APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-267/88-26 Operating License: DPR-34

Docket: 50-267

Licensee: Public Service Company of Colorado (PSC)
2420 W. 26th Avenue, Suite 15c
Denver, Colorado 80211

Facility Name: Fort St. Vrain (FSV)

Inspection At: FSV, Platteville, Colorado

Inspection Conducted: October 17-21, 1988

Inspector: for P. C. Wagner, Reactor Inspector, Plant Systems Section, Division of Reactor Safety — Date: 11/4/88

Approved: for T. Stetka, Chief, Plant Systems Section, Division of Reactor Safety — Date: 11/4/88

Inspection Summary

Inspection Conducted October 17-21, 1988 (Report 50-267/88-26)

Areas Inspected: Reactive, announced inspection of the failure of the emergency diesel generator output breakers to automatically close during an October 11, 1988, test and a routine inspection of the instrument calibration program.

Results: Within the area inspected, no violations or deviations were identified.

DETAILS

1. Persons Contacted

PSC

J. M. Williams, Licensing
C. H. Fuller, Manager, Nuclear Production
H. L. Brey, Manager, Nuclear Licensing and Resources
R. Sargent, Assistant to the Vice President, Nuclear Operations
R. Craun, Nuclear Engineering Manager
R. W. Moler, Planning & Scheduling
H. O'Hagan, Outage Manager
M. Block, System Engineering Manager
J. P. Hak, Supertindent
J. M. Gramling, Supervisor, Nuclear Licensing - Operators
L. R. Sutton, Supervisor, Quality Assurance (QA) Auditing
S. W. Chesnutt, Supervisor, Nuclear Licensing - Compliance
M. H. Holmes, Nuclear Licensing Manager
W. D. Rodgers, Nuclear Licensing and Resources
D. W. Evans, Operations Manager
J. K. Jackson, Supervisor QA/Quality Control (QC)
M. J. Ferris, QA Operations Manager
J. R. Reesy, Support Engineering Manager
D. Warembouing, Manager, Nuclear Engineering
R. A. Schenderlein, Special Projects

These persons attended the exit interview on October 21, 1988. The NRC inspector also contacted other engineering, licensing, and craft personnel.

2. Emergency Diesel Generator Test (92700)

a. System Design and Background

The onsite AC power supply to the essential loads at the Fort St. Vrain Nuclear Generating Station (FSV) is provided by emergency diesel generator sets (EDG) 1A and 1B. Each of the EDGs is driven by two diesel engines (diesel engines A and B on EDG 1A and diesel engines C and D on EDG 1B), one mounted on each end of the 480V generator with the capability of being disconnected (declutched) from the generator. With both engines operating, the EDG is rated at 1210 kw; if one of the engines fails, the EDG can provide 605 kw to the bus. A simplified one-line diagram is provided in Figure 1, attached. The NRC inspector reviewed the licensee's schematic diagrams related to the automatic operation of the onsite power supplies to evaluate system operation.

Upon a loss of off-site power (LOSP), a start signal is provided to the engines of both EDGs. The 480V switchgear bus supply breakers

252TR1, 252TR2, and 252TR3 are tripped and loads are tripped off the 480VAC buses.

When either EDG 1A or 1B has started and its output voltage is enough to pick up relay CR-9201 (EDG 1A) or CR-9202 (EDG 1B), timer motor T1 (XTR-92204) will be energized. Timer T1 functions to provide a 1-second signal every 3 seconds, alternately, to relays CR-9203 (EDG 1A) and CR-9204 (EDG 1B). Should a failure of Timer T1 occur, Timer T2 (XRT-92204-01) would be energized and provide the function to CR-9203 and CR-9204.

Relay CR-9203 (EDG 1A) or CR-9204 (EDG 1B) would be energized when its associated generator had both of its diesels running and the Timer T1, 1-second signal was present. The relay that was energized first (CR-9203 or CR-9204) would determine the generator that would supply power to two of the 480V buses; the other generator would supply power only to its associated bus when the 1-second time delay relay (TR-9202 for EDG 1B or TR-9201 for EDG 1A) times out. Relays TR-9201 and TR-9202 are energized when the opposite EDG's output breaker closes and auxiliary relays close a contact as the result of a two out of three undervoltage condition. Should relay CR-9203 be energized first, a trip signal is sent to bus tie breaker 252BT32 (Bus 2 to Bus 3) and a close signal is sent to bus tie breaker 252BT12 (Bus 1 to Bus 2) and EDG 1A output breaker 252DG1A. The opposite action would occur if CR-9204 were energized first, breaker 252BT12 would receive a trip signal and breakers 252BT32 and 252DG1B would receive a close signal.

