Entergy

Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 501 858 5000

2CAN080203

August 5, 2002

U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station OP1-17
Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Power Uprate Startup Testing Report

Dear Sir or Madam:

Following Refueling Outage 2R15, Arkansas Nuclear One-Unit 2 (ANO-2) implemented a power uprate of 7.5% as approved by License Amendment 244.

ANO-2 Technical Specification 6.9.1.1 requires submittal of a summary report of plant startup and power escalation testing following amendment to the license involving an increase in power level, installation of fuel that has a different design or was manufactured by a different supplier, and modifications that may have significantly altered the nuclear, thermal, or hydraulic performance of the plant.

The attached report summarizes the relevant testing conducted during startup and power escalation to demonstrate satisfactory plant performance at the new licensed power level of 3026 megawatts thermal. Detailed test data are located on site.

Testing not completed at the time of this submittal (as indicated in the attachment) will be included in a supplement to this report to be submitted by November 4, 2002, as required by ANO-2 Technical Specification 6.9.1.3.

This submittal contains no commitments.

Sincerely,

Sherrie R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/rhs
Attachment

IE26

cc:

Mr. Ellis W. Merschoff
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

Mr. Thomas W. Alexion
NRR Project Manager Region IV/ANO-2
U. S. Nuclear Regulatory Commission
NRR Mail Stop 07-D-01
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

ARKANSAS NUCLEAR ONE UNIT 2
POWER UPRATE STARTUP TESTING REPORT

Background

Development of the ANO-2 power uprate startup testing program was based on a review of the Updated Safety Analysis Report, the scope of modifications performed, the scope of testing completed following steam generator replacements and power uprate projects by other licensees, and industry experience from startup testing.

During power ascension, data were taken at 2.5% increments from 90% to 100% reactor power. Steady state data were collected at the 90% and 92.5% (previous rated full power) plateaus so that operating performance parameters could be projected for uprated power before the previous full power rating was exceeded. Steady state data were evaluated against design predictions and any identified discrepancies were resolved prior to proceeding with power ascension. The Test Working Group, made up of ANO management and experienced testing personnel, reviewed all significant test deficiencies and anomalies identified at each power plateau before recommending ascension to the next plateau.

Power Uprate Testing

1. Feedwater Control System/Reactor Regulation System Testing

The objective of this test was to verify proper operation of the Feedwater Control System/Reactor Regulation System (FWCS/RRS) following power uprate related modifications made during Refueling Outage 2R15.

Testing included monitoring of system operation during power ascension, data collection at various power levels, closed loop steam generator level perturbation testing at 97.5% power, and verification of associated instrumentation accuracies under various plant conditions.

The testing verified that the FWCS/RRS meets or exceeds all original design requirements for operation at uprated power.

2. Vibration Testing Inside and Outside Containment

The objective of this test was to perform walkdowns and collect vibration data on critical plant piping systems inside and outside containment to verify that vibration levels remained acceptable following power uprate. Specific systems monitored were the Reactor Coolant System (RCS), Main Steam, Main Feedwater, Steam Generator Blowdown, and Emergency Feedwater systems.

Formal walkdowns and data collection began at approximately 92.5% power (the previous full power) and continued to the uprated 100% power. Walkdowns were conducted inside containment at approximately 92.5% and 100% power.

Walkdowns outside containment were conducted at approximately 92.5%, 95%, 97.5%, and 100% power.

Specific sites within selected systems were designated as "Steady-State Data Point Sites." Quantitative vibration data were collected at these sites using hand-held vibration test equipment.

For the most part, vibration was acceptable on all monitored systems. Several test deficiencies were initiated to facilitate Engineering evaluations. Two deficiencies resulted in near-term corrective actions. Vibration dampening restraints were added to a main steam flow transmitter sensing line inside containment and electro-hydraulic control tubing associated with the main steam control valves was stiffened.

3. Inside Containment Thermal Expansion Measurements/Walkdowns

The objective of this test was to obtain operational thermal cycle movement measurements for the steam generator snubbers, main steam whip restraints, and the steam generator sliding bases after the initial operating cycle following steam generator replacement. Measurements and observations were conducted at normal operating temperature and pressure, during cooldown, and in cold shutdown.

The steam generators, and the RCS as a whole, thermally contracted as expected during plant cooldown following the first full cycle of operation following steam generator replacement. The steam generator snubber, sliding base, and main steam whip restraint measurements and observations were within the established acceptance criteria and were consistent with measurements and observations completed after steam generator replacement in Refueling Outage 2R14.

4. Electrical and Miscellaneous Heat Exchanger Testing

The objective of these tests was to verify adequate performance of the main generator stator (rewound during the previous outage), Isophase Bus Cooling System, Stator Water Cooling System, Hydrogen Cooling System, Exciter Air Cooling System, main and auxiliary transformers, and the 4.16 KV and 6.9 KV motors.

The main generator stator was assessed during a 100-hour continuous test run at 100% power. Turbine generator stator temperatures and other monitored parameters remained within acceptable limits during the test.

The main and auxiliary transformer winding hot-spot temperatures, oil temperatures, load, and ambient temperatures were monitored at full power operation. All monitored parameters remained within acceptable limits.

The running currents of the 4.16 KV and 6.9 KV motors were monitored using ammeters located in their respective load centers. The 6.9 KV motors monitored included the Circulating Water and Reactor Coolant Pump motors. The 4.16 KV motors monitored included Condensate Pumps, Main Chillers, Heater Drain Pumps, and Service Water Pump motors. All motors operated within acceptable limits.

