APPENDIX B

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-267/88-03 License: DPR-34

Docket: 50-267

Licensee: Public Service Company of Colorado (PSC)

Facility Name: Fort St. Vrain Nuclear Generating Station

Inspection At: Fort St. Vrain (FSV) Nuclear Generating Station, Platteville, Colorado

Inspection Conducted: February 1-29, 1988

Inspectors: Robert E. Farrell 3-18-88
R. E. Farrell, Senior Resident Inspector (SRI) Date

Paul W. Michaud 3-17-88
P. W. Michaud, Resident Inspector (RI) Date

Approved: T. F. Westerman 3/25/88
T. F. Westerman, Chief Date
Reactor Projects Section B

Inspection Summary

Inspection Conducted February 1-29, 1988 (Report 50-267/88-03)

Areas Inspected: Routine, unannounced inspection of followup of licensee action on previously identified findings, operational safety verification, followup of unusual event, engineered safety features walkdown, monthly surveillance observation, monthly maintenance observation, radiological protection, and physical security observation.

Results: Within the eight areas inspected, one violation was identified (the failure to implement and follow procedures for maintenance and operations activities, paragraph 4).

DETAILS

1. Persons Contacted

FSV

*L. Brey, Manager, Nuclear Licensing and Fuels
*M. Ferris, Manager, Quality Assurance (QA) Operations
*C. Fuller, Manager, Nuclear Production
*M. Holmes, Manager, Nuclear Licensing
*F. Novachek, Manager, Technical/Administrative Services
*P. Tomlinson, Manager, QA
*D. Warembourg, Manager, Nuclear Engineering
*R. Williams Jr., Vice President, Nuclear Operations
*J. Reesy, Staff Assistant, Nuclear Engineering
*F. Borst, Nuclear Training Manager
*M. Deniston, Shift Supervisor
*S. Hofsetter, Nuclear Licensing
*M. Block, Superintendent, Nuclear Betterment
*L. Scott, Manager, QA Service
*R. Sargent, Assistant to Vice President, Nuclear Operations
*R. Webb, Maintenance Supervisor

The NRC inspectors also contacted other licensee and contractor personnel during the inspection.

*Denotes those attending the exit interview conducted March 8, 1988.

2. Followup of Licensee Action on Previously Identified Findings

(Closed) Open Item 267/8507-06: Shorten Time Between Change Notice (CN) Issue And Notation On Drawing - In some cases, a caution that changes had been made under a CN was not reflected on the affected drawings for 30 days or more after a CN was issued. This presented a concern that a modified system or component could be in service for that amount of time without adequate drawings. By utilizing a computerized document update information system, the licensee has shortened the time involved to mark all affected drawings to approximately 1 week, with the drawings in the control room, shift supervisor's office, and records center updated the same day a CN issue notification is received. The NRC inspector verified these activities are taking place by direct observations and a review of documentation. This item is closed.

(Closed) Open Item 267/8507-07: Devcon Epoxy Only Qualified to 200°F. Epoxy used to attach thermocouples to control rod drive assemblies was qualified to only 200°F, while actual operating temperatures can exceed 200°F. Two tests were performed by the licensee to establish this adhesive's acceptability. One test performed under Fuel Handling Procedure 100-31 involved a visual examination and measurement of force

required to remove the epoxy from a CRD element, which had been subjected to varying power operating conditions in the reactor core between 1979 and 1984. The second test, T-288, involved subjecting epoxy to greater than 300°F temperature and then performing a pull test to verify that thermocouples remained sufficiently attached. Based on these tests, the licensee concluded the Devcon epoxy was acceptable for use in applications up to 300°F. The NRC resident inspectors reviewed the licensee's tests and evaluation and found them acceptable. This item is closed.

3. Operational Safety Verification

The NRC resident inspectors reviewed licensee activities to ascertain that the facility is being operated safely and in conformance with regulatory requirements and that the licensee's management control system is effectively discharging its responsibilities for continued safe operation.

