and sump level rise.

Operator manually controls RC-2A level, bypasses steam generator pressure trip A, observes bypass alarm annunciates and low pressure trip alarm and trip lights clear; channel A ASGT trip lights remain on.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.31.5

Malfunction Identifier: SIS5

Test Description: Safety injection tank gas space leak. A variable size leak occurs from the gas space of the selected tank(s).

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-D	Selection A
Magnitude 0-100% 100% = 1" Diameter Hole	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
Safety injection tank pressure
Safety injection tank level
Containment pressure

Test Precis: Following malfunction actuation, observe: SI tank 6A pressure drops, SI-6A high-low pressure, then at 243 psig SI-6A low pressure alarms annunciate.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.32.3

Malfunction Identifier: GEN6

Test Description: Stator cooling water pump suction line leak. A variable size leak occurs on the suction line of the selected stator cooling water pump(s) downstream of the isolation valve.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A and/or B	Selection used: A
Magnitude 0-100% 100% = Double ended shear of suction piping	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
- Stator cooling inlet temperature
- Stator cooling outlet temperature
- Stator winding temperatures
- Stator cooling water pressure
- Turbine building sump level

Test Precis: Following malfunction actuation, observe: stator cooling system flow and pressure decrease, standby pump starts with associated alarms, standby pump trips and approximately 70 seconds later, turbine trips, followed by reactor trip. Turbine building sump level increases, generator stator winding temperatures increase.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.33.1

Malfunction Identifier: TUR1

Test Description: Main turbine lube oil reservoir leak. A variable size leak occurs at the base of the main turbine lube oil reservoir.

Initial Conditions: 100% Power

Options available:	Options Used:
Magnitude 0-100% 100% = 1" Line Break	Magnitude 100%
Ramp Time 0-3600 s	Ramp Time 0
Delay Time 0-3600 s	Delay Time 0
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, observe: bearing oil pressure decreasing, turbine oil tank level high-low and bearing oil pressure low alarms; motor suction, emergency bearing, and turning gear oil pumps running with attendant alarms; after oil tank empties, oil pumps cavitate, then trip with attendant alarms; turbine vibration alarm and trip; turbine coasts down quickly

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.33.5

Malfunction Identifier: TUR5

Test Description: Main turbine high vibration. The selected bearing experiences excessive vibration of the magnitude selected.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Selection A-J	Selection C
Magnitude 0-20 mils	Magnitude 10m
Ramp Time 0-3600 s	Ramp Time 900 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: Bearings 1 through 6 vibrations
Bearings 1 through 6 oil outlet temperatures

Test Precis: Following malfunction actuation, observe: turbine vibration alarm annunciates as vibration readings rise on bearings (highest to lowest) 3, 2, 4, 5, 1, and 6; turbine trip when vibration is greater than 10 mils; vibration decrease except through resonance speeds.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.33.6

Malfunction Identifier: TUR6

Test Description: Turning gear failure. The turning gear fails to engage when needed.

Initial Conditions: Any condition that has the main turbine rotating at greater than 300 rpm

	Options Available:	Options Used:
	Delay Time 0-3600 s	Delay Time 0
	Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored: None

Test Precis: Following malfunction actuation, operator follows OI-ST-3, Turbine Generator Shutdown, observes bearing oil pressure stable and the turning gear oil pump starts. At 200 rpm, operator starts bearing lift pumps and observes listed normal indications. At 0 rpm, operator observes turning gear not started, then attempts manual start. Turning gear stopped or disengaged alarm annunciates

Plant is recovered when operator clears malfunction, starts turning gear motor and observes alarm clears.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.34.2

Malfunction Identifier: WDS2

Test Description: Gas decay tank leak. A variable size leak occurs on gas decay tank B.

Initial Conditions: 100% Power, BOL

Options Available:	Options Used:
Magnitude 0-100% 100% = 1.5" diameter hole	Magnitude 100
Ramp Time 0-3600 s	Ramp Time 60 s
Delay Time 0-3600 s	Delay Time 0 s
Mode Direct/Remote/Conditional	Direct

Test Parameters Monitored:
Stack gas iodine monitor
Stack gas air particulate monitor
Waste gas decay tank pressure

Test Precis: Following malfunction actuation, observe: high activity indicated in the main stack with alarms, CRHS and VIAS actuations with actions and alarms; process monitor meters and recorders indicate high; stack monitor alarms and indications; corridor area monitors read high; tank WD-29B pressure decreased. After isolating tank and compressor rooms, observe radiation readings decrease.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.35.1

