UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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ARLINGTON, TEXAS 76011-4005

July 8, 2004

EA-04-100

Gregg R. Overbeck, Senior Vice President, Nuclear
Arizona Public Service Company
P.O. Box 52034
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SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 - NRC INSPECTION REPORT 05000528/2004011, 05000529/2004011, 05000530/2004011 AND INVESTIGATION REPORT 4-2002-052

Dear Mr. Overbeck:

This refers to the inspection conducted by the Nuclear Regulatory Commission (NRC) into the circumstances of an October 4, 2002, incident involving the movement of irradiated fuel. The purpose of the inspection was to follow up on a failure to follow procedural requirements that resulted in damage to an irradiated fuel assembly. In addition, certain aspects of this incident were investigated by the NRC's Office of Investigations. On June 10, 2004, Mr. Anthony Gody of my staff discussed the results of the NRC's review of this incident with you and members of your staff.

This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, an apparent violation of NRC requirements was identified involving a failure to promptly and adequately communicate important aspects of this incident to appropriate Palo Verde Nuclear Generating Station (PVNGS) management personnel. A detailed discussion of the apparent violation is in the enclosed inspection report. Based on its review of all of the circumstances surrounding this incident, the NRC is concerned that this communication failure may have involved willfulness, i.e., careless disregard for PVNGS procedural requirements that are designed to assure that incidents of this significance are promptly communicated to appropriate levels of plant management. Specifically, it appears that details regarding the seriousness of the incident and steps taken by the spent fuel handling machine operator immediately following the incident were not communicated to appropriate levels of plant management. The NRC is concerned that these communication failures prevented PVNGS management from assessing the circumstances of this incident in a timely manner and taking appropriate corrective actions before fuel handling resumed.

This apparent violation is being considered for escalated enforcement action in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. The current Enforcement Policy is available on the NRC's Web site at www.nrc.gov; select **What We Do**, **Enforcement**, then **Enforcement Policy**. Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued for this apparent violation at this time. In addition, please be advised that the characterization of the apparent violation described in the enclosed inspection report may change as a result of further NRC review.

As discussed with you by telephone, before making a final enforcement decision in this matter, the NRC would like to discuss the apparent violation in a predecisional enforcement conference. The conference, which will be closed to public observation and transcribed, has been scheduled for August 20, 2004, in the NRC's Region IV office in Arlington, Texas. The decision to hold a predecisional enforcement conference does not mean that the NRC has made a final determination that a violation has occurred or that enforcement action will be taken. This conference is being held to obtain information to assist the NRC in making an enforcement decision. This may include information to determine whether a violation occurred, information to determine the significance of a violation, including whether willfulness was involved, and information related to any corrective actions taken or planned. The conference will provide an opportunity for you to provide your perspective on these matters and any other information that you believe the NRC should take into consideration in making a final enforcement decision. You will be advised by separate correspondence of the results of our deliberations on this matter. No response regarding the apparent violation is required at this time.

In addition to the apparent violation, the NRC also has identified four issues that were evaluated under the risk significance determination process as having very low safety significance (green). Three of the findings were determined to be violations of NRC requirements. These violations, which are described in the enclosed inspection report, are being treated as noncited violations, consistent with Section VI.A of the Enforcement Policy. If you contest the violations or the significance of the noncited violations, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to the Regional Administrator, NRC Region IV, the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001, and the NRC Resident Inspector at PVNGS.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

//RA//

Dwight D. Chamberlain, Director
Division of Reactor Safety

Dockets: 50-528; 50-529; 50-530
Licenses: NPF-41; NPF-51; NPF-74

Enclosure:
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ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Dockets:	50-528; 50-529; 50-530
Licenses:	NPF-41; NPF-51; NPF-74
Report No.:	05000528/2004-011; 05000529/2004-011; 05000530/2004-011
Licensee:	Arizona Public Service Company
Facility:	Palo Verde Nuclear Generating Station, Units 1, 2, and 3
Location:	5951 S. Wintersburg Road Tonopah, Arizona
Dates:	January 26 through June 10, 2004
Inspectors:	J. F. Drake, Operations Engineer, Operations Branch P. C. Gage, Senior Operations Engineer, Operations Branch
Approved By:	Anthony T. Gody, Chief Operations Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000528/2004011; 05000529/2004011; 05000530/2004011; January 26 through June 10, 2004; Palo Verde Nuclear Generating Station, Units 1, 2, and 3