After a confirmation signal is received from both bus tie breakers that they have opened or closed in accordance with input signals from relays CR-9203 or CR-9204, either relay 286G1A or 286G1B respectively would be energized. Relay 286G1A (EDG 1A) or 286G1B (EDG 1B), when energized, provides a signal to programmer 1A and programmer 1B, deenergizes the T1 timer motor, and locks out the opposite 286 relay. Relays 286G1A and 286G1B are hand reset (GE type HEA61) and remain in set position after the input signal is removed.

If relay 286G1A is energized, programmer 1A (Sequence A, Drums 1 and 2) will sequence on loads connected to 480V Bus No. 1 and programmer 1B (Sequence B, Drum 1 and 2) will sequence on loads connected to 480V Bus 3. If relay 286G1B is energized, programmer 1B (Sequence A, Drums 1 and 2) will sequence on loads connected to Bus 3 and programmer 1A (Sequence B, Drums 1 and 2) will sequence on loads connected to Bus 1.

Programmers 1A and 1B will run for 100 seconds, sequencing on the loads as required. After loads are sequenced on, the EDGs continue to supply the necessary electric power for essential equipment.

An internal licensee evaluation (EE-92-0008) stated that no loads were automatically sequenced onto Bus 2, however, the NRC inspector's

review disclosed some inconsistencies between the licensee's evaluation, the FSAR, and the electrical drawings with regard to this Bus 2 load sequencing. The licensee agreed to evaluate the apparent inconsistencies and correct the appropriate documents. This is considered to be an unresolved item pending clarification of the inconsistencies.

Unresolved Item (267/8826-01): Evaluate inconsistencies between plant drawings and the FSAR to determine whether loads are sequenced onto EDG Bus 2.

In compliance with FSV Technical Specification SR 5.6.1e, "Standby Diesel Generator Surveillance," the licensee performs a simulated loss of off-site power (LOSP) and turbine trip test at least once each refueling cycle to provide assurance of proper system operation. The test is performed in accordance with Procedure SR 5.6.1e-1.5Y dated March 9, 1988. The procedure contains provisions for ensuring that where circuitry is duplicated, the duplicate circuits are both tested for proper functioning, i.e., automatic power transfer to the 480V Bus 2 and proper load sequencing based on the first available EDG. In order to test these duplicated circuits, one set of circuitry is inhibited, the test is run and the circuitry is restored. Then the other duplicated circuits are inhibited, the test run again, and all circuits are restored to normal.

During an LOSP test on October 11, 1988, EDG 1B duplicated functions were inhibited in accordance with SR 5.6.1e-1.5Y. When offsite power was removed from the feeders to the 480V bus, the feeder breakers (252TR1, 252TR2, and 252TR3) opened, and normal load shedding occurred. Both EDGs (all four engines) started and came up to rated speed and voltage within specification; however, neither EDG output breaker (252DG1A or 252DG1B) closed to energize the 480V buses. The bus tie breaker (252BT12) did close as expected.

The control room operator attempts to restore normal (offsite) power to the 480V essential buses were unsuccessful. The EDG output breakers were placed in "pull-to-lock" to inhibit them from closing, and the functions which had been inhibited were restored. The restoration of offsite power could still not be accomplished. The EDG output breakers were then released from "pull-to-lock" and both, closed, thereby energizing the buses as was expected to occur initially during the test. Power was subsequently transferred back to the offsite source without problem.

b. Evaluation

The NRC inspector discussed the sequence of events and the followup actions with licensee personnel involved. As the result of these discussions, the NRC inspector determined that the licensee had already addressed the areas of concern. The NRC inspector compared the SR 5.6.1e-1.5Y requirements to the detailed schematic drawings to

determine if such items as incorrect initial positions of switches or circuit breakers, failures of relay, switch or breaker contacts, and changes to the circuitry design could have resulted in the conditions which were observed during the October 11, 1988 test. None of these conditions were determined to be a verifiable cause of the test failure.

