U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos. 50-528/91-49, 50-529/91-49, and 50-530/91-49

Docket Nos. 50-528, 50-529, and 50-530

License Nos. NPF-41, NPF-51 and NPF-74

Licensee Arizona Public Service Company
P. O. Box 53999, Station 9012
Phoenix, AZ 85072-3999

Facility Name Palo Verde Nuclear Generating Station
Unit 2

Inspection Conducted October 27 through December 2, 1991

Inspectors D. Coe, Senior Resident Inspector
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Approved By _____ 12/11/91
P. S. Koltay, Chief Date Signed
Reactor Projects Section II

Inspection Summary

Inspection on October 27, through December 2, 1991
(Report Numbers 50-528/91-49, 50-529/91-49, and 50-530/91-49)
Areas Inspected: Special inspection of the circumstances surrounding errors made during Unit 2 refueling activities on October 27, 1991. These were; 1) lifting Control Element Assemblies (CEAs) at least one foot out of the core without the supervision of a Senior Reactor Operator (SRO), 2) failure to establish and maintain communications with the control room during the core alteration, 3) failure to recognize and acknowledge an alarm condition which required operators to halt core alterations, and 4) failure to perform boron samples as required by procedure prior to opening a gate between the spent fuel pool and the fuel transfer canal.

During this inspection the following Inspection Procedure was utilized: 60710.

Results

General Conclusions and Specific Findings

Based on the inspection of licensee identified core alteration incidents, the inspectors concluded that these events involved apparent violations of the plant's Technical Specifications (TS). The inspector identified concerns in the areas of work control, adequacy of procedures and control room operators' awareness of plant conditions. These concerns collectively were indicative of the licensee's failure to provide proper oversight, as required by TS, resulting in inadequate controls over core alteration activities.

Significant Safety Matters

The above noted concerns represent a weakness in the management control of licensed activities related to core alterations and procedural adherence during refueling operations.

Summary of Violations

Six apparent violations were identified.

DETAILS

1. Persons Contacted

The below listed technical and supervisory personnel were among those contacted:

Arizona Public Service (APS)

T. Bradish, Manager, Compliance
G. Eimer, Unit 2 Shift Supervisor
*R. Flood, Plant Manager, Unit 2
J. Levine, Vice President, Nuclear Power Production
A. Reynolds, B&W Site Manager
W. Reeves, Unit 2 Outage Manager
D. White, Unit 2 Shift Supervisor

*Personnel in attendance at the Exit Meeting held with the NRC Resident Inspectors on November 14, 1991.

The inspectors also talked with other licensee and contractor personnel during the course of the inspection.

2. Core Alteration Without Senior Reactor Operator (SRO) Present - Unit 2 (60710)

On October 27, 1991, with the reactor in Mode 6, at approximately 12:10 pm (noon) (MST), a contractor refueling crew commenced withdrawing Control Element Assemblies (CEAs) into the Upper Guide Structure (UGS), in preparation for removal of the UGS for commencement of core fuel offload. The activity was initiated without a licensed SRO present at the refueling cavity, as required by Technical Specification (TS) 6.2.2.1.d. Additionally, direct communications between the control room and personnel at the refueling station were not established, as required by TS 3.9.5., and the control room did not authorize the core alterations, as required by licensee procedures. A detailed discussion of these events follows.

At approximately 4:15 am (MST) on October 27, 1991, operators established the reactor refueling pool level at 119 feet in preparation for installing the UGS lift rig onto the UGS flange. This pool level is approximately five feet above the vessel flange. From about 6:30 am to 7:30 am, both the operations crew and the contractor crew responsible for the UGS lift rig installation conducted shift turnover briefings. However, the refueling SRO (RSRO) was not present for the contractor crew job briefing given by the contractor supervisor and radiation protection technicians. At approximately 7:38 am that morning, the contract workers lowered the UGS lift rig onto the UGS flange and began attaching it. The RSRO was present for this evolution, which constituted a core alteration due to attaching the UGS lift rig below the level of the vessel flange (114 feet 1.5 inches). The procedure used by the contractor crew, 31MT-9RC33, "Reactor Vessel Upper Guide Structure Removal and Installation," and the procedure used by the operations crew,

420P-2ZZ12, "Mode 6 Operations" both required either a signature or initial that an RSRO was present, and 420P-2ZZ12 also required a signature that direct communications was established between the control room and the refueling pool. These requirements were met for the UGS lift rig lowering and attaching evolution.

