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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Limerick Generating Station, Unit 1
Startup Test Report

This Startup Report is being submitted pursuant to the requirements of Limerick Generating Station (LGS), Unit 1 Technical Specifications (TS) Section 6.9.1.1, 6.9.1.2, and 6.9.1.3. This report addresses (1) the installation of fuel that has a different design and (2) installation of a new design Power Range Neutron Monitoring System.

If you have any questions or require additional information, please contact Mr. Giuseppe Rubinaccio at (610) 718-3595.

Very truly yours,

JvonSuskil

cc: H. J. Miller, Administrator Region I, USNRC
A. L. Burritt, USNRC Senior Resident Inspector, LGS

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PECO ENERGY

Limerick Generating Station

UNIT 1
CYCLE 9
STARTUP REPORT

SUBMITTED TO
THE U.S. NUCLEAR REGULATORY COMMISSION
PURSUANT TO
FACILITY OPERATING LICENSE NPF-39

July
2000

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1.0 SUMMARY

This Startup Test Report is submitted to the Nuclear Regulator Commission (NRC) in accordance with the requirements of Limerick Generating Station (LGS) Technical Specifications (TS) 6.9.1.1 through 6.9.1.3. The report summarizes the startup testing performed on LGS Unit 1 following the installation of a fuel of different design during the eighth Unit 1 Refueling Outage (1R08). All testing identified within the LGS Updated Final Safety Analysis Report (UFSAR) Chapter 14.2 is addressed and evaluated for applicability to the change to the fuel type as required by Technical Specifications.

The Reactor Mode Switch was placed in the startup position on April 24, 2000. The final synchronization to the grid was performed on April 28, 2000, marking the official end to the Unit 1 eighth refueling outage. The Unit reached full power operation on April 30, 2000.

This is the first application of a quantity of GE13 fuel with a debris filter at LGS Unit 1. The composition of the GE13 fuel is no different then the previous reloads of GE13 fuel, the exception being the addition of a debris filter to the bottom of the bundle. This filter has been installed to help to keep foreign material out of the bundle itself. The addition of this filter will slightly increase the differential pressure which will be seen across the core. This change is the reason this startup test report is being written as this filtered bundle will change the thermal-hydraulic properties of the core slightly. Additionally during LGS Unit 1 refuel number 8 the Power Range Neutron Monitoring System (PNRMS) was installed. The PRNMS is discussed in Section 3.9.

1.1 Purpose

The Startup Test Report summarizes the testing performed on LGS Unit 1 following a change to the fuel design. All testing identified within the LGS UFSAR Chapter 14.2 is addressed and evaluated for applicability to the change to the fuel type as required by TS 6.9.1.1. Each test required for a change in fuel type is described in section 3, including the test objective, acceptance criteria, and results. This report is submitted in accordance with the requirement of TS 6.9.1.1 through 6.9.1.3.

1.2 Acceptance Criteria

Level 1 Acceptance Criteria normally relate to the value of a process variable assigned in the design of the plant, component systems or associated equipment. If a Level 1 criteria is not satisfied, the plant will be put in a suitable hold condition until resolution is obtained. Tests compatible with this hold condition may be continued. Following resolution, applicable tests must be repeated to verify that the requirements of Level 1 criteria are now satisfied.

Level 2 criteria are associated with expectations relating to the performance of systems. If a level 2 criterion is not satisfied, operating and test plans would not necessarily be altered. Investigation of the measurements and the analytical techniques used for predictions would be started.

1.3 Testing Requirements

Each of the tests listed in LGS UFSAR Chapter 14.2 were evaluated for applicability to change in fuel type. Section 2 lists the tests not required to be performed for a change in fuel type. All tests are numbered as designated in the UFSAR.

2.0 UFSAR Chapter 14.2 Tests Not Required

2.1 STP-9, Water Level Reference Leg Temperature

The objectives of this test are (1) to measure the level instrumentation reference leg temperature, (2) recalibrate the water level instruments if the measured temperature is significantly different from the value assumed during the initial end points calibration, and (3) to obtain baseline data on the Narrow Range and Wide Range water level instrumentation.

The new fuel design does not affect the performance of systems needed to satisfy the objectives of this test.

2.2 STP-13, Plant Monitoring System

The objective of this test is to verify the performance of the Plant Monitoring System (PMS) under plant operating conditions.

The PMS has been fully tested at plant operating conditions. The functions of the PMS are not changed due to change in fuel types. The process computer databank was prepared, reviewed by FM-UG-270, and installed by performance of RE-C-38.