The NRC resident inspectors toured the control room on a daily basis during normal working hours and at least weekly during backshift hours. The reactor operator and shift supervisor logs and Technical Specification compliance logs were reviewed daily. The NRC resident inspectors observed proper control room staffing at all times and verified operators were attentive and adhered to approved procedures. Control room instrumentation was observed by the NRC inspectors and the operability of the plant protective system and nuclear instrumentation system were verified by the NRC resident inspectors on each control room tour. Operator awareness and understanding of abnormal or alarm conditions were also verified. The NRC resident inspectors reviewed the operations order book, operations deviation report (ODR) log, clearance log, and temporary configuration report (TCR) log to note any out-of-service safety-related systems and to verify compliance with Technical Specification requirements.

The licensee's station manager and superintendent of operations were observed in the control room on a daily basis, with the superintendent of operations frequently in the control room during the day and during special tests or evolutions.

The NRC resident inspectors verified the operability of a safety-related system on a weekly basis. The PCRV overpressure protection system, 120 VAC vital power distribution system, reactor plant cooling water system, and firewater system were verified operable by the NRC resident inspectors during this report period. During plant tours, particular attention was paid to components of these systems to verify valve positions, power supplies, and instrumentation were correct for current plant conditions. General plant condition and housekeeping were acceptable.

Shift turnovers were observed at least weekly by the NRC resident inspectors. The information flow appeared to be good, with the shift

supervisors routinely soliciting comments or concerns from reactor operators, equipment operators, and auxiliary tenders.

No violations or deviations were identified in the review of this program area.

4. Followup of Unusual Event

On February 10, 1988, at 3:47 p.m. (MST), "A" helium circulator tripped due to a low speed signal with the reactor at 75 percent power. The circulator trip resulted in a reactor runback to between 50 percent to 60 percent reactor power and then reactor power was further reduced by the plant operators to 25 percent power. While attempting to balance feedwater between Loop 1 and Loop 2, an upset in the helium circulator auxiliaries supplied by feedwater resulted in the tripping of "B" and "D" helium circulators at 4:07 p.m. (MST).

The tripping of two circulators (A & B) in one loop resulted in a loop shutdown (ESF actuation). The reactor operators manually scrammed the reactor from 25 percent power with only one helium circulator running.

At 6:40 p.m. (MST), the licensee identified that an unplanned release was occurring and an unusual event was declared. An operator had been dispatched to vent the surge tank associated with the liner cooling water system. The licensed operator dispatched to perform this function inadvertently opened the wrong valve venting the tank to the plant stack rather than to the gaseous radwaste system. The total release over approximately 200 minutes was small. (4.26×10^5 microcuries of noble gas activity)

The plant maintained forced circulation cooling at all times. The SRI responded to the event and was onsite all night. The Colorado Department of Health was in contact with the site and was briefed by the licensee as well as the SRI.

The licensee has subsequently determined that the "A" helium circulator trip occurred due to an apparent interchange of speed indication signal cables during a recent equipment calibration. The trip occurred when the "B" helium circulator was placed in manual control for calibration.

a. Background

The unusual event of February 10, 1988, and associated unplanned release started with the trip of helium circulator "A".

Helium circulator speed cable daily calibration was in process when circulator "A" tripped.

When a circulator's speed cables are calibrated, the circulator is taken from auto to manual control to minimize the chances of a trip.

Helium circulator "A" speed cables had been successfully calibrated and circulator "A" returned to auto control. Helium circulator "B" was placed in manual control and calibration of the "B" circulator speed cables was in process when circulator "A" tripped.

The licensee determined that on February 2, 1988, while calibrating the speed modules (SM) on circulator "A", SM 2109 could not be balanced while getting its signal from cable 18194. The technician decided to check if the problem was in SM-2109 or in the cable 18194. The licensee suspected the speed problems were in the cables. Seven spare speed cables are available from each circulator's SM. The technician unplugged cable 18194 from SM 2109 and plugged in cable 18133. With cable 18133 installed, SM-2109 balanced and was left in this configuration by the technician. Cable 18133 does not sense circulator "A" speed but is a spare speed cable from the "B" circulator.

b. Design Information

There are two speed indications from each circulator: a steam turbine speed indication and a water turbine speed indication. The water turbine speed indicator is much easier to read than the steam indicator and generally the one the operators use. Since both drives are on a common shaft, the speed should be the same regardless of which turbine is driving the circulator.

