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SUBJECT: Provides justification for deletion of loss of offsite power (LOP) test as suppl to 870831 submittal re mod of initial test program. Reasons that LOP test has not been conducted at greater than 10% power stated.

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Arizona Nuclear Power Project
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161-00887-EEVB/RAB
March 17, 1988

Docket No. STN 50-530

U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

References:
(1) Letter from J. G. Haynes, ANPP, to NRC, ANPP letter 161-0074, dated August 31, 1987. Subject: Changes to Initial Test Program.
(2) Letter from E. E. Van Brunt, Jr., ANPP, to J. B. Martin, NRC, ANPP Letter 36657, dated February 24, 1986. Subject: Startup Experience Report for Palo Verde Unit 1, Supplement 1.
(3) Letter from J. G. Haynes, ANPP, to J. B. Martin, NRC, ANPP Letter 39447, dated December 19, 1986. Subject: Startup Report for PVNGS Unit 2.
(4) Letter from J. G. Haynes, ANPP, to NRC, ANPP Letter 161-00103, dated March 24, 1987. Subject: Recovery Program for Damaged Emergency Diesel Generator Engine.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Loss of Offsite Power Testing
File: 88-001-419.01; 88-056-026

In accordance with License Condition 2.C.(4) to NPF-65, PVNGS Unit 3 Facility Operating License, ANPP submitted reference (1) which modified the initial test program for Unit 3. Deletion of the Loss of Offsite Power (LOP) test was one of the changes delineated in the submittal. This letter supplements the Reference (1) submittal to provide justification for deleting the LOP test, which R.G. 1.68 recommends being done at greater than 10% power.

ANPP has not conducted the LOP test for Unit 3 at greater than 10% power for the following reasons: 1) The successful LOP tests at PVNGS Units 1 and 2 demonstrate the adequacy of the PVNGS design relative to LOP; 2) Preoperational tests and surveillance tests at PVNGS Unit 3 have demonstrated the proper performance of the equipment that is called upon during a LOP event. The Attachment to this letter provides the information necessary to determine that the testing done at PVNGS is an acceptable alternate test program to show that the performance of Unit 3, in the event of a LOP, will be as expected.

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If you have any further questions, please call A. C. Rogers of my staff at Extension 4087.

Very truly yours,

E. E. Van Brunt

E. E. Van Brunt, Jr.
Executive Vice President
Project Director

EEVB/RAB/jle
Attachment

cc: G. W. Knighton
J. B. Martin
E. A. Licitra
M. J. Davis
T. J. Polich

Attachment

Discussion of Loss of
Offsite Power Testing

# Attachment

LOP tests were successfully performed for PVNGS Units 1 and 2, with close correlation between the two test results. The LOP test method and acceptance criteria are described in CESSAR Section 14.2.12.5.9. The performance of these tests demonstrated the proper plant design and operator response to an LOP. The following features were verified by the two PVNGS tests:

(1) Adequate RCS heat removal capability exists. Natural circulation cooling was demonstrated and the Main Steam Safety Valves, Atmospheric Dump Valves, and Auxiliary Feedwater were utilized properly.

(2) Adequate reactivity control capability exists. The charging pumps, the Boric Acid Makeup Pumps and a lineup to the Refueling Water Tank were utilized properly to provide borated water for reactivity control.

(3) Adequate RCS pressure and inventory control capability exists. Pressurizer heaters, auxiliary spray, and charging systems were utilized properly.

(4) Proper performance of the vital auxiliaries, including the Diesel Generators and ESF components, was demonstrated.

The test results for PVNGS Units 1 and 2 were reported in the Startup Reports submitted to the NRC (References 2 and 3). The results are summarized in Table 1 and indicate that plant responses were as expected. As can be seen from these tables, the data from Unit 1 can be very closely correlated to that from Unit 2. There are no design differences in Unit 3 from Units 1 and 2 which would affect plant performance during a LOP.

The ability of the Unit 3 to respond to loss of offsite power has been demonstrated in the preoperational test procedure 93PE-3SA01, which is described in Appendix A, and in surveillance tests 73ST-3DG01 and 73ST-3DG02. Table 2 shows the number of tests that have been performed along with the associated ESFAS actuations. Train B testing was completed using Surveillance Test Procedures and was completed approximately 8.5 months later than Train A, because of the 3B diesel engine failure. The recovery and testing program, due to this failure, was agreed to with the staff and was documented in Reference (4) and encompassed those tests completed by preop test on Train A.

The three tests listed above verify:

(1) Load shedding from the emergency busses.

(2) The DG received a start signal from the ESF load sequencer.

(3) The 4.16 kV Class 1E preferred (offsite) power supply breaker tripped.

(4) The Diesel Generator reached voltage and frequency and the output breaker closed.

(5) The ESF load sequencer sequenced the equipment onto the bus in programmed steps which prevented DG instability.

(6) The load on the bus did not exceed the rating of the Diesel Generator.

(7) Preferred (offsite) power could be restored to the Class 1E 4.16 kV bus.

The Unit 3 response to large transients has been satisfactorily demonstrated by two events which occurred during the Power Ascension Test Program. These events also demonstrated the similarity of plant responses in Unit 3 to those in Units 1 and 2. On December 17, 1987, a reactor trip occurred on Unit 3 when a CEA subgroup deviation initiated a low DNBR trip. The response time for the trip was less than 1 second which compares favorably with the data in Table 1. Please note that low DNBR causes the reactor to trip on a LOP.

The second event was a turbine trip from 93% power on December 27, 1987. The data obtained from this trip satisfactorily fulfills the acceptance criteria for the load rejection test which would have been obtained from completing procedure 73PA-3MA01, Unit 3 Load Rejection Test. Tables 3 and 4 summarize the initial conditions and the results of this turbine trip. As can be seen the plant response to this transient was as expected.

