APPENDIX A

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-267/87-32 Operating License: DPR-34

Docket: 50-267

Licensee: Public Service Company of Colorado (PSC)
P.O. Box 840
Denver, Colorado 80201-0840

Facility Name: Fort St. Vrain Nuclear Generating Station (FSV)

Inspection At: Platteville, Colorado

Inspection Conducted: November 16-20 and November 31 through December 4, 1987

Inspectors: T. F. Westerman — 1-8-87
T. F. Westerman, Chief, Reactor Projects Section B — Date

R. E. Ireland — 1/11/88
R. E. Ireland, Chief, Plant Systems Section — Date

M. E. Murphy — 1/11/88
M. E. Murphy, Reactor Inspector, DRS — Date

A. R. Johnson — 1/15/88
A. R. Johnson, Reactor Inspector, DRS — Date

Accompanying Personnel: K. L. Heitner, Project Manager, NRR
F. B. Litton, Materials Engineering Branch, NRR

Approved: T. F. Westerman — 1/25/88
T. F. Westerman, Chief, Reactor Project Section C — Date

Inspection Summary

Inspection Conducted November 16-20 and November 30 through December 4, 1987 (Report 50-267/87-32)

Areas Inspected: Nonroutine, announced inspection of fire recovery activities in response to the fire of October 2, 1987.

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

DETAILS

1. Persons Contacted

Licensee

+*R. Williams, Jr., Vice President, Nuclear Operations
C. Fuller, Station Manager
+*F. Novachek, Technical/Administrative Services Manager
+*P. Tomlinson, Manager, QA
*L. Scott, QA Services Manager
+*J. Gramling, Supervisor, Nuclear Licensing - Operations
*M. Block, Supervisor, Nuclear Betterment
+*M. Dender, Jr., Nuclear Licensing Coordinator
*N. Snyder, Supervisor, FSV Maintenance
*M. Cappello, Supervisor, Planning/Scheduling/Store
*H. O'Hagan, NPD Outage Manager
+D. Warembourg, Manager, Nuclear Engineering
+G. Schmalz, Fire Protection Engineer
+F. Borst, Nuclear Training Manager
+M. Ferris, QA Operations Manager
+R. Craun, Manager, Nuclear Site Engineering
+M. Holmes, Manager, Nuclear Licensing
+T. McIntire, Nuclear Site Engineering
+J. Eggebroten, Supervisor, Technical Support Engineering
J. Wambach, Mechanical Engineer
B. Ring, QA Engineer (Metallurgist)
M. Seed, Civil Engineer
B. Tarrant, Mechanical Engineer

NRC

+*R. Farrell, Senior Resident Inspector
*J. Milhoan, Director, Division of Reactor Safety
+G. Pick, Reactor Inspector

+Denotes presence at November 20, 1987, exit meeting
*Denotes presence at December 4, 1987, exit meeting

2.0 Recovery from the Turbine Building Fire

Following the hydraulic oil fire on October 2-3, 1987, the licensee met with the staff on October 30, 1987, and provided a preliminary report on the impact of the fire. Section 10 of the report provided a list of action items to be completed prior to rise to power. On November 23, 1987, the licensee provided by letter a response to NRC questions regarding the fire and an update of Section 10 of the October 30, 1987, report.

The inspection of the action items identified in Section 10 of the October 30, 1987, report is as follows:

2.1 Restoration and Testing of Plant Systems

The licensee identified all tagged items in the fire zone using teams of QC/QA and engineering personnel. A station service request (SSR) was used to document the inspection. An operability test was then performed to determine basic component functionality and performance where appropriate. Evaluations with regards to the environmental qualification (EQ) of class 1E equipment important to safety were also performed to determine equipment status; i.e., replace or use-as-is. Repairs and/or replacements were controlled by use of an engineering change notice (CN) and a controlled work procedure (CWP) where a configuration change occurred. Where there was general maintenance or replacement in kind, the work was controlled by an SSR.

Work completed under a CN and CWP was tested by a cold checkout test (CCT) and a functional test (FT). Post-maintnenance testing (PMT) was performed for work accomplished using an SSR. In some cases, a Technical Specification (TS) surveillance test (SR) or a special test called a T-test was performed in lieu of an FT or PMT.