2.3 STP-14, Reactor Core Isolation Cooling System

The objectives of this test are (1) to verify the proper operatoin of the Reactor Core Isolation Cooling (RCIC) System over its expected operating pressure and flow ranges, and (2) to demonstrate reliability in automatic starting from cold standby when the reactor is at power conditions.

The new fuel design does not affect the performance of systems needed to satisfy the objectives of this test.

2.4 STP-15, High Pressure Colant Injection System

The objectives of this test are (1) to verify the proper operation of the High Pressure Coolant Injection (HPCI) System over its expected operating pressure and flow ranges, and (2) to demonstrate reliability in automatic starting from cold standby when the reactor is at rated pressure conditions.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.5 STP-16, Selected Process Temperatures

The objective of this test is to assure that the measured bottom head drain temperature corresponds to bottom head coolant temperature during normal operation.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.6 STP-17, System Expansion

This test verifies that safety related piping systems and other piping systems as identified in the FSAR expand in an acceptable manner during plant heatup and power escalation. Specific objectives are to verify that: (1) piping thermal expansion is as predicted by design calculations; (2) snubbers and spring hangers remain within operating travel ranges at various piping temperatures; and (3) piping is free to expand without interference.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.7 STP-18, Tip Uncertainty

The objective of this test is to determine the reproducibility of the traversing in-core probe system.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.8 STP-20, Steam Production

The objective of this test is to demonstrate that the Nuclear Steam Supply System (NSSS) can provide steam sufficient to satisfy all appropriate warranties as defined in the NSSS contract.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.9 STP-22, Pressure Regulator

The objectives of this test are as follows:

To demonstrate optimized controller settings of the pressure control loop by analysis of the transients induced in the reactor pressure control system by means of pressure regulator setpoint changes.

To demonstrate the take-over capability of the back-up pressure regulator upon failure of the controlling pressure regulator and to set spacing between the setpoints at an appropriate value.

To demonstrate smooth pressure control transition between the turbine control valves and the bypass valves when reactor steam generation exceeds the steam flow used by the turbine.

To demonstrate the stability of the reactivity-void feedback loop to pressure perturbations.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.10 STP-23, Feedwater System

The objectives of this test are:

To demonstrate that the feedwater system has been adjusted to provide acceptable reactor water level control.

To demonstrate an adequate response to a feedwater temperature reduction.

To demonstrate the capability of the automatic core flow runback feature to prevent low water level SCRAM following the trip of one feedwater pump at high power operation.

To demonstrate that the maximum feedwater runout capability is compatible with the licensing assumptions.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.11 STP-24, Turbine Valve Surveillance

The objectives of this test are to demonstrate acceptable procedures and maximum power levels of periodic surveillance testing of the main turbine control, stop and bypass valves without producing a reactor SCRAM.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.12 STP-25, Main Steam Isolation Valves

The objectives of this test are (1) to functionally check the Main Steam Isolation Valves (MSIVs) for proper operation at selected power levels, (2) to determine the MSIV closure times, and (3) to determine the maximum power level at which full closure of a single MSIV can be performed without causing a reactor SCRAM. The full isolation is performed to determine the reactor transient behavior that results from the simultaneous full closure of all MSIVs at high power level.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.13 STP-26, Relief Valves

The objectives of this test are (1) to verify that the relief valves function properly (can be manually opened and closed), (2) to verify that the relief valves reseat properly after actuation, (3) to verify that there are no major blockages in the relief valve discharge piping and (4) to demonstrate system stability to relief valve operation.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.14 STP-27, Main Turbine Trip and Load Rejection

The objectives of this test are (1) to determine the response of the reactor system to a turbine trip or generator load rejection; and (2) to evaluate the response of the bypass, SRV, and the reactor protection systems.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.15 STP-28, Shutdown From Outside The Main Control Room

The objectives of this test are to demonstrate that the Reactor (1) can be safely shutdown from outside the Main Control Room (MCR), (2) can be maintained in a Hot Standby condition from outside the MCR and (3) can be safely cooled from hot to cold shutdown from outside the MCR. In addition, it will provide an opportunity to demonstrate that the procedures of Remote Shutdown are clear and comprehensive and that the operational personnel are familiar with their application.

The change in fuel type does not change the capability of the reactor to be shutdown from outside the MCR. Therefore, a repeat of this test is not required.