ANPP has learned that there is a precedent for not performing a LOP test from greater than 10% power. The SNUPPS FSAR question 640.1 describes the methodology used by Wolf Creek and Callaway to satisfy the requirements for the Loss of Offsite Power Test as described in Reg. Guide 1.68. ANPP has compared test descriptions found in the Wolf Creek FSAR and PVNGS test procedures 93PE-3SA01, Integrated Test of Engineered Safety Features and 73PA-3MA01, Unit Load Rejection Test and found them to provide testing for similar functions. The objectives and a description of PVNGS test procedure 93PE-3SA01 is found in Appendix A. PVNGS procedure 93PE-3SA01 tested functions similar to Wolf Creek procedures S-03NF02 and S-03NF03. PVNGS procedure 73PA-3MA01 is similar to Wolf Creek procedure S-070011. Appendix B contains the appropriate pages from the Wolf Creek FSAR which contain the test descriptions.

ANPP believes that the alternate LOP testing program performed in Unit 3, in conjunction with the testing completed in Units 1 and 2, are adequate to determine that plant responses in Unit 3 would be as expected and provides an equivalent for the test described in R.G. 1.68. It is also our position that the performance of an LOP test from greater than 10% power would place unnecessary transients on plant equipment such as condenser tubes, reactor coolant pump seals, and the pressurizer spray nozzle.

Table 1

Summary of LOP Test Results

| Test Feature/Result | U-1 | U-2 |
|---|---|---|
| ° Starting Power Level, Conditions of Test | 52% pwr unplanned event 10/03/85 | 40% pwr planned test 06/25/86 |
| ° Reactor Trip on Low DNBR | @ 1 sec | @ 1 sec |
| ° Turbine Trip | On reactor trip | Initiated just prior to Rx Trip |
| ° Diesel generators started & Class 1E load groups energized | @ $\leq$ 15 sec | @ 12 sec |
| ° Charging (1 pump) restored | @ 50 sec | @ 60 sec |
| ° RCS heat removal via ADVs | @ 4 min | @ 4 min |
| ° Aux spray utilized | twice for ∿1 min each | twice for ∿ 1 min each |
| ° Natural circulation verified | @ 15 min | @ 15 min |
| ° Vital auxiliaries restored | @ 40 min | |
| ° Offsite Power Restored | | @ 45 min |
| ° Forced circulation restored | @ 102 min | @ 215 min |
| ° Time in Hot Standby | 25 min | over 30 min |
| ° RCS Pressure Range (psia) | 2120 - 2290 | 2200 - 2390 |
| ° Motor driven Emerg. FWP supplies SG with adequate level | Yes (> 38% WR) | Yes (> 70% WR) |
| ° Pzr level range (cutoff = 26%) | 39% - 47% | 45% - 60% |
| ° Main Steam Safeties + ADVs Remove Heat - No RCS overcool, No SIAS | Yes | Yes |

Table 2

Loss Of Power Testing Performed On Unit III During Start-Up And Prior to Commercial Operation

| TEST | BUS | PROCEDURE | SECTION | DATE |
|---|---|---|---|---|
| LOP TRAIN A | S03A | 93PE-3SA01 | 8.2 | 12-16-86 |
| SIAS/CIAS Followed by LOP Combined Trains Non-Class De-ener | S03A S04B | 93PE-3SA01 | 8.28 | 12-21-86 |
| SIAS/CIAS LOP Train A Injection to RCS (Cold Start) | S03A | 93PE-3SA01 | 8.30 | 12-21-86 |
| SIAS/CIAS LOP Train A Injection to RCS (Hot Start) | S03A | 93PE-3SA01 | 8.31 | 12-22-86 |
| LOP TRAIN B | S04B | 73ST-3DG02 | 8.6 | 08-26-87 |
| SIAS/CIAS LOP Train B Injection to RCS (Cold Start) | S04A | 73ST-3DG02 | 8.7 | 08-26-87 |
| SIAS/CIAS LOP Train A Injection to RCS (Hot Start) | S04A | 73ST-3DG02 | 8.8 | 08-28-87 |
| AFAS-1 Followed by LOP Train B | S04B | 73ST-3DG01 | 8.6 | 09-22-87 |
| SIAS/CIAS/LOP Train A (Hot Start) | S03A | 73ST-3DG01 | 8.8 | 09-23-87 |

Table 3

| UNIT LOAD REJECTIONS INITIAL CONDITIONS | | |
|---|---|---|
| Parameter | Actual Value | Test Value |
| Reactor Power | 93%, increasing | 95%, stable |
| Cold Leg Temperature (°F) | 564 | Not Specified |
| Pressurizer Pressure, psia | 2250 | 2235 - 2265 |
| Steam Generator Pressure, psia | 1080 | 1064 - 1102 |
| Steam Generator Level, % | 54 | Not Specified |
| CEA position | ARO* | PDIL(ARO Recommended) |
| Control System Status | | |
| -Reactor Regulating System | Auto | Auto |
| -Control Element Drive | Standby[1] | Auto |
| -Feedwater Control System | Auto | Auto |
| -Steam Bypass Control System | Auto | Auto |
| -Pressurizer Level Control | Auto | Auto |
| -Pressurizer Pressure Control | Auto | Auto |
| -Reactor Power Cutback System | Auto | Auto |

* -- ARO = All Rods Out = All control rods fully withdrawn

[1] Changed to Auto fifteen seconds after turbine trip by operator

Table 4

| SINGLE VALUE ACCEPTANCE CRITERIA FOR 100% UNIT LOAD REJECTION | | |
|---|---|---|
| Parameters | Test Results | Acceptance Limits |
| Max. Pressurizer Pressure (psia) | 2375 | 2388 |
| Min. Pressurizer Level (%) | 31 | 29.4 |
| Min. RCS Hot Leg #1 Temp. (°F) | 584 | 574 |
| Min. RCS Hot Leg #2 Temp. (°F) | 584 | 574 |
| Max. SG #1 pressure (psia) | 1247* | 1242 |
| Max. SG #2 pressure (psia) | 1248* | 1242 |

*Out of tolerance results due to misadjusatment of the stroke times of the steam bypass valves. The stroke times were subsequently adjusted to provide the proper stroke times.