The report covered a period of an announced inspection by two regional operations engineers Three Green noncited violations, one Green finding, and one apparent violation with the safety significance to be determined were identified. The significance of most findings is indicated by its color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process." Findings for which the Significance Determination Process does not apply may be green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

NRC-Identified and Self Revealing Findings

Cornerstone: Initiating Events

Inspector Identified Findings

GREEN. The inspectors identified a noncited violation of Technical Specification 5.4.1 associated with a failure to operate the spent fuel handling machine in accordance with Procedure 78OP-9FX03, "Spent Fuel Handling Machine," Revision 16. There were three instances of this: (1) On October 4, 2002, the spent fuel handling machine operator moved fuel assemblies of two differing weights and was not cognizant of design differences of the fuel assemblies and did not stop fuel movement when the load was greater than 50 lbs. different from expected; (2) On October 4, 2002, the spent fuel handling machine operator failed to verify that the hoist was in its full up position prior to moving a spent fuel assembly, and (3) later on October 4, 2002, another spent fuel handling operator failed to verify that the hoist was in its full up position prior to moving a spent fuel assembly. In both Examples (2) and (3), the operators failed to verify the "UP LIMIT" light was on and failed to verify the hoist indicator was at the "UPLIMIT." As a result, in Example (3), the one fuel assembly was damaged. These issues were contrary to Procedure 78OP-9FX03 and resulted in damage to the lower grid assembly of Fuel Assembly P1M316.

This finding is greater than minor because it had an actual impact of damage to an irradiated fuel assembly and, therefore, could be reasonably viewed as a precursor to a significant event. If the fuel cladding had failed, it could have caused a release of fission products to the environment. The finding is of very low safety significance because all mitigation systems were available during the fuel movement operations and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. This finding also had crosscutting aspects in the area of human performance. (Section 4OA2 1.b.1.a)

GREEN. The inspectors identified a noncited violation of Technical Specification 5.4.1 associated with an inadequate abnormal operating procedure. Specifically, the inspectors determined that PVNGS Procedure 40AO-9ZZ22, "Fuel Damage,"

Revisions 1 through 6, were not adequate in that the entry conditions never required operations personnel to enter the procedure and take actions to mitigate the event. Step 1.1 states, in part, "Section 3.0, Irradiated Fuel Damage may be entered when any of the following conditions exist . . . when equipment or component failures result in any of the following: irradiated fuel assembly contacting a solid structure; bubbles emerging from a spent fuel assembly; bent, twisted, or warped spent fuel assembly; or visual damage to spent fuel pin cladding." Since this abnormal operating procedure was never entered, applicable actions were never considered during the Fuel Assembly P1M316 event.

This finding is greater than minor because actions taken in response to fuel handling errors could result in significant fuel cladding damage and effect the barrier cornerstone. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. This finding also had crosscutting aspects in the area of problem identification and resolution. (Section 4OA2 1.b.1.b)

GREEN. The inspectors identified a self-revealing finding of very low safety significance (green) associated with the material condition of the spent fuel handling machine. A number of issues related to material condition, which affected spent fuel handling machine operations, was identified. These included intermittent overload and underload conditions with no identified cause, upender limit switches that often failed or required adjustments during fuel movement, an unreliable hydraulic power unit for the upender machine which occasionally resulted in the upender drifting from the vertical position, and the spent fuel handling machine trolley occasionally stopped for no apparent reason.

This finding is greater than minor because it had an actual impact resulting in damage to an irradiated fuel assembly and, therefore, could be reasonably viewed as a precursor to a significant event. If the fuel cladding had failed, it could have caused a release of fission products. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. (Section 4OA2 1.b.2)

TBD. The inspectors identified an apparent violation of 10 CFR Part 50, Appendix B, Criterion XVI. Specifically, the licensee established measures to assure that conditions adverse to quality are promptly identified and corrected in Procedure 90DP-0IP10, "Condition Reporting." Procedure 90DP-0IP10, Revision 15, Step 3.1.2, required that the shift manager be promptly notified if a condition required immediate action to ensure the safety of plant personnel or equipment. Additionally, Procedure 90DP-0IP10, Appendix B, requires verbal notification to the leader and to the appropriate shift manager. The SFHM operator failed to notify the shift manager and department leader for fuel operations that he took actions which he felt were necessary to place the fuel assembly in a "safe" condition. Additionally, it appears that details regarding the seriousness of the incident and steps taken by the SFHM operator immediately following the incident were not communicated to appropriate levels of plant management (See Section 4OA2 1.b). The failure to notify the shift manager and department leader for fuel operations resulted in an inappropriate organizational response to the Fuel

Assembly P1M316 event that did not involve station management in the decision-making process.