As a final check to determine compliance with TS-required surveillance requirements, i.e, to demonstrate operability, the licensee initiated a cross-reference matrix by component to the testing performed and the TS-required surveillance testing. This review was still in process at the end of this inspection and will be verified by the resident inspectors for completion prior to restart. (See NRC Inspection Report 50-267/87-34.)

In addition, the licensee will perform an integrated loop shutdown test (T-test) for both loops prior to restart. This also will be witnessed by the resident inspectors. (See NRC Inspection Report 50-267/87-34.)

The NRC inspector concluded that the licensee has established an adequate program for restoration and testing of components included in the fire activities.

No significant deficiencies have been identified by the testing program, but problems such as open fuses, one case of crossed leads, and inadequate termination of power cable have been identified.

No violations or deviations were identified.

2.2 Electrical Systems Restoration

2.2.1 Summary of Fire Damage

The October 3, 1987, fire caused considerable damage to electrical components and cables in the immediate vicinity of the fire. In order to assess that damage and to determine what repairs or replacements would be needed, the licensee conducted a number of detailed walkdowns. In most cases, the need for repair or replacement was obvious. However, in order to assist in the engineering evaluation that was necessary, particularly for electrical equipment (including cables) which must be EQ, the licensee prepared three-dimensional temperature profiles. These profiles were based on the observed effects of the fire on various materials for which the properties are well known.

In the immediate vicinity of the fire, a number of electrical components had to be replaced outright or be repaired through replacement of parts which were or might have been damaged by heat. In addition, approximately 100 runs of conduit (predominantly located above the fire) had to be replaced, along with some junction boxes (JB) and associated cable terminations in existing or new JBs at specific equipment items. Cables which were destroyed in two cable trays below the immediate location of the fire also needed replacement.

2.2.2 Bases for Replacement and Repair Work

The fire damage included cables and components which are classified as nonsafety, safety-related, and EQ. Repair and replacement for both nonsafety and safety-related cables and components entailed "like-kind" restoration and return to original prefire condition. Replacement and repair of EQ equipment required a comprehensive evaluation of the aging effects of the fire on cables and components in those temperature zones which were at 300°F or slightly higher, and in a 10-foot buffer zone outside the 300°F profile, for which specific temperatures could not be established based on physical evidence. The licensee's evaluation for EQ equipment is contained in EE-EQ-0065, Revision A and for EQ cables in EE-EQ-0066, Revision A.

Electrical replacement and repair work of all safety classes was governed by SSRs wherever modifications were not required. If modifications were required to complete the replacement and repair work, CNs and corresponding CWPs were utilized.

2.2.3 EQ Equipment

As stated above, EE-EQ-0065 contains a comprehensive evaluation of the effects of the fire on EQ electrical components. This evaluation contains a component-by-component assessment of the impacts of fire zone temperatures on the qualified life of components and the

effects, if any, of water used to extinguish the fire on those components. Based on this evaluation, the licensee elected to replace or repair components or to evaluate the remaining qualified life of components which were not directly damaged by temperature exposure but which may have suffered some aging of degradable materials.

In order to assure identification of all electrical equipment, including EQ equipment in the fire zone, the licensee used the existing plant components list (PCL) and the EQ master equipment list (MEL) together with equipment location drawings. Through this means, a list of EQ equipment subject to various fire zone temperatures was compiled.

Based on review of EE-EQ-0065 and interviews of licensee personnel, the NRC inspectors concluded that the licensee's evaluation was complete and that repair and replacement work was consistent with the EQ program requirements previously established by the licensee for maintenance of EQ equipment. The NRC inspectors examined several components that had been replaced and concluded that the work had been done consistent with EE-EQ-0065 and the SSRs which governed the work.

Based on interviews of licensee personnel and review of work documents, the NRC inspectors observed that all work was consistent with the DOR guidelines which apply to FSV. The only component upgrades to NUREG 0588 Category I requirements identified were the replacement of Cannon connectors by Namco connectors to a Moog servovalve and Collins transducer.