## Appendix A

### Objectives and Description of PVNGS Test 93PE-3A01, Integrated Test of Engineered Safety Feature

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| PALO VERDE NUCLEAR GENERATING STATION MANUAL | PROCEDURE NO. 93PE-3SA01 | |
|---|---|---|
| INTEGRATED TEST OF ENGINEERED SAFETY FEATURES | REVISION 0 | Page 9 of 716 |

## 1.0 OBJECTIVES

1.1 To demonstrate the independence of the redundant onsite Class 1E electrical power systems and their associated load groups and to verify proper operation of the design accident loads in response to the Engineered Safety Features Actuation System.

1.1.1 To verify that each Class 1E electrical power system (switchgear, load centers, motor control centers, and distribution panels) remain deenergized when the normal, alternate and emergency supply breakers to the load group are isolated. (Subsections 8.1 (Train B), 8.14 (Train A)).

1.1.2 To verify that the Class 1E 125 VDC control centers remain deenergized after being isolated from their associated battery and battery chargers. (Subsections 8.1 (Train B), 8.14 (Train A)).

1.1.3 To demonstrate the proper operation of each Class 1E load group in response to the following ESF actuations (the opposite load group will be deenergized to demonstrate that the successful operation of one load group is in no way affected by the failure of the other load group):

(1) LOP (Subsections 8.2 (Train A), 8.15 (Train B))

(2) SIAS/CIAS (Subsections 8.3 (Train A), 8.16 (Train B))

(3) RAS (Subsections 8.4 (Train A), 8.17 (Train B))

(4) CSAS (Subsections 8.5 (Train A), 8.18 (Train B))

(5) MSIS (Subsections 8.6 (Train A), 8.19 (Train B))

(6) AFAS-1 (Subsections 8.7 (Train A), 8.20 (Train B))

(7) AFAS-2 (Subsections 8.8 (Train A), 8.21 (Train B))

(8) CREFAS (Subsections 8.9 (Train A), 8.22 (Train B))

(9) CRVIAS (Subsections 8.10 (Train A), 8.23 (Train B))

(10) FBEVAS (Subsections 8.11 (Train A), 8.24 (Train B))

(11) CPIAS (Subsections 8.12 (Train A), 8.25 (Train B))



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1.1.3.1 To verify that the DG starts automatically and attains the required voltage and frequency within the specified time on an LOP.

1.1.3.2 To verify that on an LOP, the proper loads are shed prior to DG breaker closure.

1.1.3.3 To verify proper operation of the loading sequence for an LOP, SIAS/CIAS, CSAS, AFAS, CREFAS, CRVIAS, and FBEVAS.

1.1.3.4 To verify that the equipment aligns correctly in response to the ESFAS actuations.

1.1.3.5 To verify that the DG breaker does not trip if an SIAS occurs after an LOP.

1.1.3.6 To verify the emergency override of the DG test mode by demonstrating that the DG breaker trips if an SIAS or AFAS occurs with the DG in DROOP mode.

1.1.3.7 To demonstrate that the ESFAS actuated equipment remains in its required safety position when the trip signal is reset.

1.1.3.8 To demonstrate the ability to manually override the trip signal to specified components.

1.1.3.9 To demonstrate the automatic bypass of the motor overload contact for specified components on ESFAS actuations.

1.1.3.10 To demonstrate the ability to synchronize the DG with offsite power and restore the DG to a standby status after an LOP.

1.1.3.11 To demonstrate that on an SIAS or AFAS without LOP, the DG can be manually overriden from the control room.

1.1.4 To demonstrate the independence of the Class 1E electrical power systems from the non class electrical power systems (Subsection 8.27).

1.1.5 To demonstrate that proper operation of each Class 1E load group is not affected by the loss of non class electrical power systems or the simultaneous actuation of both Class 1E load groups in response to SIAS/CIAS LOP. (Subsection 8.28)

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1.1.5.1 To demonstrate that on an SIAS, the DG starts automatically and operates on standby.

1.1.5.2 To demonstrate that if an LOP occurs after an SIAS (DG operating on standby), the load sequencer restarts equipment within specified time.

1.1.5.3 To verify that the equipment aligns correctly in response to the ESFAS actuations.

1.1.6 To demonstrate the proper operation of each Class 1E load group in response to a simulated SIAS/CIAS and subsequent LOP with the SI pumps aligned to inject into a depressurized RCS and with the DG at ambient conditions. (Subsections 8.30, 8.32)

1.1.6.1 To demonstrate that the DG starts automatically and attains the required voltage and frequency and operates on standby.

1.1.6.2 To demonstrate that the safety injection system can deliver the required flow to the RCS within the specified time.

1.1.6.3 To demonstrate that if an LOP occurs after flow is established to the RCS, the DG breaker closes, the load sequencer restarts the loads and flow is reestablished to the RCS within the specified time.

1.1.6.4 To verify that the DG voltage and frequency are maintained within the required limits at all times.

1.1.6.5 To demonstrate proper system alignment in response to the ESFAS actuation.

1.1.6.6 To demonstrate that the Class 1E load groups function independent from each other on an SIAS/CIAS LOP.

1.1.6.7 To demonstrate the automatic starting of the DG with the control mode switch in LOCAL.

1.1.6.8 To demonstrate that the largest single load on each DG can be shed and that the DG voltage and frequency are maintained within the required limits.

1.1.6.9 To verify that the auto-connected loads on the DG do not exceed the continuous rating of the DG.



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1.1.6.10 To demonstrate the full load carrying capability of the DG for an interval of not less than 24 hours (the first two (2) hours of which will be at 110%) after reaching stable temperatures.

1.1.7 To demonstrate the proper operation of each Class 1E load group in response to a coincident LOP/SIAS/CIAS with the pumps aligned to inject into a depressurized RCS and with the DG at full load temperature. (Subsection 8.31, 8.33)

1.1.7.1 To demonstrate that the DG starts automatically and attains the required voltage and frequency within the required limits and time. in response to the ESFAS actuation.