This apparent violation was greater than minor because it had an actual impact on management response for damage to an irradiated fuel assembly and, therefore, could be reasonably viewed as a precursor to a significant event. If the fuel cladding had failed, it could have caused a release of fission products. The safety significance of this finding will be determined pending the outcome of the predecisional enforcement conference. (Section 4OA2 1.b.3)

GREEN. The inspectors identified a noncited violation of 10 CFR Part 50, Appendix B, Criterion XVI, “Corrective Action,” for failing to effectively correct conditions adverse to quality that contributed to the damage to irradiated Fuel Assembly P1M316. Specifically, Criterion XVI states, in part, that “. . . conditions adverse to quality, such as malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected." The licensee failed to effectively correct conditions adverse to quality, which included repeated violations of equipment operating procedures and conduct of operations procedures, as well as long-standing degraded material condition of the fuel handling equipment, that ultimately contributed to the damage of irradiated Fuel Assembly P1M316.

This finding is greater than minor because it had an actual impact of damage to an irradiated fuel assembly and, therefore, could be reasonably viewed as a precursor to a significant event. If the fuel cladding had failed, it could have caused a release of fission products. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. This finding also had crosscutting aspects in the area of problem identification and resolution. (Section 4OA2 1.b.4)

REPORT DETAILS

4. OTHER ACTIVITIES

4OA2 Problem Identification and Resolution

1. Spent Fuel Handling

a. Inspection Scope

The inspectors evaluated the circumstances surrounding a series of spent fuel handling errors that culminated in damage to an irradiated fuel assembly (P1M316) on October 4, 2002, and a failure to enter the issues related to the fuel handling errors into the corrective action program until NRC involvement. The scope of the inspection included a review of: (1) procedural requirements associated with spent fuel handling in the fuel building, such as, communications with licensed operators and the control room, the conduct of operations, equipment operating procedures, abnormal and emergency operations, and the decision making command structure following an abnormal event involving potentially damaged fuel; (2) training and qualifications of refueling machine operators, spent fuel handling machine (SFHM) operators, senior reactor operators limited to fuel handling (LRSO), and other personnel involved in the movement of fuel; (3) the specific circumstances associated with fuel movement errors which occurred on October 4, 2002; (4) the failure to identify and correct operating issues associated with previous fuel handling issues; and (5) a detailed review of external factors, such as, the material condition and reliability of refueling equipment, quality of and adherence to procedures, refueling operations command and control, fatigue, schedule related pressures, human interactions, effectiveness of peer reviews, etc.

b. Assessment

Introduction. On October 4, 2002, improper spent fuel handling operations at the facility resulted in damage to an irradiated fuel assembly. While specific corrective actions had been implemented from previous events, they were not entirely effective in addressing the cumulative effects of fuel handling issues. These problems were found to include procedural issues, ineffective communications, and a tolerance for operating degraded equipment.

In the Procedure Issues Section below, the inspectors identified one self-revealing Green noncited violation associated with the licensee's failure to follow refueling procedure and one self-revealing Green noncited violation associated with an inadequate abnormal operating procedure for damaged fuel. In the Material Condition Issues Section below, the inspectors identified one self-revealing Green finding associated with the poor material condition of the SFHM and its effect on operations. In the Communications Issues Section below, the inspectors identified one apparent violation associated with inadequate communications between the SFHM operator, the shift manager, and the department leader for fuel handling. Finally, in the Corrective Actions Section below, the inspectors identified one self-revealing Green noncited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," for failing to effectively correct numerous operating issues associated with previous fuel movements which ultimately resulted in damage to Fuel Assembly P1M316.