The isophase bus coolers performed well during power ascension. The "B" cooler was in service and tested through 97.5% while the "A" cooler was in service and tested at 100% power. The coolers met their acceptance criteria. All other generator coolers performed well during power ascension and met their acceptance criteria.

5. **Heater Drain Pump Performance Tests**

The objective of these tests was to verify that the heater drain pumps performed adequately following modifications associated with power uprate.

During power ascension, critical pump parameters were monitored to verify acceptable performance. Monitored parameters included pump suction and discharge pressure, flow rate, pump speed, motor winding and bearing temperatures, and vibration.

The test results verified satisfactory pump performance under power uprate conditions. However, the recorded flow exceeded the vendor flow curve by more than the ± 5% acceptance criterion. Evaluation of this deficiency resulted in a recommendation to increase the procedural minimum operating pump differential pressure to ensure that net positive suction head margin is maintained.

6. **Nuclear Steam Supply System (NSSS) Data Collection**

The objective of this test was to collect NSSS data during power ascension from 90% power to the uprated 100% power to allow comparison of NSSS parameters to acceptance criteria developed from design documents. Data were collected at 90%, 92.5%, 95%, 97.5%, and 100% power. Parameters monitored included RCS temperatures, pressurizer pressure and level, steam generator level, steam generator dome pressure and outlet pressure, and steam header pressure.

The acceptance criteria for RCS temperatures, pressurizer pressure and level, steam generator level, and the calculated steam generator fouling factor were met at each plateau. Steam generator dome pressure, outlet pressure, and steam header pressure were higher than the acceptance criteria developed for the test due to better than expected thermal-hydraulic performance of the generators. These conditions were evaluated as acceptable.

7. **Secondary Plant Parameter and Performance Testing**

The objective of this test was to provide instructions for post-modification testing of the high and low pressure turbines, Moisture Separator Reheater (MSR) low load and high load valves, and the MSR excess steam valves. This test also monitored key secondary plant parameters during power ascension from 90% power to the uprated 100% power for comparison to acceptance criteria developed from design documents. Data were collected at 90%, 92.5%, 95%, 97.5%, and 100% power.

The majority of the monitored parameters met their acceptance criteria at the various power plateaus. Those that did not meet their design predictions were evaluated as acceptable.

This testing also includes performance testing to verify plant heat balance predictions. This testing has not yet been completed. The results of this test will be included in a supplement to this report.

8. Maximum Dependable Capability (MDC) Testing

The objective of this test is to determine the new MDC rating for the unit.

This testing has not yet been performed. The results of this test will be reported in a supplement to this report.

9. Steam Generator Performance Test

The steam generator performance test has been completed but the results have not yet been completely analyzed.

The results of this test will be included in a supplemental report.

10. Steam Generator Moisture Carryover Test

The moisture carryover test has been completed but the results have not yet been completely analyzed.

The results of this test will be included in a supplemental report.

11. Unit Load Transient Test

The objective of the Unit Load Transient Test was to verify the acceptable integrated dynamic response of plant systems to plant transients by initiating a step load decrease of ≥ 25% from approximately 75% power. The transient test data would also provide validation of the Westinghouse-Combustion Engineering Long Term Cooling Analysis and for the ANO-2 simulator code changes made relative to steam generator replacement and power uprate.

The Unit Load Transient Test was scheduled to be performed during shutdown for 2R15. However, problems with a channel of Excore Nuclear Instrumentation necessitated rescheduling of the test. It was determined by ANO management that November 2002 would be the best time to conduct the test based on plant availability and schedules. A conference call was conducted with the NRC staff who concurred that November 2002 was an acceptable time for performance of the test. The NRC stated that they did not consider performance of this test to be a commitment.

During startup from 2R15, a main turbine control valve failed shut and then suddenly re-opened. The plant transient initiated by this event was similar to the one intended by the load transient test. All plant systems responded satisfactorily to the transient.

The data collected during this event are being evaluated by Design Engineering to determine if it is sufficient to meet the objectives of the load transient test. If so, a load transient test will not be performed in November 2002.

The results of the Design Engineering evaluation will be included in the supplement to this report.

12. Startup Physics Testing

The objectives of the Startup Physics Tests were to demonstrate that, during reactor operation, the measured core physics parameters would be within the assumptions of the Updated Final Safety Analysis Report (UFSAR) accident analyses, within the limits of the plant's Technical Specifications, and within the limits of the Cycle 16 reload analysis. Additionally, the tests were intended to verify the nuclear design calculations and provide the bases for validation of database constants in the Core Protection Calculators (CPC) and the Core Operating Limit Supervisory System. The program consisted of a series of tests preformed at various stages of plant startup, including prior to criticality, low power physics testing, and during power ascension.

Based on analysis of the startup physics testing results, it was concluded that the measured core parameters verified the Cycle 16 design calculations and the proper loading of the first ANO-2 core to utilize Erbia as an integral burnable absorber. With the exception of the CPC Channel A shape annealing matrix measurement, all measurements of nuclear characteristics and checks of related instrumentation met acceptable criteria limits and requirements of the UFSAR, Core Operating Limits Report, and Technical Specifications.

The Channel A Excore/CPC was considered inoperable until such time as analyses could be completed to verify that conservative operation of this channel could be maintained.