1.1.7.2 To verify the proper operation of the load sequencer and that the DG voltage and frequency are maintained within the specified limits.

1.1.7.3 To demonstrate proper system alignments in response to the ESFAS actuation.

1.1.7.4 To demonstrate the automatic starting of the DG with the control mode switch in REMOTE.

1.1.7.5 To verify that the auto-connected loads on the DG do not exceed the continuous rating of the DG.

1.1.8 To demonstrate the proper operation of ESF equipment in response to an AFAS with subsequent LOP and with the AF pump aligned to inject into a depressurized steam generator. (Subsection 8.34)

1.1.8.1 To demonstrate that on an AFAS the DG starts automatically and attains the required voltage and frequency and operates on standby.

1.1.8.2 To demonstrate that if an LOP occurs after flow is established, the DG breaker closes, the load sequencer restarts the loads and flow is reestablished within the specified time.

1.1.9 To demonstrate the automatic transfer to emergency source on loss of normal power for the 120 VAC non-Class 1E ungrounded instrument and control power. (Subsection 8.27)

*TEST PURPOSE AND SCOPE:*

The purpose of this preoperational test was to demonstrate the independence of the redundant Class 1E electrical power systems and their associated load groups and to verify the proper operation of the design accident loads in response to Engineered Safety Features Actuations.

This preoperational test was performed to provide an integrated functional test of the Engineered Safety features (ESF) equipment from the NSSS and BOP ESFAS cabinets through the actuation of the field equipment. Accident signals were simulated at the ESFAS cabinets and the associated ESF equipment (pumps, valves, fans, etc.) were allowed to move to their required safety configuration. Trips were initiated in the various possible combinations of power sources and load groups.

*COMPLEMENTARY TESTS*

| | |
|---|---|
| 93PE-3NA01 | Non-Class 1E 13.8KV Power System |
| 93PE-3DG01 | Diesel Generator System A/B Test |
| 93PE-3PE01 | Diesel Generator Electrical Test |
| 93SU-3SA01 | Preparation For Integrated Test of Engineered Safety Features |
| 93PE-3PK03 | Class 1E 125VDC Component Low Voltage Operability Test |
| 92PE-3SA01 | BOP ESFAS System Preoperational Test |
| 92PE-3SB14 | NSSS ESFAS System Preoperational Test |

*TEST DESCRIPTION*

The following test description is based on the test procedure as written and does not necessarily reflect the exact chronological order as conducted.

The initial conditions aligned the plant as close to normal operating configuration as possible. Major pump breakers, i.e. LPSI, HPSI, CS, AF and CHP were placed in the "TEST" position.

*SUBSECTIONS 8.1 THROUGH 8.13:*

These subsections demonstrated the independence of the Class 1E Load Group 1 (Train A) from Class 1E Load Group 2 (Train B). Initially, Train A and Train B were verified to be energized from normal offsite power. Train B was then deenergized and a verification was made on Class 1E switchgear, load centers, motor control centers and distribution panels to insure that Train B was deenergized and Train A was energized (Subsection 8.1)

With Train B deenergized, an LOP was initiated on Train A by opening breaker B-NAN-S03A. A verification was made that Train A was reenergized by the emergency diesel generator and that the associated ESF equipment moved to its required safety configuration. Train B was monitored to insure that it remained deenergized (Subsection 8.2).

With Train B deenergized and Train A powered from the emergency source, an SIAS/CIAS was initiated on Train A. A verification was made that the associated ESF equipment moved to its required safety configuration. Train B was monitored to insure that it remained deenergized (Subsection 8.3).

With Train B deenergized, Train A powered from the emergency source and an SIAS/CIAS established, a EAS was initiated on Train A. A verification was made that the associated ESF equipment moved to its required safety configuration. The EAS was then reset and the associated equipment was verified to remain in its required safety configuration. The EAS was reinitiated and the ability to OVERRIDE the EAS for specified components was demonstrated. Next, the SIAS/CIAS was reset and the associated equipment was verified to remain in its required safety configuration. The SIAS/CIAS was reinitiated and the ability to override the SIAS/CIAS for specified components was demonstrated. OVERRIDE capability to the diesel generator in the maintenance mode in response to an emergency signal was demonstrated along with the restart timing interlock of the essential chiller. Response of J-CHA-UV-516 to independent SIAS and CIAS signals was also demonstrated in this subsection. Normal offsite power was reestablished to Train A and all equipment was returned to the pretest position (Subsection 8.4).

With Train B deenergized, each of the following trips were initiated individually:

| | | |
|---|---|---|
| CSAS | - | Subsection 8.5 |
| MSIS | - | Subsection 8.6 |
| AFAS-1 | - | Subsection 8.7 |
| AFAS-2 | - | Subsection 8.8 |
| CREFAS | - | Subsection 8.9 |
| CRVIAS | - | Subsection 8.10 |
| FBEVAS | - | Subsection 8.11 |
| CPIAS | - | Subsection 8.12 |

After the initiation of each trip, the associated ESF equipment was verified to have moved to its required safety configuration. Each trip was then reset and the associated equipment was verified to remain in the safety configuration. Each trip was then reinitiated and the ability to OVERRIDE each trip for specified components was demonstrated. During each trip, Train B was monitored to insure that it remained deenergized. Each of the trips were then RESET and verification was made that all associated equipment in the OVERRIDE mode remained in the same configuration. All associated equipment was then restored to the pretest position.

Following the demonstration that Train A functioned with a complete failure of Train B, Train B was reenergized. During the reenergization, the separation of Train B emergency diesel generator start circuits was demonstrated (Subsection 8.13).