2.2.4 EQ Cables

In regards to the replacement of EQ cables damaged by the fire, the licensee performed a comprehensive evaluation, similar to that done for EQ components, contained in EE-EQ-0066. The licensee has taken the position, in accordance with their EQ program, that fire damaged cables can be replaced with "like-kind" DOR qualified cable in agreement with the guidance contained in Regulatory Guide 1.89, Section C.6, in particular, subparagraphs (b), "item to be replaced is a part of an item of equipment qualified as an assembly;" and (c), "used as a replacement on hand as a part of stock prior to February 22, 1983."

The NRC inspectors reviewed PSC CN No. 2701 involving subcomponent EQ replacement cables in cable trays via JBs located in the fire zone. The NRC inspectors identified only a few EQ cables (Rockbestos Firewall III, NUREG 0588, Category I) out of all the safety-related replacement cables in the cable trays. These EQ cables were terminated in JB 1444 (west end) and JB 1445 (east end) using Buchanan Model NQ-511 and NQ-211 terminal blocks (TB), qualified to

NUREG 0588, Category I. The terminal lugs (Amp Inc.) used for the TB terminations were not required to be EQ qualified as demonstrated by PSC engineering evaluation EE-EQ-54. EE-EQ-54 referenced another utility's type test which demonstrated survival of LOCA conditions for FSV.

The NRC inspectors examined the manner in which the JB associated with the cable trays were mounted and determined that they were adequately supported consistent with seismic requirements. Lug attachments to the terminal blocks appeared consistent with installation requirements. The NRC inspectors noted that, although cables from the cable trays were not clamped as they entered the JB, they were either looped or tied-off to the cable trays to prevent relative motion and tension on cables during maintenance work or seismically induced cable tray motion.

Approximately 100 runs of conduit were replaced, principally at elevations above the immediate fire location. Approximately 1/2 of these runs contained EQ cables and the remainder contained both safety and nonsafety-related cables. Review of selected SSRs and CWPs, followed by observation of work in progress and/or completed, confirmed that work had proceeded in accordance with defined procedures.

Most of the replaced conduit utilized existing "trapeze" supports, which were installed to the FSAR seismic criteria. New supports were installed in connection with JB 1477 (CN-2711B) which was required to reroute cables to hydraulic solenoid valves. Supports for this JB are structurally adequate for the seismic loadings specified in the FSAR. An internal PSC memorandum from M. A. Seed to P. F. Tomlinson, dated November 25, 1987, confirmed that site engineering had concluded that existing conduit supports had not been damaged by the fire and that they were acceptable for continued use.

2.2.5 Conclusions

Based on review of the licensee's technical evaluations, work packages, and observations of work in progress and work completed, the NRC inspectors concluded that all electrical components and cables damaged during the October 3, 1987, fire have been satisfactorily replaced. Further, with respect to EQ equipment and cables, all work needed to assure current qualified status and to assure preservation of qualified status through preventive maintenance and/or replacement of components has been completed.

2.3 Analyses of Structural Components from the Fire Area at Fort St. Vrain Reactor

A tour of the fire area was conducted with licensee personnel. The tour was followed by a review by the NRC inspector of the metallurgical analyses of the structural components taken from the

fire area. The metallurgical tests consisted of hardness measurements, metallographic replication, NDE magnetic particle inspection, and tensile testing.

Since the components were taken from the area in which the highest temperatures were indicated, the analysis was intended to bracket maximum structural damage in the fire area. The analysis did not show any material deficiency attributable to the exposure. The metallographic structure and hardness indicated that a polymorphic change in material had not occurred. The components were acceptable and properties were consistent with the originally installed material. The magnetic particle inspection showed indications, but these were shallow, capable of being buffed out, and expected to have minor effect on structural integrity. Although geometric deformation in certain I-beams occurred, which were replaced by the licensee, the analysis showed no material deficiency attributable to metallurgical structure change resulting from fire exposure.

The NRC inspector concluded that the material properties of the major ferrous structural components were not degraded as a result of the fire at the Fort St. Vrain reactor. However, the material properties of nonferrous metal, such as aluminum and plastics (but not copper) were degraded in the immediate vicinity. These materials were replaced by the licensee to restore the original plant structural integrity.