Event Description, Root and Contributing Causes

According to the licensee's investigation, at approximately 10 p.m. on October 4, 2002, the SFHM operator grappled Fuel Assembly P1M316 from the upender machine. While hoisting Fuel Assembly P1M316 out of the upender, the SFHM operator thought the "UPLIMIT" light on the SFHM control console was lit, which was one of the indications that Fuel Assembly P1M316 had cleared the upender machine. The SFHM Procedure 78OP-9FX03, Revision 16, Step 4.3.18, stated, "Raise hoist until "UPLIMIT" light is on. Check hoist indicator to ensure "UPLIMIT" has been reached." Although the "UPLIMIT" light was believed to be checked, the hoist indicator was not checked by the operator. The SFHM operator trolleyed the SFHM out of the fuel handling zone of the spent fuel pool and gave permission to the second operator to sequence the upender machine to the "containment" position. As the upender machine was sequencing to the "containment" position, the SFHM trolley motion stalled. Once the operators recognized that Fuel Assembly P1M316 had not cleared the upender machine, the upender machine sequence was stopped. According to interviews with personnel both directly and remotely involved in the event, approximately 7 inches of the lower part of Fuel Assembly P1M316 was stuck in the upender machine while the top of Fuel Assembly P1M316 was still grappled to the SFHM. Descriptions of the actual position of Fuel Assembly P1M316 were varied, but it is believed that the upender was approximately 5 to 10 degrees from vertical, and the SFHM trolley had traveled approximately 1.5 to 3 feet from the upender position.

The licensee identified that the root cause of the October 4, 2002, fuel damage event was that the SFHM operator failed to ensure that Fuel Assembly P1M316 was clear of the upender machine before moving the SFHM trolley away and authorizing the movement of the upender machine back to the "containment" position. This was contrary to Procedure 78OP-9FX03 and resulted in damage to the lower grid of Fuel Assembly P1M316. Other notable issues contributed to the failure to verify that Fuel Assembly P1M316 was clear of the upender machine before moving the SFHM, these included: inadequate self- and peer-checking, inadequate procedure use, schedule pressure, unclear definitions of responsibilities and authorities between the SFHM operator and the peer checker, inadequate communications on the spent fuel handling machine, weaknesses in training of fuel handling personnel, and a number of equipment design and reliability issues resulting in a lack of sensitivity to certain alarms and indications. Each of these issues, their regulatory implications, and corrective actions are discussed in the sections below.

Recovery Actions, Root and Contributing Causes

As discussed above, the SFHM operator recognized that Fuel Assembly P1M316 was stuck in the upender machine because the SFHM trolley had stalled during SFHM trolley movement. The SFHM operator stated that he believed he had notified the on-shift LSRO and the reactor engineer stationed in the control room of the problem with Fuel Assembly P1M316. The SFHM operator stated that he also believed that the shift manager had been appropriately notified. The licensee's investigation found that implementation of the procedural requirement to maintain direct communications between the control room and personnel at the refueling station described in Procedure 72IC-9RX03, "Nuclear Administrative and Technical Manual," Appendix C,

was not effective. This became apparent through interviews, which demonstrated that, in reality, communications between personnel on the SFHM, LSRO1 in the containment building, the reactor engineer, and the shift manager did not result in a clear understanding of what occurred with Fuel Assembly P1M316.

After the SFHM trolley had stalled and the SFHM operator found the electrical SFHM controls inoperable, the SFHM operator then installed a manual hand wheel on the SFHM trolley and manually hand cranked the SFHM trolley toward the upender machine in an effort to more vertically orient Fuel Assembly P1M316. During interviews, the SFHM operator indicated that the safest orientation for Fuel Assembly P1M316 was vertical over the hoist. The hand-cranking evolution, although not prohibited by procedures, was conducted without authorization from LSRO1 or from the control room. During interviews, LSRO1 indicated that he ordered the SFHM operator to stop fuel movement in the fuel building. The actual timing of LSRO1's order and hand-cranking of the SFHM trolley could not be confirmed. Therefore, the team could not establish if the SFHM trolley was moved after the order was given. Regardless, no other individuals but those on the SFHM were aware that the SFHM trolley had been manually repositioned over the upender machine. Interviews with the SFHM operator indicated that the SFHM trolley was manually moved to place Fuel Assembly P1M316 in a "safe condition." With respect to the premise behind moving the SFHM trolley manually to place Fuel Assembly P1M316 in a "safe condition," the team concluded that the manual movement of the SFHM trolley with Fuel Assembly P1M316 suspended between the SFHM and the upender machine without LSRO1 and shift manager involvement was not appropriate. Furthermore, the team concluded that it would have been a more appropriate decision to evaluate the potential for additional damage to or dropping Fuel Assembly P1M316 before manually hand-cranking the SFHM trolley. After reviewing the design of the grapple assembly and the position of Fuel Assembly P1M316, the team concluded the following: (1) Fuel Assembly P1M316 was stable following the overload trip of the SFHM trolley, and (2) dropping Fuel Assembly P1M316 during hand-cranking was not a probable event.