2.16 STP-29, Recirculation Flow Control System

The objectives of this test are (1) to demonstrate the flow control capability of the plant over the entire pump speed range and (2) to determine that the controllers are set for the desired system performance and stability.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.17 STP-30, Recirculation System

The objectives of this test are to:

Obtain recirculation system performance data during steady-state conditions, pump trip, flow coastdown, and pump restart.

Verify that the feedwater control system can satisfactorily control water level on a single recirculation pump trip without a resulting turbine trip and associated SCRAM.

Record and verify acceptable performance of the circuit of a two-recirculation pump trip.

Verify the adequacy of the recirculation runback to avoid a SCRAM upon simulated loss of one feedwater pump.

Verify that no recirculation system cavitation will occur in the operable region of the power-flow map.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.18 STP-31, Loss Of Main Turbine Generator And Offsite Power

This test determines electrical equipment and reactor system transient performance during a loss of Main Turbine Generator coincident with loss of all sources of offsite power.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.19 STP-32, Essential HVAC System Operation And Containment Hot Penetration Temperature Verification

The objectives of this test are to demonstrate, under actual/normal operating conditions, that the various Heating Ventilation and Air Conditioning (HVAC) systems will be capable of maintianing specified ambient temperatures and relative humidity within the following areas:

Primary Containment (drywell suppression chamber)
Reactor Enclosure and Main Steam Tunnel
MCR
Control Enclosure
Radwaste Enclosure

In addition, this test shall verify that the concrete temperature surrounding Main Steam and Feedwater containment penetrations remains within specified limits.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.20 STP-33, Piping Steady State Vibration

The objective of this test is to verify that the steady state vibration of Main Steam, Reactor Recirculation and selected BOP piping systems is within acceptable limits.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.21 STP-34, Offgas Performance Verification

The objectives of this test is to verify that the Offgas System operates withing the TS limits and expected operating conditions.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.22 STP-35, Recirculation System Flow Calibration

The objective of this test is to perform a complete calibration of the recirculation system flow instrumentation, including specific signals to the plant monitoring system.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.23 STP-36, Piping Dynamic Transients

The objectives of this test are to verify that the following piping systems are adequately designed and restrained to withstand the following transient loading conditions:

Main Steam - Main Turbine Stop Valve/Control Valve closures at approximately 20-25%, 60-80%, and 95-100% of rated thermal power.

Main Steam and Relief Valve Discharge - Main Steam Relief Valve actuation.

Recirculation - Recirculation Pump trips and restarts.

HPCI steam supply - HPCI turbine trips.

Feedwater - Reactor feed pump trips/coastdowns.

The new fuel design did not affect the performance of systems needed to satisfy the objectives of this test.

2.24 STP-70, Reactor Water Cleanup System

The objective of this test is to demonstrate specific aspects of the mechanical operability of the Reactor Water Cleanup System.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

2.25 STP-71, Residual Heat Removal System

The objective of this test is to demonstrate the ability of the Residual Heat Removal (RHR) System to remove residual and decay heat from the nuclear system so that the refueling and nuclear servicing can be performed. Additionally, this test will demonstrate the ability of the RHR System to remove heat from the suppression pool.

The new fuel design did not affect the performance of systems needed to satisfy the objective of this test.

3.0 UFSAR Chapter 14.2 Tests Required

3.1 STP-1, Chemical and Radiochemical

Objectives

The principal objectives of this test are (1) to secure information on the chemistry and radiochemistry of the reactor coolant, and (2) to determine that the sampling equipment, procedures and analytical techniques are adequate to supply the data required to demonstrate that the chemistry of all parts of the entire reactor system meet specifications and process requirements.

Discussion

Noble Metals Chemical Addition (NMCA) was performed during 1R08. This modification involved the addition of a noble metal coating on the wetted reactor pressurevessel internals consisting of two liquid noble metals (platinum and rhodium) into the primary coolant during shutdown for 1R08. The injection occurred with Unit 1 in Mode 3, with the bulk coolant temperature held at 295 degrees F (nominal). The noble metal coating will act as a surface catalyst, and when used in conjunction with Hydrogen Water Chemistry (HWC), stress corrosion cracking of the internals can be mitigated. Permanent noble metal monitoring equipment was also installed as part of the modification.

Acceptance Criteria

Level 1

Chemical factors defined in the TS and fuel warranty must be maintained within specified limits. The activity of the gaseous and liquid effluents must conform to licensing limitations. Water quality must be known at all times and must remain with in guidelines of water quality specifications.