2.4 HV-2292 Hydraulics

The NRC inspectors verified by review of records and interview of licensee personnel that repairs, including replacement of thermal relief valves and orifices had been completed. This included both electrical and mechanical work. The last work item was installation of an electrical JB in accordance with CWP 292 which was verified by the NRC inspector as complete on December 4, 1987.

2.5 Hydraulic Oil Filter Canisters

The NRC inspector verified that the licensee had changed Controlled Work Instruction SMAP-25, "System-22 Hand Valve Oil Filter Replacement," to preclude the use of a pipe wrench on filter housings. The procedure now requires use of a strap wrench to preclude filter housing damage.

The NRC inspector also verified that bleed lines on pipe canisters are not necessary as the capability exists to vent the system through the installed 5-valve manifold. The NRC inspector also verified that the FSV standard clearance points for system 91 has been updated to reflect this capabiilty in issue 9 of that document.

2.6 Cleanup of Hydraulic System

The NRC inspector verified cleanup of the hydraulic oil. The NRC inspectors reviewed the chemistry test reports. The reports indicated that the hydraulic fluid in the system had been restored to proper specifications.

2.7 Control Room Ventilation System

A review was made of certain aspects of the Control Room Ventilation System. These are discussed as follows:

- The licensee is utilizing a control room panel instrument which had been calibrated to indicate that the control room is at a positive pressure relative to the turbine building. However, there is no formal schedule for calibration of this instrument. The licensee plans to institute such a program, but the program is not in place now. This is an open item. (267/8732-01)

- The NRC inspector verified that the licensee had moved the ventilation pressure sensor from the auxiliary electric room to the control room in accordance with CN 2713. The NRC inspector also verified completion of testing in accordance with FT 2713. The testing satisfactorily demonstrated that a positive pressure could be maintained in all modes of ventilation operation. These tests also included opening and closing of control room doors.

2.8 Control Room and Reactor Building Filter Testing

The NRC inspector reviewed the following completed surveillance tests associated with the control room and reactor building:

SR 5.5.3a-5A	Reactor Building Exhaust Filters and Charcoal Adsorber Samples
SR 5.5.3bc-A	Reactor Building Exhaust Filters Charcoal Adsorber Halogenated Hydrocarbon Removal and HEPA Leak Test
SR-HE-7-A	Control Room Makeup Filter-Charcoal Adsorber Halogenated Hydrocarbon Removal and HEPA Filter leak Test
SR-HE-6-A	Control Room Makeup Filter-Charcoal Adsorber Samples

The testing was performed by a contractor (NCS Corporation). All tests were found to be satisfactory. The tests included visual inspection, airflow distribution, charcoal adsorber halogenated hydrocarbon test, and HEPA filter leak test. Test results indicated a greater than 99 percent efficiency for all tests.

2.9 Fire Detection/Protection

The licensee committed to the following actions prior to startup in the areas of fire detection and protection:

- Initiate management directive on fire alarms
- Issue new procedure on fire protection operability
- Determine compensatory actions associated with the fire detection systems

To satisfy these commitments the licensee developed FPOR-12, "Fire Protection Operability Requirements - Fire Detectors" and promulgated it with the issue of Operations Order 87-14. FPOR-12 specifically addresses the compensatory actions to be taken with the loss of fire area or zone detection and/or loss of the control room annunciator.

The NRC inspector reviewed Operation Order 87-14 and FPOR-12 and attended a training session for licensed operators on the new fire protection operability requirements.

2.10 Hydraulic Oil Storage Lockers

The NRC inspector observed that both hydraulic oil storage lockers had been installed and that all oil drums had either been properly stored or removed from the turbine building.

2.11 Review of SSRs for Missing Handwheels

The NRC inspector reviewed a computer run markup of SSRs that had been performed by the licensee to determine the status of missing System 91 handwheels. The NRC inspector also verified by walkdown of System 91 that missing handwheels had been replaced.