Malfunction Identifier: MM-1

Test Description: Loss of coolant accident with loss of off-site power and one diesel generator failure. Multiple malfunction

Initial Conditions: 100% Power, BOL

Malfunctions used	Malfunction Selections
RCS Loop Leak	14% Magnitude, 10 second ramp time
Diesel Fail to start	A selected
Switchyard Line Faults	A, B and C conditional upon Reactor Trip

Test Parameters Monitored:

Pressurizer pressure
Steam generator pressures
Reactor vessel level
Core exit thermocouple temperatures
RCS temperatures
HPSI and LPSI flows
Safety injection tank levels
Auxiliary feedwater flows
RCS subcooling

Test Precis: Upon activation of the RCS loop leak malfunction, the loss of offsite power occurs, reactor coolant pumps trip, main feedwater pumps trip, a bubble forms in the reactor vessel head, the RCS hot legs reach saturation conditions. The secondary safety valves lift, SIAS is actuated, the pressurizer empties, one diesel generator does not start, HPSI flow initiates via one train, the core uncovers, then is reflooded.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.35.2

Malfunction Identifier: MM-2

Test Description: Inadvertent opening of a pressurizer pilot operated relief valve (PORV) with a loss of offsite power and one diesel generator failure. multiple malfunction

Initial Conditions: 100% Power, BOL

Malfunctions used	Malfunction Selections
Global Failure of PORV	100% Open
Diesel Fail to start	A selected
Switchyard Line Faults	A, B and C conditional upon reactor trip

Test Parameters Monitored:

Pressurizer pressure
Steam generator pressures
Reactor vessel level
Core exit thermocouple temperatures
RCS temperatures
HPSI and LPSI flows
Safety injection tank levels
Auxiliary feedwater flows
RCS subcooling

Test Precis: Upon activation of the global failure for the PORV, the reactor trips on low RCS pressure, a loss of offsite power occurs, reactor coolant pumps trip, main feedwater pumps trip, a bubble forms in the reactor vessel head, the RCS hot legs reach saturation conditions. SIAS is actuated, one diesel generator does not start, HPSI flow initiates via one train, steam flows out of the PORV and the core remains covered for the duration of the event.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.35.3

Malfunction Identifier: MM-3

Test Description: Inadvertent opening of a pressurizer pilot operated relief valve (PORV) with a loss of all feedwater, offsite power, one HPSI pump, and one ECCS train. Multiple malfunction

Initial Conditions: 100% Power, BOL

Malfunctions used	Malfunction Selections
Failure of PORV	100% Open, 60 second ramp time
Failure of ALL Feedwater Pumps	Conditional upon failure of PORV
Failure of 2 of 3 HPSI Pumps	Failure to start
Failure of one ECCS Train to actuate	Malfunctions ESF-1 through 13
Switchyard Line Faults	A, B and C conditional upon Reactor Trip

Test Parameters Monitored:

Pressurizer pressure
Steam generator pressures
Reactor vessel level
Core exit thermocouple temperatures
RCS temperatures
HPSI and LPSI flows
Safety injection tank levels
Auxiliary feedwater flows
RCS subcooling

Test Precis: Upon activation of the loss of the main feedwater pumps, the reactor trips on low steam generator level, followed by the loss of all off-site power. All reactor coolant pumps trip, secondary safety valves open, SIAS actuates on the one remaining operable train. A bubble forms in the reactor vessel head, the RCS hot legs approach saturation conditions.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.35.4

Malfunction Identifier: MM-4

Test Description: Loss of all feedwater, offsite power, one HPSI pump, and one ECCS train. Multiple malfunction

Initial Conditions: 100% Power, BOL

Malfunctions used	Malfunction Selections
Failure of ALL Feedwater Pumps	Direct activation
Failure of 1 HPSI Pump	Failure to start
Failure of one entire ECCS Train to actuate	Malfunctions ESF-1 through 13
Switchyard Line Faults	A, B and C conditional upon reactor trip

Test Parameters Monitored:

Pressurizer pressure
Steam generator pressures
Reactor vessel level
Core exit thermocouple temperatures
RCS temperatures
HPSI and LPSI flows
Safety injection tank levels
Auxiliary feedwater flows
RCS subcooling

Test Precis: Upon activation of the main feedwater pumps trips, all feedwater flow is lost, and the steam generator levels decrease rapidly, causing a reactor trip on low steam generator level. The loss of all off-site power causes all reactor coolant pumps to trip. Secondary safety valves open to control steam generator pressure. Natural circulation is established, and the vessel level does not decrease to allow bubble formation. RCS temperatures do not reach saturation conditions. Due to the inventory in the steam generators, the RCS temperatures remain fairly stable for an extended period of time.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Test Number: 14.5.5.35.5

Malfunction Identifier: MM-5

Test Description: Loss of coolant accident (LOCA) with one steam generator isolated, a loss of offsite power, and one diesel generator failure. Multiple malfunction.