Level 2

None

Results

During Startup of LGS Unit 1 reactor, following its eighth refueling outage, reactor coolant chemistry parameters as well as radioactive gaseous waste releases and radioactive liquid waste releases were maintained within the limits set forth in the LGS Unit 1 TS. The following is a list of chemistry related surveillance tests (ST) satisfactorily performed in support of unit startup activities:

ST-5-041-800-1, ST-5-041-875-1, ST-5-041-876-1, ST-5-041-877-1, ST-5-041-878-1, ST-5-041-879-1, ST-5-041-885-1, ST-5-061-570-0, ST-5-070-885-1, ST-5-076-810-1, ST-5-076-815-1

In addition to the surveillance tests, routine tests and normal analysis were performed. Results are as follows:

PARAMETER	ACTUAL DATA (100%) 4/29/00 to 5/5/00	ACCEPTANCE CRITERIA
Primary Rx Coolant Iodine	1.183 x 10-4	≤0.2μCi/gm
Primary Rx Coolant Conductivity	.082	≤1.0 μmhos/cm
Primary Rx Coolant pH	6.77	≥5.6 to ≤8.6
Primary Rx Coolant Chloride	0.32	≤200 ppb

Fuel Warranty Appendix I - Water Quality Requirements were met during startup. On March 7, (first day past outage at approximately 100% power), feedwater copper concentration was 0.0055, iron was 0.274 ppb and total metals was 0.26 ppb (fuel warranty limit 2 ppb, 10 ppb, and 15 ppb respectively). Condensate demineralizer effluent conductivity was 0.059μmho/cm.

Condensate and reactor water cleanup demineralizer performance was monitored closely during the startup. Demineralizers were regenerated as necessary to maintain reactor water conductivity less than 0.3 μmho/cm.

3.2 STP-2, Radiation Measurements

Objective

The objectives of this test are to (1) determine the background radiation levels in the plant environs prior to operation for base data assess future activity buildup, and (2) monitoring radiation at selected power levels to assure the protection of personnel and continuous compliance with the guideline standards of 10CFR20 during plant operation.

Acceptance Criteria

Level 1

The radiation doses of plant origin and occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines of the standards for protection against radiation outlined in l0CFR20.

Level 2

None

Results

Radiation surveys were conducted at power level of 100% in accordance with GP-2 Appendix 6, "Normal Plant Startup - Health Physics." Radiation shielding as described in the UFSAR was verified as adequate. Radiation does rates remained within the standards for protection against radiation outlined in 10CFR20 thus meeting testing criteria.

3.3 STP-3, Fuel Loading

Objective

The objective of this test is to load fuel safety and efficiently to the full core size.

Acceptance Criteria

Level 1

The core is fully loaded in accordance with established procedures, and the partially loaded core must be subcritical by at least 0.38% $\Delta K/K$ with the analytically determined strongest rod fully withdrawn.

Level 2

None

Results

The beginning of cycle shutdown margin calculated in the Cycle Management Report Limerick 1 Cycle 9 was 1.43% $\Delta K/K$. Core reload was conducted in accordance with Technical Specifications. Equipment required to be operable to ensure that shutdown margin is maintained was verified by various performances of ST-6-097-630-1 and ST-6-107-591-1 between March 29, 2000 and April 24, 2000. Post-core alteration core verification was completed on April 19, 2000 after all refueling operations were completed by performance of the M-C-797-020. All fuel bundles were verified to be in their proper locations and properly oriented in the control cells.

3.4 STP-4, Shutdown Margin Demonstration

Objective

The objective of this test is to demonstrate that the reactor will be sufficiently subcritical throughout the cycle with any single control rod withdrawn.

Acceptance Criteria

Level 1

The shutdown margin (SDM) of the fully loaded, cold (68°F), xenon free core occurring at the most reactive time during the cycle must be at least 0.38% ΔK/K with the analytically strongest rod withdrawn. If the SDM is measured at some time during the cycle other than the most reactive time, compliance with the above is shown by demonstrating that the SDM is 0.38% ΔK/K plus an exposure dependent correction factor which corrects the SDM at that time to the minimum SDM.

Level 2

Criticality should occur within ± 1.0% ΔK/K of predicted critical.

Results

For Unit 1 Cycle 9, the required shutdown margin must be greater than 0.38% ΔK/K where R is equal to 0.003% ΔK/K. Therefore the calculated shutdown margin for Cycle 5 must be greater than 0.383 ΔK/K.

On April 24, 2000 as Unit 1 reached criticality, data was collected to calculate shutdown margin in accordance with ST-3-107-870-1, "Shutdown Margin Demonstration." Cycle 9 shutdown margin was determined to be 1.407% ΔK/K. This satisfies the Level 1 criteria.