In an effort to understand the communications that took place between the SFHM operator and others on the communications circuit, a number of personnel were interviewed. The LSRO1 indicated that he remembered being informed by the SFHM operator that Fuel Assembly P1M316 was stuck in the upender. The LSRO1 indicated that even though he asked a number of pertinent questions, he was not getting a clear picture of what happened in the fuel building. The LSRO1 indicated that he surmised that the SFHM trolley had been moved out of the refueling zone because the interlocks would have prevented the upender machine from sequencing to the "containment" position until the SFHM trolley was at that location. After LSRO1 gave the order to stop all activities in the fuel building, he contacted another licensed operator limited to fuel movement (LSRO2), who was not on watch at the time to investigate the status of Fuel Assembly P1M316. When LSRO2 arrived in the fuel building, he noted that personnel on the SFHM were about to install a handwheel on the hoist and ordered them to stop. The LSRO2 asked the personnel on the SFHM what they intended to do and if they had moved the upender machine. The SFHM operator replied they were about to manually lift Fuel Assembly P1M316 out of the upender machine and "no," they had not moved the upender machine. It was determined through interviews with the fuel handling team that the upender machine actually had been sequenced to the "containment" position

after the SFHM trolley had been moved out of the fuel handling zone and that the SFHM trolley had been manually repositioned over the upender after the overload trips had been received prior to LSRO2 arriving in the fuel building.

The licensee identified that the root cause of the improper actions associated with not involving LSRO1 and the shift manager in the decision making process following the Fuel Assembly P1M316 event was that SFHM operators lacked sensitivity to fuel handling events. Contributing causes identified by the licensee included: (1) previous corrective actions to improve communications were not effective, (2) pre-job briefings did not address the notification process for off-normal conditions, (3) the event checklist did not accomplish its purpose, (4) training and pre-job briefs did not ensure SFHM operators were knowledgeable of the entry conditions for the abnormal operating procedure for fuel damage, and (5) senior reactor operators limited to fuel handling were reluctant to establish communications directly with control room supervision. Each of these issues, their regulatory implications, and corrective actions are discussed in the sections below.

Corrective Actions, Root and Contributing Causes

On October 9, 2002, an NRC manager contacted the department leader for fuel operations to discuss fuel bowing issues. During that discussion, the NRC manager inquired about operator errors noted in reactor engineering logs. The NRC manager found that the department leader was not aware of what the operator errors referred to (ultimately, the Fuel Assembly P1M316 event) and that no corrective actions had been taken. Following the teleconference, the licensee initiated a Significant Condition Report/Deficiency Report (CRDR) 2559423 and an investigation was commenced. On October 10, 2002, the licensee conducted inspections of Fuel Assembly P1M316 and found damage that resulted in the fuel assembly not being reloaded.

The inspectors identified several issues related to the implementation of the licensee's problem identification and resolution program. The first issue was that the initial actions taken by the SFHM operator to recover Fuel Assembly P1M316 were not in accordance with procedures on conduct of operations and condition reporting (see below). Second, the licensee failed to take corrective actions to resolve previous operational issues surrounding the fuel movement (some of which involved procedural violations, see below). This was particularly important since it was noted in the licensee's subsequent investigation that a precursor event had occurred when an SFHM operator was moving an irradiated fuel assembly while it was not at the "UPLIMIT" position. Third, no CRDR had been initiated and no verbal notification to the SFHM operator's leader (department leader for fuel operations) or the shift manager until the NRC manager contacted the department leader for fuel operations 5 days later. Although the SFHM operator drafted a statement regarding the events that took place while he was on watch before he left for home, he did not share that statement with anyone. These issues were contrary to the condition reporting process (see below). The actual communications that took place were vague and failed to communicate the pertinent details of the Fuel Assembly P1M316 event nor did the SFHM operator communicate the subsequent recovery actions taken independently by the SFHM operator on his own volition. The SFHM operator indicated that he needed to take those actions to place Fuel Assembly P1M316 in a "safe condition."

.1 Procedure Issues

.1a *Failure to follow Procedures*

Introduction. Three examples of a Green noncited violation were identified for failure to follow procedures as prescribed in Technical Specification 5.4.1.

Description. On October 4, 2002, during core offload, there were three instances where licensee personnel failed to operate the spent fuel handling machine in accordance with Procedure 78OP-9FX03, "Spent Fuel Handling Machine," Revision 16. As a result of failing to follow procedures, Fuel Assembly P1M316 was damaged and was subsequently not reloaded into the core due to the damage. These errors were documented in CRDR 2711453.