Initial Conditions: 100% Power, BOL

Malfunctions used	Malfunction Selections
RCS Loop Leak	RCS1C, 2.75% Magnitude, 10 sec ramp
Failure of MSIV for A Steam Generator	Fail Closed upon RCS Leak actuation
Failure of Auxiliary FW valve for "B" Steam Generator	Fail Closed
Switchyard Line Faults	A, B and C conditional upon Reactor Trip
Diesel Generator 1 Failure	Fail to start
Failure of all Charging Pumps	Fail to start/run

Test Parameters Monitored:

- Pressurizer pressure
- Steam generator pressures
- Reactor Vessel level
- Core exit thermocouple temperatures
- RCS temperatures
- HPSI and LPSI flows
- Safety injection tank levels
- Auxiliary feedwater flows
- RCS subcooling

Test Precis: Upon activation of the LOCA, the main steam isolation valve for B steam generator closes, the secondary safety valves open on B steam generator, the reactor trips, followed by a loss of all off-site power, loss of all reactor coolant pumps, all main feedwater pumps, SIAS actuation and the formation of a bubble in the reactor vessel head. HPSI initiates, the pressurizer empties, but the core is not uncovered.

Any Uncorrected Test Failures? No

Did this test reveal any exception to ANSI/ANS-3.5-1985? No

Testing Program Changes

Changes to the performance testing program for the second four-year interval as compared to the first four-year interval are as follows.

The following tests were deleted from the certification testing program for the listed reasons:

14.4.4 Electrical Bus Test
14.4.5 Air System Test

The above two tests were deleted because they are handler tests that were developed for the factory acceptance testing program prior to simulator shipment from the vendor. Changes to the configuration of the simulator are handled through the maintenance and modification process, making the performance of these tests redundant to the maintenance and modification process.

14.5.1.2.1 Reactor Core
14.5.1.2.18 Incore Nuclear Instrumentation System
14.5.2.1 Rod Worth Test
14.5.2.2 Boron Worth Test
14.5.2.3 Isothermal Moderator Temp. Coefficient Test
14.5.2.4 Power Coefficient Test
14.5.2.5 Xenon Test

The above core tests were deleted because they are not needed to meet the requirements of ANSI/ANS-3.5-1985 3.1.1 (9). These tests do not use installed instrumentation. They are performed once per core update by the software engineer responsible for the core model to ensure the data from the simulator matches the reference plant Technical Data Book.

14.5.3.2.2 Steady State Drift @ 80%
14.5.3.2.3 Steady State Drift @ 50%
14.5.3.2.4 Steady State Drift @ 30%

The above Steady State Drift tests are not required by ANSI/ANS-3.5-1985. They were part of the original factory acceptance test plan.

14.5.4.1 Maximum Rate Power Ramp

This test was redundant to test 14.5.4.12

14.5.4.2 Main Turbine Stop and Control Valve Testing
14.5.5.12.1 EHC Fluid System Leak on Accumulator

The above tests are not required by ANSI/ANS-3.5-1985. They were part of the original factory acceptance test plan.

14.5.5.2.2 Service Air System Leak

The above test was eliminated because it is redundant to 14.5.5.2.3 and 14.5.5.2.4

14.5.5.21.9 Reactor Coolant Pump Lower Seal failure
14.5.5.32.3 Stator Cooling Water Pump Suction Line Leak
14.5.5.33.1 Main Turbine Lube Oil Reservoir Leak
14.5.5.33.6 Turning Gear Failure
14.5.5.34.2 Gas decay Tank Leak
14.5.5.4.4 Condensate Pump Bearing Failure
14.5.5.9.2 Diesel Generator Fuel Transfer Pump Discharge Leak
14.5.4.3 Inadvertent Boration Dilution

The above tests are not required by ANSI/ANS-3.5-1985. They were part of the original factory acceptance test plan.