The difference between the temperature corrected eigenvalue at criticality and the predicted critical eigenvalue was determined to be 0.023% ΔK/K. This satisfies the Level 2 criteria.

3.5 STP-5, Control Rod Drive System

Objectives

The objectives to this test are (1) to demonstrate that the Control Rod Drive (CRD) System operates properly over the full range of primary coolant operating temperatures and pressures, and (2) to determine the initial operating characteristics of the CRD system.

Acceptance Criteria

Level 1

Each CRD must have a normal withdraw speed less than or equal to 3.6 in/sec, indicated by a full 12 foot stroke greater than or equal to 40 seconds.

The mean SCRAM time of all operable CRDs must not exceed the following times:

Position Inserted to From Fully Withdrawn	SCRAM Time(secs)
45	0.43
39	0.86
25	1.93
05	3.49

The mean SCRAM time of the three fastest CRDs in a two by two array must not exceed the following times:

Position Inserted to From Fully Withdrawn	SCRAM Time(secs)
45	0.45
39	0.92
25	2.05
05	3.70

Level 2

Each CRD must have normal insert and withdrawal speeds of 3.0 + 0.6 inches per second, indicated by a full 12 foot stroke in 40 to 60 seconds.

Results

Although the performance of the CRD system was not affected by the installation of the new fuel design, the SCRAM time limits are required by TS to assure thermal limits, such as critical power ratio, are not exceeded. Therefore level 1 tests were performed.

Level 1 stroke time acceptance criteria were fully satisfied by the performance of GP-13 from April 10, 2000 to April 15, 2000 during the operational hydrostatic test and startup.

Level 1 SCRAM time acceptance criteria were fully satisfied by the performance of ST-3-107-790-1 from April 21, 2000 to April 27, 2000 during the operational hydrostatic test and startup.

3.6 STP-6, SRM Performance and Control Rod Sequence

Objective

The objective of this test is to determine that the operational neutron sources, Source Range Monitoring instrumentation, and control rod withdrawal sequences provide adequate information to achieve criticality and power increases in a safe and efficient manner.

Acceptance Criteria

Level 1

There must be a neutron signal to noise ratio of at least 2:1 on the required operable SRM. There must be a minimum count rate of 3 cps on the required operable SRM.

Level 2

None

Results

Minimum SRM count rate was determined to be greater than 3 cps by the performance of ST-6-107-590-1 prior to the withdrawal of the control rods on April 24, 2000. The signal to noise ratio verification is only required to be performed in accordance with TS if the SRM count rate is less then 3.0 cps.

Since at no time during the startup was the count rate less than 3.0 cps, this verification was not performed. SRM response was verified by performance of ST-3-107-870-1 on April 24, 2000, until criticality was achieved.

3.7 STP-10, IRM Performance

Objective

The objective of this test is to adjust the Intermediate Range Monitoring (IRM) System to obtain an optimum overlap with SRM and Average Power Range Monitoring (APRM) Systems.

Acceptance Criteria

Level 1

Each IRM channel must be on scale before the SRMs exceed their Rod Block setpoint.

Each APRM channel must be on scale before the IRMs exceed their Rod Block setpoint.

Level 2

Each IRM channel must be adjusted so that one-half decade overlap with the SRMs is assured.

Each IRM channel must be adjusted so that one-half decade overlap with the APRMs is assured.

Results

TS SRM/IRM overlap was satisfied by the performance of ST-6-107-884-1 on April 24, 2000. This test demonstrated at least a half decade SRM/IRM overlap.

During the startup, all required APRMs were verified to be on scale before any IRM exceeded their SCRAM setpoint of 120% of scale. This was documented on General Plant Procedure GP-2, "Normal Plant Startup" on April 25, 2000. One-half decade of IRM/APRM overlap is verified in accordance with TS during each controlled shutdown by performance of ST-6-107-886-1.

3.8 STP-11, LPRM Calibration

Objective

The objective of this test is to calibrate the Local Power Range Monitor (LPRM) system.

Acceptance Criteria

Level 1

None

Level 2

Each LPRM reading will be within 10% of its calculated value.

Results

LPRM Calibration was performed at 100% power per ST-2-074-505-1. The LPRMs were calibrated within 10% of their calculated value.

3.9 STP-12, APRM Calibration

Objective

The objective of this test is to calibrate the APRM system

Acceptance Criteria

Level 1

The APRM channels must be calibrated to read equal to or greater than the actual core thermal power.