*SUBSECTIONS 8.14 THROUGH 8.26:*

These subsections demonstrated the independence of the Class 1E Load Group 1 (Train A) from Class 1E Load Group 2 (Train B). Initially, Train A and Train B were verified to be energized from normal offsite power. Train A was then deenergized and a verification was made on Class 1E switchgear, load centers, motor control centers and distribution panels to insure that Train A was deenergized and Train B was energized (Subsection 8.14).

With Train A deenergized, an *LOP* was initiated on Train B by opening breaker E-NAN-S04A. A verification was made that Train B was reenergized by the emergency diesel generator and that the associated *ESF* equipment moved to its required safety configuration. Train A was monitored to insure that it remained deenergized (Subsection 8.15).

With Train A deenergized and Train B powered from the emergency source, an *SIAS/CIAS* was initiated on Train B. A verification was made that the associated *ESF* equipment moved to its required safety configuration. Train A was monitored to insure that it remained deenergized (Subsection 8.16).

With Train A deenergized, Train B powered from the emergency source and an *SIAS/CIAS* established, a *RAS* was initiated on Train B. A verification was made that the associated *ESF* equipment moved to its required safety configuration. The *RAS* was then RESET and the associated equipment was verified to remain in its required safety configuration. The *RAS* was reinitiated and the ability to OVERRIDE the *RAS* for specified components was demonstrated. Next, the *SIAS/CIAS* was RESET and the associated equipment was verified to remain in its required safety configuration. The *SIAS/CIAS* was reinitiated and the ability to OVERRIDE the *SIAS/CIAS* for specified components was demonstrated. OVERRIDE capability to the diesel generator in the maintenance mode in response to an emergency signal was demonstrated along with the restart timing interlock of the essential chiller. Normal offsite power was reestablished to Train B and all equipment was returned to the pretest position (Subsection 8.17).

With Train A deenergized, each of the following Train B trips were initiated individually:

| | | |
|---|---|---|
| *CSAS* | - | Subsection 8.18 |
| *MSIS* | - | Subsection 8.19 |
| *AFAS-1* | - | Subsection 8.20 |
| *AFAS-2* | - | Subsection 8.21 |
| *CREFAS* | - | Subsection 8.22 |
| *CRVIAS* | - | Subsection 8.23 |
| *FBEVAS* | - | Subsection 8.24 |
| *CPIAS* | - | Subsection 8.25 |

After the initiation of each trip, the associated ESF equipment was verified to have moved to its required safety configuration. Each trip was then RESET and the associated equipment was verified to remain in the safety configuration. Each trip was then reinitiated and the ability to OVERRIDE each trip for specified components was demonstrated. During each trip, Train A was monitored to insure that it remained deenergized. Each trip was then RESET and verification was made that all associated components in the OVERRIDE mode remained in the same configuration. All associated equipment was then restored to the pretest position.

Following the demonstration that Train B functioned with a complete failure of Train A, Train A was reenergized. During the reenergization, the separation of Train A emergency diesel generator start circuits was demonstrated (Subsection 8.26).

***SUBSECTION 8.27 THROUGH 8.29:***

Subsections 8.27 through 8.29 demonstrated the independence of both Class 1E Load Groups from the Non Class 1E electrical systems and the ability of both Class 1E Load Groups to function simultaneously.

In conjunction with the deenergization of the Non Class electrical systems, the automatic transfer of the Non Class uninterruptable power and the cross-tie from EW to NC was demonstrated. 13.8KV and 4.16KV busses NAN-S01,S02 and NBN-S01, S02 were then deenergized. All Non Class 125VDC not required for equipment protection was also deenergized. A verification was then made that the Class 1E Load Groups were energized and the Non Class electrical distribution systems were deenergized (subsection 8.27).

With Non Class Electrical Systems deenergized, the safety injection system for both trains and the auxiliary feedwater system for Train B were aligned to run the pumps in minimum flow (discharge valves closed). The associated pump breakers were then placed in the operate position. An *SIAS/CIAS* was initiated simultaneously on both Train A and Train B. A verification was made that the associated *ESF* equipment on both trains moved to its required safety configuration.

With Non Class Electrical systems deenergized, an *SIAS/CIAS* established on both trains and diesel generators A and B placed in the OVERRIDE/DROOP mode, a complete loss of offsite power to the unit was simulated by opening breakers E-NAN-S05D and E-NAN-S06C. A verification was made that each Class 1E Load Group was reenergized by its emergency diesel generator and that the associated *ESF* equipment had moved to the required safety configuration. Normal offsite power was then restored to all elecrical distribution systems and all equipment was returned to the pretest position (Subsection 8.28).

Restoration of Normal Non Class Electrical system power was accomplished in subsection 8.29.

***SUBSECTIONS 8.30 AND 8.31:***

In subsections 8.30 and 8.31, the RCS injection and full emergency load testing of the Train A diesel generator were performed. The safety injection system was aligned for injections into a fully depressurized RCS (Vessel head removed). An SIAS/CIAS was then initiated on Train A. After the injection flow stabilized, an LOP was initiated on Train A by opening breaker E-NAN-S03A. After injection flow was reestablished, the largest single load on Train A (HPSI pump) was tripped. Movement of the associated ESF equipment to the safety configuration was then verified. Normal offsite power was reestablished to Train A and the equipment was restored to the pretest condition. Next, the Train A emergency diesel generator was synchronized with offsite power and loaded to 100%. After temperatures stabilized, the load was increased to 110% for two (2) hours. The load was then reduced to 100% for twenty-two (22) additional hours (subsection 8.30).

At the completion of the twenty-four (24) hour full load test, the diesel generator output breaker was tripped (full load rejection test). After voltage and frequency stabilized, the diesel generator was shutdown. A simultaneous SIAS/CIAS/LOP on Train A was then initiated within five (5) minutes after the diesel was shutdown (DG Hot Start). After flows stabilized, the injection was stopped. Movement of the associated safety equipment to the safety configuration was then verified. Normal offsite power was reestablished to Train A and the equipment was returned to the pretest position (Subsection 8.31).