There are 12 speed cables coming from the speed modules of each helium circulator. Four of these cables are utilized for speed control. One cable for steam turbine speed, one cable for water turbine speed, and two spares.

Eight cables from each circulator are dedicated to the plant protection system (PPS). Three of these cables are used at one time (one for each logic channel). Five cables are dedicated spares.

c. Speed Control

The speed control circuitry looks at the water turbine indicated speed and the steam turbine indicated speed and controls from the higher of the two indicated speeds (no difference if everything working correctly).

As long as the "B" circulator speed was less than or equal to the "A" circulator speed, the control system saw no problem and chose the "A" circulator steam turbine speed to control circulator "A". With cable 18133 (a "B" circulator speed cable) controlling SM-2109 (the "A" circulator water turbine SM) the problem arose during calibration of "B" circulator speed when the "A" circulator was in auto control and the "B" circulator speed exceeded the "A" circulator speed.

When this happened, the control circuit for "A" circulator, selecting the higher speed indication, selected the "A" circulator water turbine speed. This was actually the "B" circulator speed, since a "B" cable was feeding this speed module. This falsely told the control circuit that the "A" circulator was running faster than the control circuit required, so the control circuit began closing the "A" circulator steam speed valve.

Since the control circuit was actually reading "B" circulator speed it saw no change in the "A" circulator speed indication and continued to close down the "A" circulator speed valve. When the "A" circulator reached the low setpoint of the circulator speed-to-feedwater flow program, which forces a limit on primary to secondary flow ratio, the the PPS which was correctly reading circulator "A" speed tripped the circulator.

d. Findings

The technician calibrating the SM was utilizing licensee Procedure SR-RE-17-W, Issue 10, "Circulator Speed Modifier Weekly Check."

The procedure did not address cable termination.

When the technician removed the installed cable (18133) he was no longer performing surveillance activities, but was performing maintenance activities. Maintenance activities are governed by the licensee's Administrative Procedure P-7, Issue 12, "Station Service Request Processing." Procedure P-7 as modified by Procedure Deviation Request 88-0006, dated January 13, 1988, specifically states, in Section 2.0, that the procedure applies to corrective and preventative maintenance and not to calibration activities.

Procedure P-7 is the licensee's procedure for controlling maintenance activities. Procedure P-7 requires initiation of a Station Service Request to authorize, document, and control maintenance activities. Failure to follow Procedure P-7 is an apparent violation of NRC regulations (267/8803-01).

The operator venting reactor plant cooling water system surge tanks was guided by System Operating procedure (SOP) 46, Issue 39, "Reactor Plant Cooling Water System." SOP-46 in Step 3.7, "Venting the Vapor Space in T-4601 or (T-4602)," details the steps for venting the reactor plant cooling water surge tank vapor space to the gas waste system. The steps call for first opening V-4653 for Surge Tank T-4601 (V-4654 for Surge Tank T-4602). Then the operator is to open V-461691 for Surge Tank T-4601 (V-461692 for Surge Tank T-4602). Opening these two valves for each surge tank vents the vapor space of each tank to a common line leading to the gas waste system. When these steps are completed, the operator opens Valve V-46193, which

opens the common line from the two surge tanks to the gas waste system relieving the pressure in the surge tanks.

All of the valves mentioned in the preceding paragraph are manual valves. Adjacent to the valves, V-461691 on Tank T-4601 and V-461692 on Tank T-4602, are hand operated valves, V-461634P and V-461635P, respectively. Opening Valve V-461634P after opening Valve V-4653 vents Surge Tank T-4601 to the plant exhaust stack. Opening Valve V-461635P after opening Valve V-4654 vents Surge Tank T-4602 to the plant exhaust tank.

The valves are now clearly marked as to function. At the time of the incident, the valves were marked with small stamped metal tags identifying the valves by number.

Procedure SOP-46 in Step 3.7 clearly listed the valves to be opened. The valves were identified in the procedure by valve number corresponding to the valve numbers attached to the valves. The operator opened either or both Valves V-461634P and V-461635P, rather than V-461691 and V-461692. This vented the gaseous content of Tanks T-4601 and/or T-4602 to the plant stack resulting in an unplanned radioactive release. The failure to follow Procedure SOP-46 is second example of Violation (267/8803-01).