In the root cause analysis for CRDR 2711453 and subsequent interviews with refueling personnel, it was determined that there had been numerous overload trips of the spent fueling handling machine, with no apparent cause. The licensee identified the cause of these overload trips as being associated with the overload setpoint of the spent fuel handling machine (approximately 1633$\pm$ 12.5lbs). The core was loaded with two different fuel assembly designs. One fuel assembly weighed approximately 1600 lbs. and the other weighed approximately 1750 lbs. The SFHM operators were not aware of the differences in the weight of the fuel assemblies and did not follow Procedure Step 4.3.17, which required the operator to monitor fuel assembly weights and to stop and determine the problem if the load was greater than 50 lbs over the expected load.

There were two instances where the SFHM operators failed to verify the hoist had reached its upper travel limit. Procedure Step 4.3.18, required the operators to verify that the "UPLIMIT" light was lit and that the "UPLIMIT" was reached. The "UPLIMIT" was verified by checking a manual position indicator called a Durant counter. Earlier in the day, the licensee documented an event where the SFHM operators traversed the spent fuel handling machine trolley out of the fuel handling zone without the fuel assembly being fully retracted. No fuel damage occurred during this event; however, it was a precursor to the next event that resulted in fuel damage.

As fuel movement continued, the operators damaged Fuel Assembly P1M316. This damage was the result of failing to verify the fuel assembly was at the "UPLIMIT" prior to moving the fuel assembly away from the upender in the spent fuel pool. For details on this event see Section 4AO2 1.b.

Analysis. The deficiency associated with this event was that licensee personnel failed to follow procedures required by Technical Specifications, which resulted in fuel damage. This finding was more than minor because damage to irradiated Fuel Assembly P1M316 occurred as a result of a failure to follow prescribed procedures. The operating issues associated with fuel handling operations could be reasonably viewed as a precursor to a more significant event affecting the barrier integrity cornerstone. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. This finding had crosscutting aspects in the area of human performance.

Enforcement

Technical Specification 5.4.1 requires, in part, that written procedures be established, implemented, and maintained as recommended in Appendix A of Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2, February 1978. Regulatory Guide 1.33, Revision 2, Appendix A, provides the typical activities that should be covered by written procedures. Section 2.l. specifies that general plant operating procedures be developed for refueling and core alterations.

Accordingly, (1) Procedure 78OP-9FX03, Step 4.3.17, required the SFHM operator to "Monitor load cell indication. It should be ±50 lbs. of assembly weight (if exceeded, stop and determine problem before continuing)," and (2) Procedure 78OP-9FX03, Step 4.3.18, required the SFHM operator to, “Raise hoist until ‘UP LIMIT’ light is on. Check hoist indicator to ensure ‘UPLIMIT’ has been reached,” prior to moving irradiated fuel as required by the fuel transfer form.

Contrary to the above: (1) On October 4, 2002, the SFHM operator moved fuel assemblies of two differing weights and was not cognizant of design differences of the fuel assemblies and did not stop fuel movement when the load was 50 lbs. greater than expected. One fuel assembly design weighed approximately 1600 lbs. and the other weighed approximately 1750 lbs. Because of the lack of knowledge of the two differing designs of fuel weight, the operator could not have adequately followed the guidance of the procedural steps listed above. (2) On October 4, 2002, on two occasions, SFHM operators failed to verify that the hoist was in its full up position prior to moving a spent fuel assembly. The operators failed to verify the “UPLIMIT” light was on and failed to verify the hoist indicator was at the “UPLIMIT.” As a result, one fuel assembly was damaged. Because these examples of failure to follow refueling procedures are of very low safety significance and have been entered into the licensee’s corrective action program (CRDR 2711971), this violation is being treated as a noncited violation, consistent with Section VI.A of the NRC Enforcement Policy: Noncited Violation 05000528; 05000529; 05000530/2004011-01, Failure to Follow Refueling Procedure 78OP-9FX03, “Spent Fuel Handling Machine,” Revision 16.

.1b *Inadequate Procedure*

Introduction. A Green noncited violation was identified for failure to establish an adequate procedure for an abnormal condition (damaged irradiated fuel assembly) as prescribed in Technical Specification 5.4.1.