Testing Program 1995—1998

The performance test schedule for the next four-year interval is as follows. Note that Cycle 1 refers to tests due in the first year of the four year testing program (i.e., 1995), Cycle 2 refers to 1996, and so forth. "All" refers to tests due each year of the four year program. There are currently 101 Test procedures in the Certification Testing Program.

Test No.	Test Title	Cycle
14.3.3	Verification of Spare Computer Time	All
14.5.3.1	Normal Operations Test	All
14.5.3.2.1	Steady State Drift @ 100%	All
14.5.3.3.1	Steady State Accuracy 100%	All
14.5.3.3.2	Steady State Accuracy 80%	All
14.5.3.3.3	Steady State Accuracy 50%	All
14.5.3.3.4	Steady State Accuracy 30%	All
14.5.4.10	Trip Any RCP Test	All
14.5.4.11	Loss Of Load	All
14.5.4.12	Maximum Rate Power Ramp (100-75-100)	All
14.5.4.13	LOCA With Loss of All Offsite Power	All
14.5.4.14	Excess Steam Demand	All
14.5.4.15	Slow RCS Depress To Sat - No HPSI	All
14.5.4.4	Reactor Trip and Recovery	All
14.5.4.5	Dropped Rod	All
14.5.4.6	Reactor Trip Test	All
14.5.4.7	Simultaneous Trip of MFW Pumps Test	All
14.5.4.8	Simultaneous Closure of MSIVs Test	All
14.5.4.9	Simultaneous Trip of All RCPs Test	All
14.5.1.1.16	Auxiliary Feedwater System	1
14.5.1.1.6	Component Cooling Water	1
14.5.1.2.10	Inplant Electrical Distribution	1
14.5.1.2.15	Reactor Protection System	1
14.5.1.2.9	Diesel Generator	1
14.5.5.1.4	Emergency Feedwater Storage Tank Leak	1
14.5.5.1.5	Auxiliary Feedwater Activation Relay Failure	1
14.5.5.11.1	4160 VAC Bus Fault	1
14.5.5.11.11	Switchyard Line Fault	1
14.5.5.11.12	Switchyard Breaker Fault	1
14.5.5.11.2	480 VAC Bus Fault	1
14.5.5.11.3	125 VDC Bus Fault	1
14.5.5.11.4	120 VAC Instrument Bus Failure	1
14.5.5.11.6	480 VAC Supply Transformer Fault	1
14.5.5.24.1	Failure of Interposing Relay	1
14.5.5.24.2	RPS Power Supply Failure	1
14.5.5.24.3	Failure of APD Positive Limit Calculator	1
14.5.5.25.2	Main Feedwater Master Controller Failure	1
14.5.5.25.7	Steam Dump Quick Opening Solenoid Failure	1
14.5.5.3.4	CCW Pump Discharge Header Leak	1
14.5.5.3.5	CCW Heat Exchanger Tube Leak	1
14.5.5.9.8	Diesel Generator Failure to Start	1