Contract personnel then began manually latching each CEA from the CEA support platform which had been lowered to its bottom position of elevation 130 feet 2 inches. The RSRO relayed this information to the control room. The Shift Supervisor (SS) questioned the RSRO as to which procedure was being used, but the RSRO was unaware of what procedure or step number was being used. The SS then questioned why latching CEAs was in progress prior to control room operators establishing the prerequisite refueling cavity water level of 127 feet 4 inches to 128 feet 4 inches, in accordance with procedure 420P-2ZZ12, "Mode 6 Operations." The RSRO questioned a contract worker on this point and was told that the water level requirement was an option based on radiological conditions and that RP had surveyed the CEA support platform and had authorized access. The RSRO informed the Control Room of this response and the latching evolution was allowed to continue to completion. Lowering the CEA support platform and latching CEAs prior to establishing the prerequisite refueling pool level is not in accordance with licensee procedure 420P-2ZZ12 and is an apparent violation of Technical Specification 6.8.1 (Violation 529/91-49-01).

The RSRO remained in containment until informed by the control room operator that raising the refueling cavity water level had been delayed by a valve problem. The RSRO then left containment at approximately 10:45 am, along with the contractor crew who turned over their task to another contractor "relief" crew because the first crew had reached their four hour limit for being inside containment.

The licensee Containment Work Coordinator (CC) observed the completion of the CEA latching operation and informed the control room that they could flood up the refueling cavity in preparation for CEA withdrawal. Between 11:00 am and 11:30 am, the shift supervisor told the CC that he was not pleased that the containment work was in conflict with the operations procedure and determined that a briefing for all personnel would be held at 1:00 pm in the control room prior to lifting the CEAs, so that the two governing procedures could be synchronized. At 11:30 am he also authorized raising refueling cavity water level to achieve the initial conditions required for withdrawing CEAs. The CC has stated that he informed two contractor supervisors of the 1:00 pm briefing as he was leaving containment about 11:40 am, but the supervisor responsible for the contractor "relief" crew has stated that he did not get any notification of the briefing prior to his subsequent authorization of the CEA withdrawal. The licensee's investigation was unable to resolve the conflict between these two statements.

At about noon, when the work crew in containment saw cavity water level rising, the contractor supervisor authorized raising the CEA support platform without RSRO supervision. Although procedure 31MT-9RC33 requires verification of the presence of the RSRO, this was not accomplished and is an apparent violation of Technical Specification

6.2.2.1.d (Violation 529/91-49-02). In addition, procedure 420P-2ZZ12 requires the establishment of direct communications between the control room and personnel at the refueling station, which was not accomplished. This is an apparent violation of Technical Specification 3.9.6 (Violation 529/91-49-03). The "relief" crew contract supervisor has stated that he secured the CEA lift at approximately one foot withdrawn to take load cell readings. At this time the CC was calling contractor personnel to inform them of the 1:00 pm briefing when he was told that the CEA lift had already commenced. He ordered that the evolution be stopped. Licensee management was informed and refueling activities were suspended until approximately 3:00 pm on October 27, 1991, while the licensee held debriefings with applicable personnel.

The licensee's corrective actions following the debriefings were to require the RSRO and contractor supervisor to be co-located and to wear distinguishing arm bands, to require RSRO verbal approval each time a new evolution (generally a major procedure step) is started, to require the RSRO to attend all pre-job briefings covering any part of a core alteration, and prior to starting core offload all refueling team members and RSROs must read the night order with these requirements. In addition, the procedures involving core alterations would be reviewed for changes intended to keep them synchronized with the control room procedures. The Unit 2 Plant Manager, with concurrence of the VP-Nuclear Production, authorized resumption of refueling activities with these measures in place or planned.