The licensee had reverified that the initial conditions were apparently correct through reviews and personnel interviews. The licensee had also physically checked the involved relays, switches, and circuit breakers. Although no failures or problems were identified, the licensee decided that a prudent action would be to replace the relay contacts on relay CR-9302. The NRC inspector examined the replaced contacts and although not in a new condition, found them to be acceptable. Since no verifiable cause for the malfunction could be determined, the licensee decided to reperform the test. The licensee decided that this reperformance would utilize more personnel as observers than the number required by the procedure and would include additional monitoring instrumentation. The necessary procedural changes to accomplish this additional monitoring were incorporated in accordance with license requirements.

The NRC inspector observed the performance of the second LOSP test on October 18, 1988, from the control room. The NRC inspector verified the control room initial conditions (switch and circuit breaker positions) prior to the test, observed proper implementation of the test requirements, and proper operation of the equipment. When offsite power was removed by opening the transformer output breaker, all AC power was lost, the 480V bus feeder breakers opened, loads were shed, and both EDGs started and came on-line to power the 480V essential buses (EDG 1A powered Bus 2 through Tie Breaker 252TB12 as expected). After verification from the observers that all equipment had functioned and that all 10 data sheets had been properly completed, conditions were restored to normal and preparations for conducting Part 2 of SR 5.6.1e-1.5Y were made. (Part 2 requires that EDG 1A functions be inhibited to ensure that the EDG 1B circuitry is functioning properly.) Part 2 of the test was then run with acceptable results. Following the completion of the test, the data sheets were all collected and any unusual observations were documented for evaluation by the engineering organization.

The NRC inspector observed that the test was conducted in a coordinated, careful, and professional manner.

The NRC inspector met with licensee personnel on October 19, 1988, to discuss the results of the test. The NRC inspector was informed that the only abnormality noted during the test was the closure of the appropriate bus tie circuit breaker (due to an undervoltage signal) prior to closure of the diesel generator output circuit breaker. (The timing was considered to be less than 1 second.) The licensee did not consider this to be a concern but was planning to evaluate

the situation more thoroughly to determine if this undervoltage closure should be disabled.

The NRC inspector queried the licensee about the possibility of closing both bus tie breakers at the same time. In addition, the NRC inspector reviewed the schematic diagrams to evaluate the possibilities. The drawings show that an interlock prevents automatic closure of one bus tie breaker if the other is closed. In the case where both bus tie breakers are open, and both receive a close signal, additional provisions are present: (1) for an undervoltage condition on Bus 2, a selector switch (HS-92346) must be in either the Bus 1 position to close 252BT12 or Bus 3 for 252BT32; and (2) for automatic closure during an LOSP, relay CR-9203 provides the close signal to 252BT12 and a trip signal to 252BT32 if EDG 1A is the first available, or relay CR-9204 provides the close signal to 252BT32 and trip signal to 252BT12 if EDG 1B is the first available. It is possible to manually close both bus tie breakers at the same time, however, there is a synchronization interlock in the closing circuit for each breaker. This interlock is a normally open contact which is only closed when the single common handle is inserted in the selected circuit breakers' "sync-selector" switch and the switch turned to on. In addition to completing the interlock circuit, the syncroscope and synchronizing lights and meters are turned on. Therefore, the NRC inspector considered it very unlikely that both bus tie circuit breakers would be inadvertently closed at the same time.

Another concern over bus tie circuit breaker closure was the consequence of having the wrong breaker closed. As stated above, the selected EDG's closure relay (CR-9203 or CR-9204) provides a trip signal to the opposite tie breaker in addition to the DG output and associated tie breaker closure signals. Therefore, there would be no problem if a tie breaker was left closed or if a tie breaker was to close on undervoltage prior to the DG output breaker closure, assuming that the relays function properly (see LER 87-002 below).

The NRC inspector also discussed the problems encountered in restoring power to the 480V essential buses following the failure of the DG output breakers to close during the test conducted on October 11, 1988. The control room operators had attempted to restore power from the offsite source and were unable to close the feeder breakers because of circuit design. During an LOSP, the 480V essential buses are cleared of loads (load shedding) and normal power supplies to provide a clean bus for connection of the EDG. The six auxiliary tripping relays 252TX1-1A and 2A, 252TX2-1A and 2A, and 252TX3-1A and 2A, deenergize and provide trip signals to the feeder breakers 252TR1, 252TR2, and 252TR3. (See Licensee Event Report (LER) 87-003.) The inhibit prerequisites for the LOSP test procedure and the placing of the 252DG1A and 252DG1B breakers in "pull-to-lock" had no effect on this trip signal and consequently on the inability to close the feeder breakers.