5. Engineered Safety Features (ESF) Walkdown

The NRC resident inspectors performed a walkdown of all accessible portions of the prestressed concrete reactor vessel (PCRV) overpressure protection system to verify its operability. Sections 4.3.6 and 6.8 of the FSAR and Technical Specifications 3.2, 3.3, 4.2.7, and 5.2.1 were reviewed by the NRC resident inspectors to ensure familiarity with the system and requirements. The as-found system configuration was compared with drawing PI-11-5 to check their agreement. Valve positions and labeling were verified to be correct by the NRC resident inspectors, including the installation of locking devices on valves where required. All portions of the system were physically inspected, with the exception of the internals of the PCRV safety valve tank T-1101 which contains the relief valves and rupture discs. These components will be inspected during the next outage when T-1101 is opened. During this inspection, attention was paid to equipment conditions, housekeeping, and any items which could degrade performance. The overall condition of this system was considered good.

No violations or deviations were identified in the review of this program area.

6. Monthly Surveillance Observation

The NRC resident inspectors observed the licensee's performance of selected surveillance activities as listed below. The surveillance procedures were reviewed for conformance with Technical Specification

requirements and to ensure they had been properly reviewed and approved prior to commencing any tests. The NRC resident inspectors witnessed portions of the preparations, conduct, and system restoration for each of these surveillance tests. Test results were independently reviewed by the NRC resident inspectors to ensure they met applicable Technical Specification requirements. Surveillance activities observed during this reporting period included:

- SR 5.4.1.1.8.b-M, "Reheat Steam Temperature Scram Test," performed on February 1, 1988. This surveillance tests each hot reheat steam temperature scram channel to verify alarms, actuations, and indications. The as-found values were measured and recorded, acceptance values calculated and independently verified, and calibration of the bystable amplifiers and thermocouple amplifiers was checked at 600°F, 900°F, and 1200°F utilizing test signals. These amplifiers were adjusted as required in accordance with this procedure and the as-left values were recorded. No discrepancies were noted.

- SR 5.10.8-M, "Monthly Check of Fire Hose Stations," performed on February 2, 1988. This surveillance verified the condition of each fire hose station in the reactor and turbine buildings, and was independently verified by the NRC resident inspectors. Each station's hose valve was verified shut and not leaking, hoses and nozzles properly connected, and general equipment conditions observed. No discrepancies were noted.

- ESR 8.1.1bc-M, "Radioactive Gaseous Effluent System Test," performed on February 25, 1988. This surveillance test verifies the operation of the gaseous waste release system automatic functions. Instruments which provide inputs to cause automatic isolation and ventilation system realignments were tripped using a test signal, then each associated damper or valve which was repositioned by the automatic signal was verified to be in its proper position. The instruments and equipment were then restored to their normal lineup. No discrepancies were noted.

No violations or deviations were identified in the review of this program area.

7. Monthly Maintenance Observation

On February 4, 1988, the licensee noticed the pressure in the emergency feedwater supply to the Loop 1 helium circulator Pelton wheel drives was equal to the feedwater header pressure (approximately 3000 psia). This condition indicated a problem with Pressure Control Valve PV-21243, which should reduce the pressure to approximately 1700 psi. The licensee took the emergency feedwater header out of service at 5:57 a.m. (MST), on February 5, 1988, to perform repairs on PV-21243 and entered Technical Specification Limiting Condition for Operation (LCO) 4.0.3, since the conditions of LCO 4.3.4, "Emergency Condensate and Emergency Feedwater

Headers LCO," were no longer satisfied. LCO 4.0.3 requires the reactor to be shutdown in an orderly manner within a 24-hour period. Also applicable and providing a 24-hour grace period was LCO 4.2.2.a, "Operable Circulator LCO." Repairs were made to valve PV-21243, which included replacement of the valve trim. The associated pressure controller, PIC-21243, was calibrated in accordance with Procedure RP-EQ-16, Issue 2, dated October 15, 1986. The NRC resident inspectors observed the repairs and calibration, which were completed satisfactorily. No discrepancies were noted. The emergency feedwater header was returned to service at 1 a.m. (MST), on February 6, 1988, and LCO 4.0.3 and 4.2.2.a were formally exited at 5:15 a.m. (MST), after allowing the system to run following its return to service.