Description. The inspectors determined that the fuel damage abnormal operating procedure was not adequate. Following the Fuel Assembly P1M316 event, the licensee identified that SFHM operators were not adequately trained or pre-briefed on the entry conditions for Procedure 40AO-9ZZ22, “Fuel Damage.” This, combined with inadequately defined entry conditions for Procedure 40AO-9ZZ22, contributed to the failure to take the appropriate actions immediately following the Fuel Assembly P1M316 event. The inspectors determined that PVNGS Procedure 40AO-9ZZ22, Revisions 1 through 6, were inadequate, in that, the entry conditions did not require operations personnel to enter the procedure and take any immediate actions to mitigate the event. Specifically, Step 1.1 states, in part, “Section 3.0, Irradiated Fuel Damage may be

entered when any of the following conditions exist . . . when equipment or component failures result in any of the following: irradiated fuel assembly contacting a solid structure; bubbles emerging from a spent fuel assembly; bent, twisted, or warped spent fuel assembly; or visual damage to spent fuel pin cladding." The SFHM operator contacted a solid structure and damaged the fuel assembly but did not enter Procedure 40AO-9ZZ22. Although no actual fuel cladding damage occurred during this event, the inspectors concluded the procedure failed to require any immediate corrective actions.

Analysis. The inspectors determined this deficiency was an inadequate abnormal procedure for combating emergencies as required by Technical Specification 5.4.1. This finding is more than minor because actions taken in response to fuel handling errors could result in significant fuel cladding damage and effect the barrier cornerstone. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. This finding had crosscutting aspects in the area of problem identification and resolution.

Enforcement

Technical Specification 5.4.1 requires, in part, that written procedures be established, implemented, and maintained as recommended in Appendix A of Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2, February 1978. Regulatory Guide 1.33, Revision 2, Appendix A, provides the typical activities that should be covered by written procedures. Section 6.x. specifies procedures for combating emergencies for irradiated fuel damage, including immediate operator actions.

Contrary to the above, Procedure 40AO-9ZZ22, "Fuel Damage," Revisions 1 through 6, failed to develop entry conditions and required steps that would have resulted in the immediate operator actions taking place after irradiated Fuel Assembly P1M316 was stuck in the upender (contacted a solid structure) and was damaged during movement on October 4, 2004. Specifically, the inspectors determined Procedure 40AO-9ZZ22, Revisions 1 through 6, were inadequate, in that, the entry conditions did not require operations personnel to enter the procedure and take immediate actions to mitigate the event. Step 1.1 states, "Section 3.0, Irradiated Fuel Damage may be entered when any of the following conditions exist: . . . when equipment or component failures result in any of the following: irradiated fuel assembly contacting a solid structure; bubbles emerging from a spent fuel assembly; bent, twisted, or warped spent fuel assembly; or visual damage to spent fuel pin cladding." Since this abnormal operating procedure was never entered, applicable actions were never considered during the Fuel Assembly P1M316 event. Because this example of an inadequate procedure is of very low safety significance and has been entered into the licensee's corrective action program (CRDR 2711453), this violation is being treated as a noncited violation, consistent with Section VI.A of the NRC Enforcement Policy: noncited violation 05000528; 05000529; 05000530/2004011-02, Inadequate Procedure 40AO-9ZZ22, "Fuel Damage," Revisions 1 through 6.

.2 *Material Condition*

Introduction. The inspectors identified a self-revealing Green finding associated with a number of SFHM material condition issues that contributed to damage to Fuel Assembly P1M316.

Description. A number of issues related to material condition, which affected SFHM operation, were identified. These included intermittent overload and underload conditions with no identified cause, upender limit switches that often failed or required adjustments during fuel movement, an unreliable hydraulic power unit for upender machine, which occasionally resulted in the upender drifting from the vertical position, and an instance, when the SFHM trolley occasionally stopped for no apparent reason. The intermittent overload and underload trips and alarms desensitized SFHM operators to those alarms and may have contributed to the Fuel Assembly P1M316 event because an overload condition stops hoist movement in a manner similar to the uplimit condition. The overload condition could be mistaken for an uplimit condition if the SFHM operator did not verify other indications. That could explain why Fuel Assembly P1M316 had not cleared the upender machine prior to trolley movement. Past problems with the upender, such as, limit switch adjustments and hydraulic leakage, resulted in the upender drifting off vertical and causing overload conditions while moving irradiated fuel in and out of the upender. These past problems, combined with misstatements about operation of the upender during the Fuel Assembly P1M316 event, misled operators in thinking that the Fuel Assembly P1M316 event may have been a result of upender drifting problems.