The NRC inspector reviewed the standard and emergency operating procedures (SOPs and EOPs) related to LOSP events and EDG operation. The NRC inspector concluded that the guidance to the operator SOPs and EOPs could be improved in view of the lessons learned from the initial test failure. Licensee personnel acknowledged a weakness in this area of the procedures and provided additional guidance in the form of an Operations Order. The procedures will be revised to include the guidance in the Operations Order in the future. The NRC inspector considers this commitment to revise the procedures to be an open item.

Open Item (267/8826-02): Revise SOPs and EOPs to include guidance on EDG operation failures.

The NRC inspector also reviewed the following LERs related to the Emergency Power Systems:

(1) LER 84-014

The failure of three of the four diesel engines was traced to component failures. These components were a failed timer motor, an exhaust temperature switch, and a faulty cell in station battery 1A.

(2) LER 85-0003

This LER further explained the faulty battery cell included in LER 84-014.

(3) LER 86-022

The possibility of a single failure preventing reenergization of the 480V essential buses was identified. THE DC control power for undervoltage control relays on both Bus 1 and Bus 2 was determined to be provided from a single source. Design changes were implemented to provide redundancy.

(4) LER 87-002

The possibility of another single failure of emergency power was identified wherein both essential buses' tie breakers could be closed, without synchronizing, while power to Buses 1 and 2 was being supplied by the EDGs. Design changes were implemented to prevent automatic closure of either breaker if the other is closed (b circuit breaker contact in closure circuit) and additional changes continue to be considered.

(5) LER 87-003

An inadvertent load shedding of Buses 2 and 3 during relay testing caused ED6 1B to receive a start signal. EDG 1A was out of service. Diesel engine C (a part of EDG 1B) however, failed

to start and no verifiable cause was found. Subsequently, the engine was serviced and tested satisfactorily.

(6) LER 87-025

An unintentional trip of offsite power caused the EDGs to start and power the essential buses without incident.

(7) LER 87-028

A similar trip of offsite power caused the EDG to actuate and power the essential buses as designed.

All of the above LER events occurred during periods of reactor shutdown and posed no reactor safety hazard. The NRC inspector determined that the above events were not causally linked to the malfunction on October 11, 1988.

c. Conclusion

Based on the licensee's evaluation and inspection of possible causes of the initial malfunction and the successful completion of the LOSP test on October 18, 1988, the NRC inspector concluded that the emergency power system could be considered operable. The NRC inspector determined that additional operator guidance on manual operations involving the EDGs was needed, and while the Operations Order was acceptable for the interim, the need for procedure revisions to be an open item as identified in paragraph 2.b of this report.

No violations or deviations were identified.

3. Instrumentation Calibration (56700)

Since the licensee was performing maintenance on safety-related instrumentation, the NRC inspector observed an instrument calibration. The calibration of differential pressure transmitter PDT 21545 for circulator 1A Buffer - Midbuffer, was conducted on October 20, 1988, in accordance with Procedure RP-EQ-15, "Calibration and Maintenance of Foxboro N-E13DM Differential Pressure Transmitters in Non Level Applications," Issue 3, dated November 19, 1987. The replacement testing and calibration of PDT 21545 was specified in Station Service Request 88502230, which had been approved on August 6, 1988.

The NRC inspector reviewed RP-EQ-15 and the Companion Surveillance Procedure SR 5.4.1.3.6c-R1, "A Circulator Seal Malfunction Calibration." The procedures both contained detailed step-by-step instructions.

The above procedures contained spaces for the technician to initial and date each step and for a Quality Control (QC) inspector to initial and date those steps of a more critical nature. During the calibration, the

NRC inspector observed that the steps were properly initialed when completed and that all data was properly entered. The data taken (as-found values) during the calibration was all within the allowable limits and no adjustments were made. The NRC inspector also verified that the tools and instruments (torque wrench, voltmeter, pressure measuring device, etc.) were in calibration and noted that the technicians and QC inspector also verified the calibration dates.

The NRC inspector observed that the technicians rechecked the valve lineup and cleaned the area prior to departing. The NRC inspector had no questions related to the completion of this calibration.