***SUBSECTIONS 8.32 AND 8.33:***

In subsections 8.32 and 8.33, the RCS injection and full emergency load testing of the Train B diesel generator were to be performed. The safety injection system was aligned for injections into a fully depressurized RCS (Vessel head removed). An SIAS/CIAS was then initiated on Train B. After the injection flow stabilized, an LOP was initiated on Train B by opening breaker E-NAN-S04A. After injection flow was reestablished, the largest single load on Train B (AF pump) was tripped. Movement of the associated ESF equipment to the safety configuration was then verified. Normal offsite power was reestablished to Train B and the equipment was restored to the pretest condition. Next, the Train B emergency diesel generator was synchronized with offsite power and loaded to 100%. After temperatures stabilized, the load was increased to 110%. The Diesel Generator was to have remained in this status for two (2) hours and then an addition twenty-two hours at 100%. This evolution was not accomplished however, due to a crankcase explosion in the Diesel Generator. Testing was terminated at this point, however, the remainder of the test is outlined below to describe the carry over testing that must be accomplished as a result of the Diesel Generator failure.

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At the completion of the twenty-four (24) hour full load test, the diesel generator output breaker should be tripped (full load rejection test). After voltage and frequency stabilize, the diesel generator should be shutdown. A simultaneous *SIAS/CIAS/LOP* on Train B should then be initiated within five (5) minutes after the diesel is shutdown (Diesel Generator Hot Start). After flows stabilize, the injection should be stopped. Movement of the associated safety equipment to the safety configuration should then be verified. Normal offsite power should then be reestablished to Train B and the equipment returned to the pretest position (Subsection 8.33).

***SUBSECTION 8.34:***

In Subsection 8.34, injection to the steam generator with the essential motor driven auxiliary feedwater pump was to have been performed. The essential motor driven auxiliary feedwater pump should be aligned for injection into steam generator #1 and the level in steam generator #1 should be lowered until the *AFAS-1* trip is initiated. When the flow stabilizes, the regulating valves should be defeated in the OPEN position such that these valves will not cycle closed. An *LOP* should then be initiated on Train B. Verification should then be made that the essential motor driven auxiliary feedwater pump was load shed and restarted in less than 11 seconds and that full flow was reestablished within 22 seconds. The regulating valves should then be enabled which will allow auto closure of these valves on LO Steam Generator Level signal reset.

Appendix B

Wolf Creek FSAR
Test Description

alternate 4,160-V feeder breaker position signals are initiated, and the actuation of the LOCA sequencer, shutdown sequencer, safety-related load shed, and non-safety-related load shed circuits is verified.

b. Signals are initiated to actuate the LOCA sequencer, shutdown sequencer, safety-related load shed, and non-safety-related load shed circuits, and proper load shed and load sequencing are verified.

14.2.12.1.73.4 Acceptance Criteria

a. Actuation of the LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits on receipt of under-voltage, safety injection, containment spray actuation, diesel generator breaker position, and normal and alternate 4,160-V feeder breaker position signals is in accordance with system design.

b. The LOCA sequencer, shutdown sequencer, safety-related load shed, and nonsafety-related load shed circuits shed and sequence loads in accordance with system design.

14.2.12.1.74 LOCA Sequencer Preoperational Test (S-03NF02)

14.2.12.1.74.1 Objectives

a. To demonstrate that initiation of a safety injection signal (SIS) will shed the nonsafety-related loads, start the diesel generator, and sequence the associated equipment. The ability of each 4,160-V Class IE load group to supply the sequenced loads while maintaining voltage within design specifications is also verified.

b. To demonstrate that a loss of offsite power concurrent with SIS will shed the safety-related loads, start the diesel generator, close the diesel generator feeder breaker, and sequence the associated equipment. The ability of each diesel generator to supply the sequenced loads while maintaining voltage and frequency within design specifications is also verified.

c. To demonstrate the ability of each diesel generator to carry the short-time rating load for 2 hours and the continuous rated load for 22 hours, without exceeding design limits.

d. To demonstrate that each diesel generator, following operation for 2 hours at the short-time rated load and

22 hours at the continuous rated load, will start automatically on a loss of ac voltage concurrent with an SIS, attain voltage and frequency within design limits and time, and accept the LOCA sequenced loads, while maintaining voltage and frequency within design limits.

e. To demonstrate the ability of the diesel cooling water system to maintain the diesel temperature within design specifications, while the diesel generators are operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load.

f. To determine the fuel oil consumption of each diesel, while operating for 22 hours at the continuous rating load.

g. To demonstrate the ability of the 125 V dc system to perform its design functions while at minimum voltage.

h. To demonstrate the independence between the redundant on ac and dc power sources.

14.2.12.1.74.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Each diesel generator and its associated auxiliaries are available.

c. All components actuated by the LOCA sequencer and safety-related and nonsafety-related load shed circuits are available.

14.2.12.1.74.3 Test Method

a. A train A SIS is initiated, and the following are verified:

   1. Group 1 nonsafety-related loads are shed.

   2. Group 1 diesel generator starts.

   3. Group 1 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

   4. With bus NB01 supplying the sequenced loads from its normal source, bus voltage is recorded.

b. With group 2 dc load group isolated from its power source and group 1 dc load group voltage set to minimum, a loss of offsite power is initiated concurrent with a train A SIS, and the following are verified:

1. Safety-related group 1 loads are shed.

2. Group 1 diesel generator starts, and its feeder breaker closes.

3. Group 1 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

4. With the group 1 diesel generator supplying the sequenced loads, bus voltage and frequency are recorded.

5. The group 2 ac and dc busses are monitored to verify the absence of voltage on these busses and loads, indicating no interconnection at load groups.

c. The ability of the group 1 diesel generator to carry the short-time rating load for 2 hours without exceeding design limits is verified.

d. The ability of the group 1 diesel generator to carry the continuous rated load for 22 hours without exceeding design limits is verified. Group 1 diesel fuel oil consumption is also determined.