Test No.	Test Title	Cycle
14.5.1.1.1	Reactor Coolant System	2
14.5.1.1.17	Raw Water System	2
14.5.1.1.4	Chemical and Volume Control	2
14.5.2.6	ECP Test	2
14.5.5.16.1	Feedwater Heater Tube Leak	2
14.5.5.19.2	Wide Range Power Supply Failure	2
14.5.5.20.4	Pressurizer Steam Space Leak	2
14.5.5.20.5	Pressurizer PORV Failure	2
14.5.5.20.9	Pressurizer Level Instrumentation Failure	2
14.5.5.21.1	RCP Lube Oil Cooler Leak	2
14.5.5.21.3	RCP Guide Bearing Failure	2
14.5.5.22.1	RCS Loop Leak	2
14.5.5.22.3	Fuel Failure	2
14.5.5.26.3	Raw Water Supply Line Break	2
14.5.5.7.9	Charging Line Leak Outside Containment	2
14.5.5.8.2	Main Condenser Tube Leak	2
14.5.1.1.5	Safety Injection System	3
14.5. .2.13	D-G Sequencer	3
14.5.1.2.16	Engineered Safeguards System	3
14.5.5.13.1	SGLS Logic Matrix Failure	3
14.5.5.13.10	SIAS Logic Actuation Signal Failure	3
14.5.5.13.12	OPLS Logic Matrix Failure	3
14.5.5.13.2	CPHS Logic Matrix Failure	3
14.5.5.13.5	PPLS Logic Matrix Failure	3
14.5.5.18.1	Main Steam Line Break Inside Containment	3
14.5.5.18.3	Main Steam Line Break outside Containment	3
14.5.5.18.5	Main Steam Line Isolation Valve Failure	3
14.5.5.18.6	Main Steam Line to AFW Pump Leak	3
14.5.5.18.7	Main Steam Header Leak	3
14.5.5.2.3	Instrument Air Loop Leak	3
14.5.5.2.4	Instrument Air Riser Leak	3
14.5.5.27.2	Shutdown Cooling Heat Exchanger Inlet Header Leak	3
14.5.5.30.1	Tube Rupture	3
14.5.5.31.5	Safety Injection Tank Gas Space Leak	3
14.5.5.35.1	LOCA + Loss of Offsite Power & 1 D/G Failure	3
14.5.5.35.2	Inadvertent PORV Open w/ LOP & 1 D/G Failure	3
14.5.5.35.3	Inadv. PORV Open/LOFW/Loss of 1 HPSI/1 ECCS Train	3
14.5.5.35.4	LOFW/LOP/1 HPSI Pump & 1 ECCS Train	3
14.5.5.35.5	LOCA + 1 S/G Isol/LOP, and 1 D/G Fail	3
14.5.1.2.17	Nuclear Instrumentation System	4
14.5.1.2.2	Control Rod Drive System	4
14.5.1.2.5	Containment	4
14.5.5.12.6	Load Limit Potentiometer Failure	4
14.5.5.14.2	Main Feedwater Header Leak	4
14.5.5.14.3	Main Feedline Leak Upstream of the FCV	4

Test No.	Test Title	Cycle
14.5.5.14.5	Main Feedline Leak Inside Containment	4
14.5.5.17.1	Voltage Regulator Failure	4
14.5.5.17.4	Field Breaker failure	4
14.5.5.19.7	Power range Power Supply Failure	4
14.5.5.30.2	Reference Leg Leak	4
14.5.5.33.5	Main Turbine High Vibration	4
14.5.5.4.1	Loss of Main Condenser Vacuum	4
14.5.5.4.5	Condensate Cooler Tube Leak	4
14.5.5.4.8	Hotwell Level Control Failure	4
14.5.5.6.3	Failure of Individual Rod Raise Relay	4
14.5.5.6.4	Failure of Individual Rod Lower Relay	4
14.5.5.6.5	Stuck Rod	4
14.5.5.6.6	Dropped Rod	4
14.5.5.6.7	Failure of Clutch Power Supply	4
14.5.5.6.8	CRDM Ejection	4

ABBREVIATIONS & ACRONYMS

AFAS	Auxiliary feedwater actuation signal
AFW	Auxiliary feedwater
AOP	Abnormal operating procedure
APD	Axial power distribution
ASGT	Asymmetric steam generator trip
ASI	Axial shape index
BOL	Beginning of (core) life
CCW	Component cooling water
CEA	Control element assembly
CIAS	Containment isolation actuation signal
CPHS	Containment pressure high signal
CRHS	Containment radiation high signal
CSAS	Containment spray actuation signal
DG	Diesel generator
ECCS	Emergency core cooling system
EOL	End of (core) life
EOP	Emergency operating procedure
ERF	Emergency response facility
HCV	Hand control valve
HPSI	High pressure safety injection
LCV	Level control valve
LOA	Local operator action
LPSI	Low pressure safety injection
MOL	Middle of (core) life
MSSV	Main steam safety valve
MVAR	Mega volt-ampere reactive
MW	Megawatt
OI	Operating instruction
OP	Operating procedure
PCV	Pressure control valve
PORV	Power operated relief valve
PPLS	Pressurizer pressure low signal
RAS	Recirculation actuation signal
RCP	Reactor coolant pump
RCS	Reactor coolant system
RPS	Reactor protection system
SDBP	Steam dump and (turbine) bypass system
SDC	Shutdown cooling
SG	Steam generator
SGIS	Steam generator isolation signal
SGLS	Steam generator low (pressure) signal
SI	Safety injection
SIAS	Safety injection actuation signal
SIRWT	Safety injection refueling water storage tank
STLS	Storage tank (SIRWT) low (level) signal
TCV	Temperature control valve
TM/LP	Thermal margin/low pressure
TU	(RPS) Trip unit
VCT	Volume control tank
VIAS	Ventilation isolation actuation signal