TS and fuel warranty limits on APRM SCRAM and Rod Block shall not be exceeded.

In startup mode, all APRM channels must produce a SCRAM at less than or equal to 15% of rated thermal power.

Level 2

If the above criteria are satisfied, then the APRM channels will be considered to be reading accurately if they agree with the heat balance

Results

By various performances of ST-6-107-887-1, Level 1 acceptance criteria were met by verifying APRM channels were indicating greater then or equal to actual core thermal power and below the SCRAM and Rod Block setpoints when thermal power was greater then 25%. Level 2 acceptance criteria were also met in ST-6-107-887-1 by adjusting indicated APRM readings to within +2,-0%(not to exceed 100%) of the fraction of rated power.

The Level 1 acceptance criteria of APRM SCRAM setpoint of 15% was met by channel functional tests ST-2-074-426(7,8,9)-1 performed April 17, 2000 through April 23, 2000.

Power Range Nuclear Monitor (PRNM) Performance

Objective

Mod P-0224 essentially replaced all the APRM, LPRM, and RBM signal processing hardware in the main control room with GE NUMAC based equipment similar to that used for the WRNM system. LPRM detectors and associated field cabling was not replaced however.

This new PRNM system also employs the approved BWROG Option III Instability Detect and Suppress Algorithm as a long term solution for reactor thermal-hydraulic instability. The trip and rod block logic associated with this feature is bypassed during its first cycle of operation in order to perform tuning and assess the system's operation.

The objective was to demonstrate that the new PRNM instrumentation could track core neutron flux and recirculation drive flow during power ascension and provided adequate information to the operator.

Description

LPRM and APRM flux response was verified as OPCON 1 was approached. APRM gain calibrations were performed against a formal heat balance via direct digital download of core thermal power values from 3D Monicore to the APRMs. LPRM gain calibration was also performed via down load of LPRM GAFT values from 3D Monicore.

Acceptance Criteria

Indicated APRM power must be within 2% absolute of formal heat balance once reactor power is greater than or equal to 25%. In addition, PRNM power and associated Recirc Drive Flow indication was monitored throughout Mode-1 power ascension and verified to conform to historical data trends.

Results

Prior to startup, PRNM performance was tested via several surveillance tests and mod acceptance tests. APRM electronic calibration, trip and rod block setpoints and logic were verified by ST-2-074-426(7,8,9)-1 "Calibration /Functional Check Of Average Power Range Monitor #(1 through 4)" Calibration check of all new Recirc drive flow transmitters and associated processing loops was accomplished via performance of ST-2-074-420(1,2,3)-1 "Calibration Check of APRM 1(2,3,4) Flow Bias Signal." RBM calibration and logic checks were performed via ST-2-074-418(9)-1 "Calibration/Functional Check Of Rod Block Monitor (RBM) A(B)." Various plant interface and computer point verifications were made via MAT LG-224A-1 "PRNMS Wiring and Logic Checks." All four APRM and both RBM channels were operable for BOC9 startup.

During startup, PRNM operability was verified in accordance with GP-2 "Normal Plant Startup." LPRM flux response and APRM downscale indications were verified to clear as mode-1 was approached. APRM gain adjustments were performed utilizing ST-6-107-887-1 "APRM Gain Determination And Adjustment." During OPCON 1 power ascension, tuning of the Option III Period Based Algorithm (PBA) of the Oscillation Power Range Monitor (OPRM) was performed at various steady-state points on the power to flow map. APRM and

LPRM gain calibrations were performed via direct data download from 3D Monicore to the APRM system. All tests were acceptable.

3.10 STP-19, Core Performance

Objectives

The objectives of this test are to (1) evaluate core thermal power and core flow rates and (2) evaluate whether the core performance parameters are with limits.

Acceptance Criteria

Level 1

The following thermal limits are ≤ 1.000:

1. CMFLPD (Core Maximum Fraction of Limiting Power Density)
2. CMFCP (Core Maximum Fraction of Critical Power Ratio)
3. CMAPR (Core Maximum Average Planar Ratio)

Steady State Reactor power shall be limited to the rated core thermal power (3458 MWTh)

Core Flow shall not exceed its rated value (110 Mlbm/hr)

Level 2

None

Results

With thermal power limited to 3458 MWth and core flow limited to 110 Mlbm/hr, Level 1 acceptance criteria of thermal limits were meets and documented throughout the startup by various performances of ST-6-107-885-1 from April 28, 2000 to May 1, 2000.