e. Following group 1 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 1 diesel generator is shutdown, a loss of group 1 ac voltage is initiated concurrent with a train A SIS, and the ability of the group 1 diesel generator to start, attain voltage and frequency within design limits and time, and accept the loads resulting from the design accident loading sequence while maintaining voltage and frequency within design limits is verified. If this test is not satisfactorily completed, it is not necessary to repeat the tests of items c and d prior to rerunning this test. Instead, prior to rerunning this test, the diesel generator may be operated at the continuous rated load for 1 hour or until operating temperature has stabilized.

f. A train B SIS is initiated, and the following are verified:

1. Group 2 nonsafety-related loads are shed.

2. Group 2 diesel generator starts.

3. Group 2 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

4. With Bus NB02 supplying the sequenced loads from its normal source, bus voltage is recorded.

g. With group 1 dc load group isolated from its power source and group 2 dc load group voltage set to minimum, a loss of offsite power is initiated concurrent with a train B SIS, and the following are verified:

1. Safety-related group 2 loads are shed.

2. Group 2 diesel generator starts, and its feeder breaker closes.

3. Group 2 LOCA sequencer is actuated, and associated components are sequenced. The times for sequenced pumps to reach full flow are verified.

4. With the group 2 diesel generator supplying the sequenced loads, bus voltage and frequency are recorded.

5. The group 1 ac and dc busses are monitored to verify the absence of voltage on these busses and loads, indicating no interconnection of load groups.

h. The ability of the group 2 diesel generator to carry the short-time rating load for 2 hours without exceeding design limits is verified.

i. The ability of the group 2 diesel generator to carry the continuous rated load for 22 hours without exceeding design limits is verified. Group 2 diesel fuel oil consumption is also determined.

j. Following group 2 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 2 diesel generator is shutdown, a loss of group 2 ac voltage is initiated concurrent with a train B SIS, and the ability of the group 2 diesel generator to start, attain voltage and frequency within design limits and time, and accept the LOCA sequenced loads, while maintaining voltage and frequency within design limits, is verified. If this test is not satisfactorily completed, it is not necessary to repeat the tests of items h and i prior to rerunning this test. Instead, prior to rerunning this test, the diesel generator may be operated at the continuous rated load for 1 hour or until operating temperature has stabilized.

k. The ability of the diesel cooling water system to maintain the diesel temperature within design specifications, while the diesel generators are operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load, is verified.

14.2.12.1.74.4 Acceptance Criteria

a. A train A SIS initiates the following, in accordance with system design:

   1. Group 1 nonsafety-related loads are shed.

   2. Group 1 diesel generator starts.

   3. Group 1 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within the required times.

b. Bus NB01, while powered from its normal source, supplies the sequenced loads while maintaining voltage within design specifications.

c. With the group 2 dc load group isolated from its power source and the group 1 dc load group voltage at minimum, a loss of offsite power concurrent with a train A SIS initiates the following, in accordance with system design:

   1. Safety-related group 1 loads are shed.

   2. Group 1 diesel generator starts, and its feeder breaker closes.

3. Group 1 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

d. Group 1 diesel generator supplies the sequenced loads, while maintaining voltage and frequency within design specifications.

e. With load group 1 supplying loads following a loss of offsite power concurrent with a train A SIS, the group 2 ac and dc busses are verified de-energized, indicating no interconnection of load groups.

f. Following group 1 diesel generator operation for 2 hours at the short-time rated load and 22 hours at the continuous rated load, the group 1 diesel generator starts, attains voltage and frequency within design limits and time, and accepts the LOCA sequenced loads while maintaining voltage and frequency within design limits, on loss of group 1 ac voltage concurrent with a train A SIS.

g. A train B SIS initiates the following, in accordance with the system design:

1. Group 2 nonsafety-related loads are shed.

2. Group 2 diesel generator starts.

3. Group 2 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

h. Bus NB02, while powered from its normal source, supplies the required loads while maintaining the voltage within design specifications.

i. With the group 1 dc load group isolated from its power source and the group 2 dc load group voltage at minimum, a loss of offsite power concurrent with a train B SIS initiates the following, in accordance with system design:

1. Safety-related group 2 loads are shed.

2. Group 2 diesel generator starts, and its feeder breaker closes.

3. Group 2 LOCA sequencer actuates, and the associated components are sequenced. Sequenced pumps reach full flow within design times.

j. Group 2 diesel generator supplies the required loads, while maintaining voltage and frequency within design specifications.

k. With load group 2 supplying loads following a loss of offsite power concurrent with a train B SIS, the group 1 ac and dc busses are verified de-energized, indicating no interconnection of load groups.

l. Following group 2 diesel generator operation for 2 hours at the short-time rated load and 22 hours at continuous rated load, group 2 diesel generator starts, attains voltage and frequency within design limits and time, and accepts the LOCA sequenced loads while maintaining voltage and frequency within design limits, on loss of group 2 ac voltage concurrent with a train B SIS.

m. Each diesel generator is capable of carrying the short-time rating load for 2 hours and the continuous rated load for 22 hours, without exceeding design limits.

n. Fuel oil consumption of each diesel, while operating at the continuous rated load, is within design specifications.

o. Each diesel generator cooling water system, with the diesel generators operating for 2 hours at the short-time rating load and 22 hours at the continuous rating load, maintains the diesel temperatures within design specifications.

p. The controls required for the loss of offsite power concurrent with a SIS (shedding, sequencing, etc.) function with minimum dc voltage available.

14.2.12.1.75 Shutdown Sequencer Preoperational Test (S-03NF03)

14.2.12.1.75.1 Objectives

a. To demonstrate that de-energization of either 4,160-V Class IE load group will start the associated diesel generator, close the diesel generator feeder breaker, actuate the associated group load shed, and actuate the shutdown sequencer. All sequenced components are verified to start within required design times.

b. To demonstrate that each diesel generator will maintain voltage and frequency within design specifications while supplying the design shutdown loads.

c. To demonstrate the ability of the emergency 4.16-kV loads to start at maximum and minimum design voltages.