The inspector's review of the incident determined that although a general procedural limitation to have an SRO present during core alterations existed, and specific signature or initialed steps for SRO presence and direct control room communication existed in the two procedures governing this evolution, the licensee failed to ensure these requirements were met and failed to ensure that operations procedures to establish the prerequisite refueling cavity water level were followed. The inspector concluded that sufficient questions regarding procedural adherence and the adequacy of communications between the contractor crew, the RSRO, and the control room SS existed to have prompted more aggressive action to halt the evolution. In addition, it appeared that neither the RSRO, the contractor crew, the control room, or the CC fully recognized the responsibility and authority of the RSRO to be in direct control of the core alteration activity, nor was it apparent that licensee management had taken steps to ensure that the RSRO was clearly in control of those activities.

The inspector noted that during the CEA withdrawal, the shutdown margin was large due to the high boron concentration in the refueling pool, which is a Technical Specification requirement. However, strict control of core alteration activities is essential for ensuring that the shutdown margin is not reduced and the risk of a fuel handling accident is minimized.

The licensee informed the senior resident inspector of the event at approximately 1:00 pm (MST), on October 27, 1991. This event was discussed in conference calls between licensee and NRC management on October 27, 28, and 29, 1991.

The licensee initiated Condition Report/Disposition Request (CRDR) 2-1-0158 to document their evaluation and corrective actions, and indicated that a Licensee Event Report would be submitted per 10 CFR 50.73.

Three apparent violations of NRC requirements were identified.

3. Reactor Coolant System (RCS) Boron Samples Missed - Unit 2 (60710)

On October 27, 1991, with the reactor in Mode 6, the licensee failed to obtain boron samples of the Spent Fuel Pool (SFP) and the fuel canal prior to opening the gate between them. The purpose of the samples is to ensure that the RCS boron concentration does not become diluted to less that 2150 ppm when the gate is opened. The samples are required by procedure 420P-2ZZ12, "Mode 6 Operations." The fuel canal is connected to the containment refueling pool via valve PCN-V118.

Upon the licensee's identification of the error, the licensee sampled the refueling pool and SFP and confirmed that the boron concentration was adequate. Samples from the previous two days also were reviewed and found to be adequate. A detailed discussed of this event follows.

At approximately 7:00 pm during shift turnover, the off-going Shift Supervisor (SS) inadvertently signed off the first step in the incorrect section (5.3.14 instead of 5.3.15) of the procedure. Section 5.3.14 was required to be performed if the Fuel Transfer Tube Isolation valve, PCN-V118, was closed while filling the refueling pool, and Section 5.3.15 was required to be performed if PCN-V118 was open during the fill.

While the first step of the two sections accomplish the same function (verification that the levels of the fuel canal and SFP are the same), the subsequent steps of section 5.3.14 do not require samples until after the gate is opened and prior to opening PCN-V118. Step 5.3.15.2, which should have been performed next, requires the samples prior to pulling open the gate since PCN-V118 was already open. The off-going SS was aware that PCN-V118 was open during the fill and that a sample was required before the gate was opened. The sample requirement was discussed during shift turnover with the next shift. When personnel on the next shift called to get permission to open the gate, the on-coming shift's Assistant SS saw that the next unsigned step in the procedure was to open the gate and that the sample was not yet required. He authorized opening the gate without verifying this was appropriate, even though it conflicted with the information discussed during shift turnover. This error was discovered by the Shift Technical Advisor at about 10:30 pm. This failure to follow procedure is an apparent violation of Technical Specification 6.8.1 (Violation 529/91-49-04).

The licensee administered its Positive Discipline Program with the SS who signed the incorrect step and the Assistant SS who authorized opening the gate. Additionally, management expectations of shift

turnover, which are proceduralized, were reinforced during briefings with each operating shift. The event was discussed in a conference call between licensee and NRC management on October 28, 1991. The inspector concluded that a lack of attention to detail by the off-going SS and weak turnover communications contributed to this event.