2.12 Evaluation/Replacement of Plastic Valve Handles

The NRC inspector verified replacement of the plastic handwheels associated with HV-2205 and HV-2206, which were damaged during the fire, by review of RA-2012 and by inspection of the valves to verify replacement with metal handwheels.

2.13 Control Room Breathing Air Masks

The NRC inspector verified by inspection that five air masks are now installed in the control room.

2.14 Reporting

The licensee submitted preliminary LER 87-23 on November 2, 1987, to describe the hydraulic oil fire.

2.15 Hydraulic System Functional Test

In response to questions by the NRC inspector, the licensee performed the quarterly surveillance test of the hydraulic system (SR 5.3.5-Q) to demonstrate operability of the system. The NRC inspector reviewed the test results. All acceptance criteria were satisfied.

No violations were identified.

3.0 Hydraulic System

3.1 System Operation

System operation utilizes both the normal and emergency headers in each loop. One pump pressurizes the normal header and the other the emergency header. Each header has a 6 gpm flow limiting valve going to any one of the group headers. Thus, limiting flow to a group header is 12 gpm. The operation is different from the system as described in the FSAR.

The FSAR Section 9.11, Revision 5, states that under normal conditions only one pump is running and that the second pump is in standby. The licensee, however, operates the system with two pumps continuously running. The licensee operation of the system is not inconsistent with the Technical Specification LCO 4.3.7 which requires only that two pumps be operable per loop. The redundance provided by the second pump makes no difference whether the pump is running or is in standby. The licensee has, however, agreed as a result of the October 30, 1987, meeting with the staff in HQ, to submit a change to the FSAR to eliminate any conflict. This is considered an open item. (267/8732-02)

3.2 Indications and Alarms

The system has a number of control room indications and alarms. Main header and group header pressures can be monitored. Differential pressure alarms can sense significant failures. The key to operability is good surveillance practices. The licensee's quarterly surveillance (functional tests) on November 24, 1987, indicate the system is ready to operate again. Complete system recalibration is scheduled for the Spring.

3.3 Hydraulic Leakage

The licensee is continuing to carefully monitor the hydraulic system for excessive and uncontrolled leakage. Currently, three catch basins in the turbine building and the power system sump in the reactor building serve as collection points for leakage or flow from thermal relief valves. The presence of these systems minimizes the potential leakage and its associated fire hazard.

3.4 Inspection of System on Level 1

A visual inspection of the hydraulic system "power plant" on Level 1 of the reactor building was conducted.

The NRC inspector questioned why there were three wet pressure gauges and one dry pressure gauge. The licensee subsequently confirmed that the dry gauge was temporary and they were waiting for a replacement. In response to NRC inspector questions regarding the spread of pressure indication, the licensee verified by calibration that all but the temporary gauge (dry) were within calibration specifications. A nonconformance report (NCR) was issued for that gauge.

An NRC inspector's observation (not a commitment or regulatory requirement) was that a number of plastic handwheels remain on this portion of the system which represent a limitation in system operation during or after a fire and, in the event of a high energy line break, it was also pointed out that the Group 1 header label is missing on both loops and some deficiency tags remain in place.

4.0 NRR Review of Specific Issues Related to Fort St. Vrain Fire

A review of specific issues related to the Fort St. Vrain fire was completed by NRR on December 7, 1987, and a safety evaluation has been issued (see Appendix B). NRR has concluded that the licensee's short term corrective actions provide an acceptable basis for plant restart. The licensee is, however, committed to complete their post-restart evaluation within 60 to 90 days after restart.

5.0 Exit Interview

The NRC inspectors met with the NRC senior resident inspector and licensee representatives identified in paragraph 1.0 on November 16-20 and November 31 through December 4, 1987, and summarized the scope and findings of the inspection as presented in this report.

APPENDIX B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

December 7, 1987

MEMORANDUM FOR: James L. Milhoan, Director
Division of Reactor Safety
Region IV

FROM: Dennis M. Crutchfield, Director
Division of Reactor Projects - III, IV,
V and Special Projects
Office of Nuclear Reactor Regulation

SUBJECT: ISSUES RELATED TO THE FORT ST. VRAIN FIRE, DOCKET NO. 50-267 (TAC NO. 66365, TIA NO. IV-2-87)

References:

1. Memo dated October 21, 1987 from J. L. Milhoan, Region IV to D. M. Crutchfield, NRR, concerning Issues Related to Fort St. Vrain Fire.