The NRC inspector also reviewed the records for the calibration of five engineered safety features instruments. The calibrations were performed in accordance with the following procedures:

a. SR 5.4.1.2.6.c-R, "Reheat Heater Activity Calibration," Issue 24 dated December 7, 1984, was performed from September 14-16, 1988

b. SR 5.4.1.2.7.d-R, "Superheater Heater Temperature Calibration," Issue 18 dated March 7, 1987, was performed from March 28-30, 1988

c. SR 5.4.1.1.6.c-R, "Primary Coolant Moisture Scram Calibration," Issue 29 dated March 15, 1985, was performed from March 9 through April 3, 1987

d. SR 5.4.1.1.9.c-R, "Primary Coolant Pressure Scram Calibration," Issue 26 dated March 29, 1987, was performed from March 30 through April 2, 1987

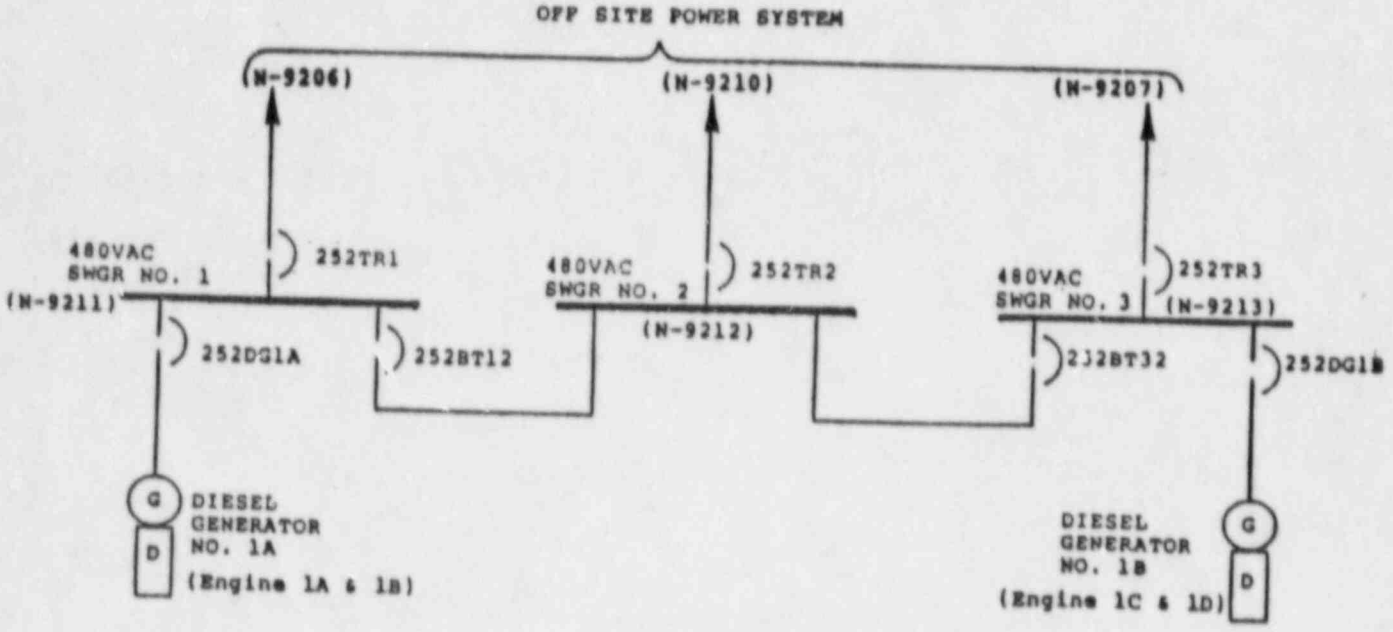
e. SR 5.4.1.1.4.d-R, "Linear Power Range Channel Calibration," Issue 22 dated August 9, 1985, was performed from April 3-8, 1987

The NRC inspector's questions related to the completion of these procedures, i.e., signatures and initials for steps and QC witness points, were answered satisfactorily by licensee personnel. The NRC inspector also questioned procedure updating and reviews and noted that there were what appeared to be an excessive number of procedure deviation reports (PDRs) on temporary procedure changes. The NRC inspector was informed that these issues had been the subject of an earlier NRC violation (50-267/8814-01). The licensee responded to this violation by letter dated October 10, 1988, and discussed the surveillance procedure rewrite program which is presently underway. Based on this response, the NRC inspector had no further questions for this inspection.

No violations or deviations were identified.

4. Exit Interview

The inspection scope and findings were summarized with those individuals identified in paragraph 1. The information provided to and reviewed by the NRC inspector was not identified as proprietary by the licensee.



SIMPLIFIED ONE-LINE DIAGRAM
OF BREAKER LINE-UP

FIGURE 1