One violation of NRC requirements was identified.

4. Technical Specification Action Statement (TSAS) Requirements Not Met - Unit 2 (71707 and 60710)

On October 27, 1991, at 9:46 pm (MST), with the reactor in Mode 6 (refueling), the Unit 2 Shift Supervisor (SS) discovered during his crew's daily alarm summary review that the annunciator for "120 VAC 1E PNL D27 INVERTER C TRBL" was in alarm. It was determined that the alarm condition was caused by vital class 1E 120 VAC bus PNC-D27, the "C" bus, being powered from its alternate voltage regulated AC source instead of from its battery backed inverter, as required by Technical Specification 3.8.3.2.b. The alarm came in at 5:16 pm, while core alterations (removal of the Upper Guide Structure and its lift rig from the reactor vessel) were in progress.

At the time of this alarm, both the "B" and "D" class 1E batteries were already declared inoperable for outage related maintenance, although the "B" battery was in service and the "D" battery was connected to its bus undergoing an equalizing charge. The licensee has interpreted the TS LCO to require either the "A" and "C" channels (the "A" train), OR the "B" and "D" (the "B" train) channels to be coincidentally operable to meet the TS requirements. The TS LCO basis is to ensure the shutdown or refueling condition can be maintained for an extended time period in the event of a loss of normal AC power, and that sufficient instrumentation and control capability is available for monitoring and maintaining the unit status.

The technical specification action statement (TSAS) requires that following the loss of the normal 120 VAC power supply, core alterations are to be immediately suspended and the electrical configuration restored. However, on October 27, core alterations continued until 6:05 pm, 49 minutes after the alarm indicating the loss of the inverter was received. Operators switched PNC-D27 back to the inverter at 9:50 pm after verifying that the inverter was functional. No cause for the power supply transfer could be identified. The failure to comply with the TSAS is an apparent violation of TS 3.8.3.2.b (Violation 529/91-49-05).

The reactor operator on shift when the alarm came in did not recall seeing or acknowledging the alarm, although the plant computer indicated it had been acknowledged at the time the alarm came in. Additionally, neither the off-going nor on-coming shifts noticed this condition during the board walkdown associated with the shift turnover. The alarm summary review, required by the shift turnover procedure, is separate from the shift turnover and was performed approximately three hours into the next shift.

Procedure 40AC-90P02, "Conduct of Shift Operations," Step 3.2.1.5, requires that onshift personnel shall be aware of and responsible for plant status. They shall remain alert and normally be within their assigned areas. They shall be attentive to instrumentation and respond to abnormal indications until corrected or verified to be false by other instrumentation.

The failure to respond to this abnormal indication is an apparent violation of Technical Specification 6.8.1 (Violation 529/91-49-06). In addition, the licensee's alarm response procedure for this specific alarm notes that the alarmed condition may affect TS LCO's. The licensee responded by initiating Condition Report/Disposition Request (CRDR) 2-1-0163, administering its Positive Discipline Program with the shift supervisor on shift when the alarm came in, and briefing all shifts in all units on the shift turnover procedural requirements and management expectations. Additionally, refueling activities were suspended at 6:00 am on October 28, 1991 by the VP-Nuclear Production, until these actions were completed. This event was discussed in a conference call between licensee and NRC management on October 28, 1991.

The inspector concluded that operator awareness of important alarm conditions and response to alarms during core alterations was deficient, and that the condition should also have been identified during shift turnover. The direct safety significance of this event was low due to the availability of the 'A', 'B', and 'D' batteries.

Two violations of NRC requirements was identified.

5. Exit Meeting

An exit meeting was held on November 14, 1991, with licensee management during which the observations and conclusions in this report were generally discussed. The licensee did not identify as proprietary any materials provided to or reviewed by the inspectors during the inspection. Additional inspection was conducted until December 2, 1991, however, the conclusions presented on November 14, 1991 did not change.