2. Letter dated November 23, 1987 (P-87414) from PSC to the NRC concerning Response to Second Request for Additional Information Concerning Recovery from Turbine Building Fire

In response to your request in Reference 1, we are providing our Safety Evaluation of the specific issues you have identified. These responses are provided in the Enclosure. Our conclusion is that the licensee's short term corrective actions provide an acceptable basis for your approval of plant restart. However, it should be made clear to the licensee that his commitments to continue certain post-restart evaluations must be honored. These evaluations must be submitted to the staff within 60 to 90 days after restart.

After the plant is restarted, it is our intention to rapidly complete the Appendix R related reviews. We appreciate your continued support in the review of Fort St. Vrain's safe shutdown systems for Appendix R.

We consider our responsibilities under TIA IV-2-87 complete at this time.

Dennis M. Crutchfield

Dennis M. Crutchfield, Director
Division of Reactor Projects - III, IV,
V and Special Projects
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Enclosure

SAFETY EVALUATION CONCERNING SPECIFIC ISSUES

RAISED BY OCTOBER 2-3, 1987

TURBINE BUILDING FIRE

FORT ST. VRAIN NUCLEAR GENERATING STATION

PUBLIC SERVICE COMPANY OF COLORADO

DOCKET NO. 50-267

1.0 INTRODUCTION AND BACKGROUND

On October 2 and 3, 1987 a fire occurred in the Turbine Building at the Fort. St. Vrain Nuclear Generating Station. On October 30, 1987, a meeting was held with the licensee to discuss the fire and the licensee's plans for recovery from the fire. By letter dated November 23, 1987, (P-87414), the licensee provided additional information regarding the recovery plan. This Safety Evaluation addresses specific issues concerning that recovery.

2.0 EVALUATION

2.1 Hydraulic System

The staff was requested to review the design of the Fort St. Vrain hydraulic system with respect to:

1. fire protection considerations including measures which may be needed to prevent hydraulic oil from reaching hot surfaces which could promote ignition; and

2. the adequacy of the hydraulic system design with respect to accommodating impulse pressures without failure (e.g., the ruptured filter canister which appeared to contribute to the fire).

The current design of the plant already contains a number of features to protect against hydraulic oil fires. Additional fire detectors are placed in areas where the hydraulic system contributes to a higher risk of fire. In the subject fire, the licensee had deactivated the audible alarms for this system and thereby compromised its effectiveness. During the October 30, 1987 meeting, the licensee committed to stronger controls over the fire alarm system and to take appropriate compensatory measures when the alarm system is partially disabled.

Additionally, the licensee's post fire evaluation concluded that the hydraulic oil system failure occurred in a thermal relief valve. This thermal relief valve had failed because it did not have a protective orifice on its inlet line. The licensee has verified the role of the orifice in limiting flow to the thermal relief valve to an acceptable level of about 1 gpm. Additionally, physical evidence showed that the failed thermal relief valve had received repeated damage from system pressure transients. However, the orifice would have prevented this problem. The licensee has now verified the correct installation of the orifices in the system. This will correct the deficiency that led to this particular fire. Other existing design features, such as spray shields and hydraulic oil drains appear to be adequate and functioning correctly, to prevent fires. The subject fire was well within our assumptions under Appendix R for fires in the Turbine Building. Hence we conclude that the fire protection considerations for the hydraulic system are acceptable for plant restart.

Additionally, the licensee has committed to conduct an evaluation of exposed hot surfaces in proximity (10 foot radius) to the 30 hydraulic valves. The licensee will evaluate surfaces with a temperature of over 500°F, which are potential ignition sources. This report will evaluate additional protective measures and will be submitted by January 30, 1988.