14.2.12.1.75.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

c. Each diesel generator and its associated auxiliaries are available.

d. All components actuated by the shutdown sequencer are available.

14.2.12.1.75.3 Test Method

a. Class IE 4,160-V load group 1 is de-energized and the following are verified:

   1. Group 1 load shedder actuates.

   2. Group 1 diesel generator starts, and its feeder breaker closes.

   3. Group 1 shutdown sequencer is actuated, and associated components are sequenced. Components are verified to actuate within the required design times.

b. Class IE 4,160-V load group 2 is de-energized and the following are verified:

   1. Group 2 load shedder actuates.

   2. Group 2 diesel generator starts, and its feeder breaker closes.

   3. Group 2 shutdown sequencer is actuated, and associated components are sequenced. Components are verified to actuate within the required design times.

c. Emergency 4.16-kV loads are started while their respective diesel generators are supplying:

   1. Minimum rated voltage

   2. Maximum rated voltage

d. The ability of each diesel generator to maintain voltage and frequency within the design specifications while supplying the design shutdown loads is verified.

14.2.12.1.75.4 Acceptance Criteria

a. De-energization of Class IE 4,160-V load group 1 initiates the following, in accordance with system design:

   1. Group 1 diesel generator starts, and its feeder breaker closes.

   2. Group 1 shutdown sequencer actuates, and associated components are sequenced. Components actuate within required design times.

   3. Group 1 load shedder actuates.

b. De-energization of Class IE 4,160-V load group 2 initiates the following, in accordance with system design:

   1. Group 2 diesel generator starts, and its feeder breaker closes.

   2. Group 2 shutdown sequencer actuates, and associated components are sequenced. Components actuate within required design times.

   3. Group 2 load shedder actuates.

c. The emergency 4.16-kV loads start and reach rated speed within design times, with minimum and maximum design voltage.

d. Each diesel generator maintains voltage and frequency within design specifications, while supplying the design shutdown loads.

14.2.12.1.76 480-V (Class IE) System Preoperational Test (S-03NG01)

14.2.12.1.76.1 Objectives

To demonstrate that the 480-V Class IE load centers can be energized from their normal and alternate sources and verify the

operability of system breaker protective interlocks. Proper operation of system instrumentation and controls is also verified.

14.2.12.1.76.2 Prerequisites

a. Required component testing and instrument calibration are complete.

b. Required electrical power supplies and control circuits are operational.

14.2.12.1.76.3 Test Method

a. The 480-V Class IE load centers are energized from their normal source, and voltages are recorded.

b. The 480-V Class IE load centers are energized from their alternate source, and voltages are recorded.

c. System breakers are operated, and breaker interlocks verified.

14.2.12.1.76.4 Acceptance Criteria

a. The voltage for each 480-V Class IE load center, when supplied from its normal source, is within design specifications.

b. The voltage for each 480-V Class IE load center, when supplied from its alternate source, is within design specifications.

c. System breaker interlocks operate in accordance with the system design.

14.2.12.1.77 480-V Class IE System (ESW) Preoperational Test (SU3-NG02).

14.2.12.1.77.1 Objectives

To demonstrate that the nonpower block 480-V Class IE MCC can be energized from their normal source and to verify their bus voltage phase sequence. Proper operation of system instrumentation and controls is also verified.

14.2.12.1.77.2 Prerequisites

a. Required component testing and instrument calibration are completed.

14.2.12.3.35.3 Test Method

a. Manually reduce the turbine generator output to achieve an approximate 50-percent load reduction.

b. Monitor plant response during the transient and record plant variables, as required.

c. If necessary, adjust the reactor control system setpoints until optimal response is obtained.

14.2.12.3.35.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion. Failure to meet these criteria does not constitute a need for stopping the test program, but correction of any deficiencies should be accomplished, as required, consistent with the current plant schedule.

a. Reactor and turbine must not trip.

b. Safety injection is not initiated.

c. Steam generator safety valves shall not lift.

d. Pressurizer safety valves shall not lift.

e. No manual intervention shall be required to bring plant conditions to steady state.

14.2.12.3.36 Plant Trip From 100 Percent Power (S-070011)

14.2.12.3.36.1 Objectives

To verify the ability of the plant automatic control systems to sustain a trip from 100 percent and to bring the plant to stable conditions following the transient, to determine the overall response time of the hot leg resistance temperature detectors, and to evaluate the data resulting from the trip to determine if changes in the control system setpoints are warranted to improve transient response based on actual plant operations.

14.2.12.3.36.2 Prerequisites

a. The rod control system, steam generator level, pressurizer pressure and level, and the steam dump system are in the automatic control mode.

b. The plant is operating at normal steady state full power.

c. Diesel generators in standby idling condition.

14.2.12.3.36.3 Test Method

a. Initiate a plant trip by opening the main generator output breaker, monitor plant response, and record plant variables, as required.

b. If necessary, adjust the control system setpoints to obtain optimal response.

14.2.12.3.36.4 Acceptance Criteria

The system parameters must stay within the limitations specified in the vendor's design transient analysis document.

14.2.12.3.37 Rods Drop and Plant Trip (S-070012)

14.2.12.3.37.1 Objectives

To demonstrate that the negative rate trip circuit will trip the reactor and to monitor plant response.

14.2.12.3.37.2 Prerequisites

a. The rod control system, steam generator level, pressurizer pressure and level, and the feedwater pump speed control are in the automatic control mode. Steam dump control system is in the $T_{avg}$ mode.

b. The plant is operating at a steady state power of 30 to 50 percent.

c. The rod group and the selected rods to be dropped have been identified.

14.2.12.3.37.3 Test Method

a. Drop two RCCAs from a common group which, because of their worth and location, are the most difficult to detect by the nuclear instrumentation system (NIS).

b. Monitor systems behavior and plant response to trip from an intermediate power level prior to the plant trip test from full power.

14.2.12.3.37.4 Acceptance Criteria

The following acceptance criteria are to be used to determine successful test completion: