



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION IV
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SAFETY EVALUATION BY THE NUCLEAR REGULATORY COMMISSION
FORT ST. VRAIN NUCLEAR GENERATING STATION
PUBLIC SERVICE COMPANY OF COLORADO
DOCKET NO. 50-267

Introduction

As a result of the failure of six Control Rod Drive Mechanisms (CRDMs) to automatically insert their associated neutron absorber material (2 control rod strings per CRDM) following a reactor scram on June 23, 1984, the NRC issued a confirmatory action letter (CAL). The CAL, dated June 26, 1984, required Public Service Company of Colorado (PSC or the licensee) to take various actions and to maintain the Fort St. Vrain (FSV) reactor in the shutdown condition until the NRC authorized restart. This failure to insert problem, in conjunction with other areas of concern, prompted the Director of the Office Nuclear Reactor Regulation, NRC, to direct an overall conduct of operations evaluation of FSV. A team of NRC personnel and NRC consultants from the Los Alamos National Laboratory conducted audits of the FSV facility on July 9 through 11, 1984 and August 1 through 3, 1984. The results of these audits are contained in a "Preliminary Report Related to the Restart and Continued Operation of the Fort St. Vrain Nuclear Generating Station" (Assessment Report) which was transmitted to PSC by letter dated October 16, 1984. This safety evaluation presents the NRC findings related to the various PSC submittals and meetings in response to the Assessment Report.

Other areas of concern which require resolution prior to plant restart (e.g., the concrete reactor vessel prestressing tendon system problems and the emergency electrical systems operation) are discussed in separate correspondence.

Evaluation

The Assessment Report required the completion of a number of items prior to the restart of FSV and additional long term items following restart. PSC responded to the Assessment Report requirements by letter dated January 4, 1985, (P-85003) with commitments to resolve the NRC concerns. Numerous meetings and submittals expanded and clarified those commitments. Our evaluation of the PSC commitments and corrective actions is contained below and follows the numbering sequence used in the Assessment Report.

A. Items Required to be Completed Prior to Restart

1. Actions Required for Control Rod Problems

- a. "Ensure that future scram signals will result in all rods automatically being inserted into the core. The licensee must identify the failure mechanism and take corrective action for

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the rods that did not scram; or if the cause cannot be positively identified through examination or analysis of the drive mechanisms and the circumstances of the failure, other compensatory measures must be taken to provide assurance of reliability of control rods. These measures could reasonably include refurbishing all drive mechanisms. Regardless, of any other measures taken to remedy the failure to scram problem prior to reactor restart, PSC must outline and commit to periodic inspection/preventive maintenance and surveillance programs for control rod drives and associated position instrumentation.

- b. "Implement procedures to prevent overdriving the control rods past the rod-in limit.
- c. "One 20-weight percent and one 40-weight percent reserve shutdown hopper should be functionally tested to assure that the reserve shutdown capability is fully available.
- d. "Until the long term corrective actions are completed, the licensee should develop a procedure that will require a reactor shutdown under conditions where purge flow is lost or when high levels of moisture exists in the coolant.
- e. "Implement a procedure for recording representative samples of CRDM temperatures at all operating conditions until continuous recordings capability is available."

By letter dated January 31, 1985, PSC provided the plans to resolve the Control Rod problems. Our review of this, and supplemental information, is described in Attachment 1, Safety Evaluation of Control Rod Drive Mechanisms and Reserve Shutdown Systems.

Attachment 2 is a copy of the Technical Evaluation performed by our consultant at the Los Alamos National Laboratory.

There are, however, a number of items which require additional resolution or which have occurred since the issuance of the Assessment Report.

As discussed in the Safety Evaluation (SE), Attachment 1.

- The licensee must provide a commitment to operate the plant within the CRDM temperature limits accepted by the NRC. The temperature limits cannot be changed without NRC approval of new temperature limits or alternative methods of assuring CRDM operability; and

- The licensee must provide a commitment to submit an improved CRDM surveillance and preventative maintenance program within six months of plant restart.

In addition, the following issues must be resolved:

- The acceptability of the replacement ball bearings used in the CRDM refurbishment; and
- The acceptability of the epoxy used to attach the CRDM temperatures sensors.

By letter dated June 14, 1985 (P-85199) PSC stated that the interim Technical specifications (TS) contain a requirement that the CRDM motor temperatures are monitored to ensure the temperatures are within acceptable limits. (See PSC letter P-85180, dated June 7, 1985, and the discussion in Item 3 below.) In addition, P-85199 committed to submit an improved CRDM surveillance and preventive maintenance program within six months of plant restart. By letters dated June 7, 1985 (P-85195) and June 13, 1985 (P-85201) PSC provided information on the epoxy and the bearings, respectively. Our review of this information is in progress and will be the subject of a subsequent SE.

Additional information concerning the CRDM position instrumentation and procedures to prevent overdriving is contained in Item 3 below, "Actions Required for the upgrade of TS", and in Attachment 3.

2. "Actions Required to Correct Weaknesses Noted in the Area of Overall Conduct of Operations"

"In the area of overall conduct of operations, the staff confirmed the deficiencies noted in various Region IV inspection reports and in the last two SALP reports. The staff has concluded that PSC must develop a comprehensive program for identifying the underlying causes for the deficiencies and for applying corrective measures. This program should be conducted by a third party consulting organization and should be aimed at reviewing the PSC management structure and practices relative to the operation of FSV with emphasis on correcting deficiencies noted in the various Region IV inspection reports, the last two SALPs and programmatic weaknesses identified in Section 4 of this report. PSC should submit the scope and schedule for this program prior to reactor restart."

The scope of this management review program was further discussed with the licensee in a meeting on November 14, 1985. (The summary of this meeting is contained in IE Inspection Report 50-267/84-32 dated May 22, 1985. Based on the information contained in the

assessment report and the further understanding gained from this meeting, the licensee commissioned the NUS Operating Services Corporation to perform this review. By letter dated February 28, 1985 (P-85066), PSC provided a copy of the NUS Report, "An Analysis and Evaluation of the Management of Nuclear-Related Activities of the Public Service Company of Colorado" together with their response to that report. PSC provided additional information in their March 29, 1985 (P-85107) submittal.

The staff reviewed these submittals and requested additional details regarding PSC's proposed actions for Sections 4.2.5 "Conduct of Operations" and 4.2.6 "Maintenance Practices" of the Assessment Report. This additional information is contained in the licensee's letter dated May 22, 1985 (P-85178). Based on our review of these submittals, we find that PSC has carried out a management review that meets the requirements of the Assessment Report.

To provide the means of implementing the corrective actions needed to address the recommendations made in this management review, PSC has developed a Nuclear Performance Enhancement Program. This program is described in the March 29, 1985, letter referenced above. Additional details were provided to the NRC on May 31, 1985, during the SALP management meeting held with PSC at the Fort St. Vrain site. The status of implementation of this program was described to the staff in a meeting on June 17, 1985.

The Nuclear Performance Enhancement Program is a proactive management scheduling and followup device that includes all of the significant findings of the NRC Assessment Report, the NUS management audit, NRC inspection findings and company generated findings. Each of the items is assigned a project manager and a schedule for completion is established in accordance with the licensee's overall priority scheme. Progress against this schedule is determined bi-weekly and management is kept advised in order to ensure that any schedule changes are agreed to by management.

The staff has determined that the Nuclear Performance Enhancement Program has the structure and capability of carrying out the corrective actions that are necessary. If properly supported by PSC management, many of the deficiencies noted by the NRC in licensee performance should be adequately addressed.

3. Actions Required for the Upgrade of Technical Specifications

- a. "A high priority effort should be undertaken to review and propose revisions to the existing Technical Specifications to reduce the likelihood of operator error and/or misinterpretation and correct omissions. The staff has determined that a schedule should be

developed by PSC which will reflect completion of the review, revision, and submittal of the proposed Technical Specifications by April 1, 1985.

- b. "To improve control rod and reserve shutdown reliability, the licensee shall propose the following changes to Technical Specifications, and implement interim procedures until the Specifications are approved:
- (1) A Weekly control rod exercise surveillance program for all partially or fully withdrawn control rods;
 - (2) A Limiting Condition for Operations defining control rod operability and the minimum requirements for rod position indication; and
 - (3) A Limiting Condition for Operations and a corresponding surveillance test to define and confirm reserve shutdown system operability."

By letter dated April 1, 1985 (P-85098) PSC provided a submittal titled "Upgraded Technical Specifications for Acceptance Review" in fulfillment of item a. above. Our evaluation of this submittal will be the subject of a future SE.

By letter dated March 15, 1985 (P-85089) PSC submitted "Draft Technical Specifications to Improve Control Rod Reliability." Our review of this submittal determined that numerous problems existed and a meeting was held on May 3, 1985 to discuss those problems. The results of this meeting are documented in our letter dated May 28, 1985.

By letter dated June 7, 1985 (P-85180) PSC resubmitted the TS, together with a commitment to implement those requirements through the use of interim procedures prior to restart. Our evaluation of this resubmittal indicated that some improvement and clarification was necessary to ensure resolution of our concerns. PSC has agreed to submit information to satisfy our concerns; we will evaluate this information prior to restart.

As discussed in Attachment 3 - "Safety Evaluation Related to Control Rod Position Instrumentation", additional operability and surveillance requirements are needed to ensure safe operation. Specifically, the following issues should be incorporated:

- Additional TS and procedures for determining control rod full-in position. (See Section 3.4 of Attachment 3.)
- Additional surveillance tests on rod position indications. (See Section 3.4 of Attachment 3.)

- Initiation of the backup shutdown system if rod full-in position indication cannot be verified within 1 hour. (See Section 3.4 of Attachment 3.)
- Additional procedural control to prevent inward overtravel of control rods. (See Section 3.2 of Attachment 3.)

The proposed TS (P-85180) discussed above provide addition controls and limitations on the operation and testing of the control rods and their indication. In addition, plant operating procedures were revised to prevent inward overtravel of the control rods. (SOP 12-01, Issue 15 which was submitted in letter P-85040 dated January 31, 1985). Some problems have been identified which PSC has agreed to resolve in the submittal discussed above.

4. Actions on Continued Water Ingress

"In the area of continued water ingress the staff has determined that PSC must develop a plan to carry out any of those modifications recommended by the PSC "Moisture Ingress Committee" that are determined by PSC to have a high potential to significantly reduce the frequency and severity of upsets involving injection of circulator bearing water into the helium coolant. Any significant reduction would clearly reduce the frequency of plant transients; improve the reliability of overall plant operations; and might, if has an effect, improve the performance of control rod drives. This plan should include a status report to the NRC as part of the annual report on the progress in implementing modifications."

By letter dated January 24, 1985 (P-85022) PSC outlined some of the modifications which have been completed, are presently under way, and are planned to be implemented to control the water ingress problem. Since this submittal did not contain sufficient detail to resolve our concerns, PSC agreed, during a meeting at FSV on February 21, 1985, to provide additional information.

Additional detail was provided in PSC letter, P-85082, dated March 12, 1985. Our review of this submittal and other germane information will be included in a future SE.

B. Actions Required Following Restart

The Assessment Report, in addition to requiring that certain items be completed as a condition for plant restart, required some longer term actions. Specifically, the Assessment Report stated:

"In addition to the above items required for restart, the staff noted several weaknesses that should be corrected on a longer term basis. The licensee must submit schedules within 60 days of restart for completing these items."

The January 4, 1985 (P-85003) PSC letter provided the required schedules, NRC review of the schedules resulted in a meeting on January 15, 1985, to

discuss differences. The results of the meeting are contained in our January 17, 1985, letter to PSC.

The items listed in the Assessment Report for which action is required following plant restart are:

- a. "Provide continuous recording of a representative sample of CRDM temperatures at all operating conditions to provide part of the data necessary for the longer term program noted below (Section 2).
- b. "Determine whether compensating design and/or operational modifications are needed to minimize moisture ingress to the CRDM cavities and minimize temperatures in the vicinity of the rod drives. In the event that temperatures recorded during plant operation prove to be higher than those for which the assembly was initially qualified, take immediate steps to perform environmental requalification testing of a CRDM assembly or hold temperatures to that for which the CRDM has been qualified (Section 2).
- c. "The present Watt-meter testing of the shim motor during drive-in and drive-out is not a reliable method to verify full insertion or withdrawal of control rods. This test should be refined or an alternative, reliable test for control rod position verification, must be developed (Section 3).
- d. "Investigate a design change to provide a positive stop on the CRDM position indicator potentiometer shaft to prevent overtravel (Section 3) and provide the results to the NRC.
- e. "Conduct an integrated systems study to resolve rod position indication, maintenance and operability questions (Section 3).
- f. "Establish procedures for verification and sign-off by the Maintenance Quality Control (MQC) of key steps in Technical Specifications surveillance procedures (Section 5).
- g. "Establish a procedure for review and concurrence by the QA organization of safety-related procedures and changes thereto (Section 5).
- h. "At the time of the audit, the MQC group was reviewing each completed surveillance procedure. The staff concluded that this practice should continue.
- i. "A review by the QA organization of the content and adequacy of the Technical Specification procedures is important, and the staff has determined that this should be implemented."

These items were all discussed in the January 4, 1985 (P-85003) submittal and some were clarified in our January 17, 1985, letter. In addition,

some of the items are further discussed as follows:

- a. Continuous recording of CRDM temperatures as, discussed in PSC letters P-85032 dated January 30, 1985, and P-85199 dated June 14, 1985, has been implemented through the use of multipoint recording devices which will provide frequent monitoring.
- b. A discussion of the modifications planned to control moisture and purge flow to the CRDMs and plans to qualify a CRDM to higher temperatures is contained in PSC letter P-85032 dated January 30, 1985.
- c. A discussion of the wattmeter test is contained in PSC letter P-85040 dated January 31, 1985. (The discussion of the wattmeter test in Attachment 3 to this SE indicates that further improvement is necessary.)
- d. A discussion of the positive stop to prevent overdriving is contained in P-85032 dated January 30, 1985 and was discussed during our February 21, 1985, meeting.

The final resolution of these long term issues will be the subject of a future SE.

Summary

All of the issues presented in the NRC's Assessment Report have been addressed by PSC as discussed above. Most of the near term issues have been satisfactorily resolved as have some of the long term issues. The remaining issues and additional issues requiring resolution prior to restart will be (or have been) the subject of separate SEs.

Since there have been numerous commitments by PSC to provide various documents and/or implement various programs or procedures, we will confirm these commitments in writing in connection with authorization of plant restart.

Attachments:

1. SE on CRDM and RSS
2. TER on CRDMs, RSS, and Tendons
3. SE on Control Rod Position Indication.