The licensee has also performed a detailed metallurgical analysis of the failed hydraulic oil filter cannister. Our original concern was that this failed cannister was the source of hydraulic oil that initiated the fire. The licensee performed a metallurgical analysis of the failed cannister and concluded that failure occurrred at temperatures above 650°F. Tests of another filter assembly showed that failure in the absence of elevated temperatures was over 4 times the hydraulic system's normal pressure. We find that the licensee's analysis shows that the hydraulic system appears adequately designed to withstand actual system operating conditions. (This includes the licensee's actions to replace the thermal relief valve orifices discussed above.)

In addition, the licensee has committed to perform quarterly surveillance on the hydraulic system to verify component operability prior to restart. The licensee has also committed to testing of hydraulic system design features such as flow limiting valves and differential pressure alarms. We believe this additional attention to hydraulic system operation will also reduce the risk of system failure and potential fire hazards. It will also assure rapid detection by the operators of system leakage.

2.2 Piping and Affected Components

The staff was requested to review piping and other components that may have been affected by exposure to cold fire water, giving consideration to impurities such as chlorides.

The major components affected by the fire are as follows:

- Hot reheat steam piping
- Hot reheat relief valves, and
- Main steam relief valves

The evaluation of each component is provided as follows:

Hot Reheat Steam Piping

The hot reheat steam piping in the fire area is fabricated from plate, rolled and welded to form a 34 inch diameter pipe. Pipe stubs for the hot reheat relief valves are welded to the main pipe. The pipe, pipe stub and relief valve body are 2¼ percent Cr, 1 percent Mo. This alloy is suitable for such high temperature service. This piping was subjected to potential damage from impingement of cold fire water during operation at temperature.

In order to perform a post-event assessment of damage to this piping, the licensee removed all insulation down to the main pipe. This exposed the relief valve body, stub pipe and main pipe. This area was examined by magnetic particle testing as was done for the initial installation. No evidence of any damage was found. It is not anticipated that the materials involved would be damaged by thermal stresses from this event.

Concern was raised that the combustion products from the fire could contain potentially corrosive chemical species. The licensee's analyses of the fire soot indicated that these were not highly corrosive. However, the licensee has used a detergent water spray to remove most of this material.

Based on the above, we find the licensee program for evaluating potential damage to the reheat steam piping and the results thereof, are acceptable.

Hot Reheat Safety Valves

The hot reheat line safety valves were damaged in the fire area. Although the valves did not lift, they were subjected to high ambient temperature and cold fire water. The most critical component is the valve calibrated spring which is adjusted to provide the proper relief settings. The licensee's current program includes refurbishment of these valves and replacement or refurbishment of the calibrated springs as required.

There are six hot reheat safety valves affected by the fire, and they are the same model 6-1706 RWE-1-103-0S150 and manufactured by Dresser Industries. At the October 30, 1987 meeting in Bethesda between NRC staff and the licensee, the licensee stated that all six valves were being repaired in accordance with the plant normal repair procedure, MP-1010, which includes disassembly, examination , replacement, and testing after reassembly. The staff has acknowledged the licensee's approach for refurbishment of the hot reheat safety valves and finds it acceptable.

Main Steam Safety Valves

During the cooldown following the fire, the main steam system was overpressurized. This happened because control circuits for the main feed water pump were lost, and the economizer inlet pressure was used to estimate the main steam pressure in Loop I. Since the pump discharge pressure could not be accurately regulated by the economizer inlet pressure, the steam generator was overpressurized. One of the Loop I main steam safety valves opened to relieve the steam system pressure. The valve that opened that has the lowest setpoint pressure and is set to open at 2720 psig. The other valves with higher pressure settings did not open.

The licensee later reported the valve that opened did not reseat properly and water leakage was found from the bonnets of the once opened valve. No details of the seat leakage and possible reasons for causing the leakage was provided by the licensee. However, in assessing the damage to these valves, the licensee noted that they are designed to operate with both water and steam. The valves normally experience a wide range of temperature, from cold water at start up to 1000° F steam at power. The valves are sized to accommodate full flow with solid water, as well as steam.