The NRC resident inspectors also followed the licensee's actions to correct the problems in the helium circulator speed cables. The circulator speed signals to both the indicators and the plant protective system had been exhibiting erratic behavior at the elevated temperatures associated with operation at higher power levels. Troubleshooting following the February 10, 1988, event, described in paragraph 4 of this report, indicated a problem with the twinax cable "Cannon" connectors at the helium circulators. These special connectors have the male end attached to the circulator housing and the female end attached to the cables. These female pin connectors have a spring-like device which in some cases had relaxed, allowing a slight gap in the pin connection at the elevated temperatures. The connectors on each of the four helium circulators were disassembled and both the male and female pins were checked with a micrometer to ensure their size was within a tolerance of 0.060 inch to 0.064 inch. A number of female pins were replaced, and the connectors reassembled. Since returning to power on February 12, 1988, the licensee has experienced no significant problems with the helium circulator speed cables or the associated indications and protective circuitry.

At 10:40 p.m. (MST), on February 25, 1988, the licensee experienced a turbine trip from approximately 50 percent power due to a false low main steam pressure signal. On investigation, the licensee discovered the root valve to Main Steam Pressure Transmitter PT-5220 was nearly shut. This valve had been repacked on February 11, 1988, and was left in a nearly shut position following this work. The valve was open enough to allow the main steam pressure to equalize across it before the turbine was placed in service. The valve's new packing shifted, evidenced by the fact that the valve developed a packing leak about the time of the turbine trip, which allowed the pressure downstream of the valve to be relieved. This reduced pressure was sensed by PT-5220, which then caused a turbine trip.

The NRC resident inspectors found no instructions in Maintenance Procedure MP-2115 to return a valve to its as-found position following maintenance. Although this is not safety-related equipment, the lack of a step to return the equipment to service following maintenance is of some concern. The licensee considers the potential problems associated with this significant and will revise all maintenance procedures for valves to

record the as-found position before commencing maintenance and to return the valve to that position or leave it in another position with the shift supervisor's knowledge and consent following completion of the maintenance activity. The NRC resident inspectors will monitor the licensee's implementation of these measures.

No violations or deviations were identified in the review of this program area.

8. Radiological Protection

The NRC resident inspectors observed the licensee's activities in this area to verify their conformance with policies, procedures, and regulatory requirements.

Health physics professionals were observed on all shifts, performing plant tours, area surveys for radiation levels and radioactive contamination, and checking the operability of area radiation monitors and continuous air samplers. The NRC resident inspectors verified that the results of area surveys were posted at entrances to radiation areas and in other appropriate locations. Health physics supervisors and personnel were aware of the plant status and activities which involved potential radiological concerns.

The NRC resident inspectors observed that health physics personnel were present and available to provide assistance whenever workers are required to enter a radiologically controlled area.

No violations or deviations were identified in the review of this program area.

9. Physical Security Observation

The NRC resident inspectors verified that there was a lead security officer (LSO) on duty authorized by the facility security plan to direct security activities onsite for each shift. The LSO did not have duties that would interfere with the direction of security activities.

The NRC resident inspectors verified, randomly and on the backshift, that the minimum number of armed guards required by the facility's security plan were present. Search equipment, including the X-ray machine, metal detector, and explosive detector, were operational or a 100 percent hands-on search was being utilized.

The protected area barrier was surveyed by the NRC resident inspectors. The barrier was properly maintained and was not compromised by erosion, openings in the fence fabric or walls, or proximity of vehicles, crates or other objects that could be used to scale the barrier. The NRC resident inspectors observed the vital area barriers were well maintained and not compromised by obvious breaches or weaknesses. The NRC resident

inspectors observed that persons granted access to the site were badged indicating whether they had unescorted or escorted access authorization.

No violations or deviations were identified in the review of this program area.

10. Exit Meeting

An exit meeting was conducted on March 8, 1988, attended by those identified in paragraph 1. At this time, the NRC resident inspectors reviewed the scope and findings of the inspection.