Thus, the valve did not experience any unusual temperature transients during the cooldown following the fire. The seat leakage experienced by the safety valve, especially following multiple openings to release two-phase fluid or water, is considered normal by the state of art safety valve design. There are three main steam safety valves on Loop I; they are the same model 3-3740WE-103-RT-21 and manufactured by Dresser Industries. The licensee verbally proposed to repair the leaking valve according to its normal repair procudure, MP-1010, which include disassembly, visual examination and testing after reassembly. The staff finds that the licensee's proposals for repair of the leaking main steam safety valve are acceptable.

2.3 Effects of Combustion Products

The staff was requested to review the short- and long-term implications of exposure of plant equipment to combustion products which may persist and be corrosive.

The licensee has performed an analysis of the combustion products deposited throughout the plant. An analysis of these products found them to consist of less than one percent chlorine and less than two percent sulfur. The licensee stated that such products are generally not highly corrosive. However, the licensee has initiated a washdown program utilizing detergent and high pressure water in an effort to remove these products throughout the plant. Additionally, the licensee has taken "wipe" samples in electrical control and junction boxes throughout the plant. As the result of these samples, the licensee has concluded that there will be no electrical problems with electrical equipment contacts as a result of the fire.

We have reviewed the licensee's efforts to assess and mitigate the effects of potentially corrosive combustion products. The licensee has taken what we believe are effective measures and we conclude his program is acceptable.

2.4 Control Room Ventilation System

The staff was requested to review the design basis for the control room ventilation system to determine whether any specific short- or long-term measures should be taken to preclude the chance that smoke might enter the control room in the event of a future turbine building fire.

The licensee is taking a number of corrective actions to improve the performance of this system prior to plant restart. These include:

- Testing and/or replacement of system filters
- System modification (pressure sensing line relocation)
- Preventive maintenance and,
- Functional testing

These are discussed below.

The licensee's plans for testing or replacing the system filters are as follows:

One of the two charcoal filters (F-7502) has been tested per the guidelines of RG 1.52 and found acceptable. The other charcoal filter (F-7504) has not been tested, but rather, the charcoal will be replaced upon delivery 4 to 6 weeks after plant restart. The system particulate filter (F-7503) has been replaced. Filter F-7504 does not function unless the control room fire detectors are actuated (purge mode). The availability of the breathing air system in the control room compensates for the possible unavailability of of F-7504 during this period. The licensee has also committed to installing additional air masks in the control room prior to rise to power.

The licensee proposed a modification to the system to move the pressure sensing line from the auxiliary equipment room to the control room. This will permit a more direct control of the pressure within the control room envelope. This modification will be completed prior to system functional testing. In addition, the licensee has performed preventive and corrective maintenance on the system to assure that it is ready for further operation.

Prior to startup, the licensee will conduct functional tests of the system to assure that the correct positive pressure is maintained in the control room in all modes of operation. Of special interest is the differential pressure relative to Building 10, which also operates at a positive pressure. The licensee will evaluate the results to these tests to determine if additional system modifications are necessary to satisfy the system design basis. (The licensee reported to the staff by telephone on November 25, 1987 that the control room differential pressure tests were successful.)

We have reviewed the design basis for the Fort St. Vrain control room ventilation system and the items described by the licensee at the October 30, 1987 meeting. We have determined that the licensee's evaluation to date and current plans for actions to be taken prior to and subsequent to power operation are acceptable. We understand that, in addition, as a condition of acceptance, the licensee will provide by January 30, 1988:

(1) an evaluation of the existing air pressure differential between the control room and the adjacent space in Building 10;
(2) a complete list of corrective actions taken;
(3) a commitment to taking further actions, as necessary; and
(4) approved emergency operating and surveillance procedures for the system during specific conditions including smoke in adjacent areas.

3.C CONCLUSIONS

Based on the above, we conclude that the licensee has taken appropriate corrective actions following the October 2-3, 1987 fire in the Turbine Building. The licensee's actions have addressed the following:

- Hydraulic System
- Piping and Affected Components, and
- Effects of Combustion Products, and
- Control Room Ventilation System
- Stronger controls over fire detection systems and compensatory measures when fire detection capability is compromised.

Based on the above, we find the licensee's proposals for plant restart is acceptable.