During interviews of operators and technicians, the inspectors found that these material condition problems occasionally resulted in operators opening control cabinets and manipulating wires and hardware to get the machinery to operate again. In addition, the inspectors noted that the licensee used a general open work order to document and facilitate repairs to fuel handling equipment. The general open work order would be periodically closed and disposed of since it was not considered a quality record. The practice of not documenting material condition problems in a program capable of tracking the issues resulted in several problems: (1) many material condition issues were not retrievable, (2) material condition issues resulting in operational work-arounds were not reported to station management unless they had a schedule impact, (3) problem trending was not possible, and (4) no assessment of the cumulative impact of the material condition problems and their impact on operations was conducted. On May 17, 2002, CRDR 2506874 was written in an apparent effort to inform management of continued problems with refueling equipment reliability. The CRDR indicated that during “the last two refueling outages . . . manual operations of limit switches or associated equipment had to be used to complete core off-load or re-load . . . these are not ideal means . . . and are precursors to more serious events.” The inspectors reviewed the closure of CRDR 2506874 and found that it had been closed in two other CRDR’s (2507835 and 2512708), which were limited to specific material issues rather than an overall assessment of the cumulative impacts that the poor SFHM material condition had on operations.

The licensee implemented a number of corrective actions on or after October 17, 2002, to address the aforementioned material condition issues. The team reviewed these

corrective actions and found them to be appropriate with some notable comments, which are discussed in the Corrective Action section below.

Analysis. The inspectors identified a self-revealing Green finding associated with a number of SFHM material condition issues that contributed to the Fuel Assembly P1M316 event. These findings were more than minor because damage to irradiated Fuel Assembly P1M316 occurred as a result of operational issues that involved a failure to follow prescribed operating procedures complicated by SFHM material condition issues. The operational issues associated with fuel handling operations and Fuel Assembly P1M316 post event actions could be reasonably viewed as precursors to a more significant event affecting the barrier integrity cornerstone. The finding is of very low safety significance because all mitigation systems were available and would have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100 .

Enforcement. None.

.3 *Communications*

Introduction. An apparent violation was identified for inadequate communications between the SFHM operator, the shift manager, and the department leader for fuel handling as prescribed in Procedure 90DP-0IP10, “Condition Reporting,” Revision 15.

Description. The inspectors identified one apparent violation associated with inadequate communications between the SFHM operator, the shift manager, and the department leader for fuel handling. As discussed earlier, LSRO1 indicated he was unable to obtain a clear picture of what had happened in the fuel building. Also during interviews, the shift manager and other licensed operators in control indicated that they were not aware of the spent fuel handling errors that culminated in damage to Fuel Assembly P1M316. Although the SFHM operator wrote a statement describing the event at the end of the shift, he did not share the statement with responsible licensee managers until several days after the event. Finally, the organizational response to the Fuel Assembly P1M316 event indicated that communications between the shift manager, LSRO1, and the SFHM operator were ineffective in keeping the licensee management informed of the status of Fuel Assembly P1M316.

As a result of the inadequate communications, responsible licensee managers were not aware of the event, its significance, and the circumstances until NRC questioning 5 days later. Given the SFHM operator’s normal position in the organization (LSRO1 and LSRO2's supervisor) and familiarity with the condition reporting procedure, it appears he should have ensured that communication to the appropriate levels of management occurred to properly identify the causes of the event and to take effective corrective actions before resuming fuel movement.

Analysis. TBD. The inspectors identified an apparent violation of PVNGS corrective action procedure. The apparent violation involved inadequate notification and communications between the SFHM operator, the shift manager, and the department leader for fuel operations. This finding was more than minor because damage to irradiated Fuel Assembly P1M316 occurred and ineffective communications contributed

to the inadequate organizational response to place equipment in a safe condition and correct operational issues prior to resuming fuel movement. The operational issues associated with fuel handling operations and Fuel Assembly P1M316 post event actions could be reasonably viewed as precursors to a more significant event affecting the barrier integrity cornerstone.

Enforcement. Criterion XVI of 10 CFR Part 50, Appendix B, states, in part, that, "[m]easures shall be established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management."

Accordingly, the licensee established measures to assure that conditions adverse to quality were promptly identified and corrected in Procedure 90DP-0IP10. Procedure 90DP-0IP10, Step 3.1.2, required that the shift manager be promptly notified if a condition required immediate action to ensure the safety of plant personnel or equipment. Procedure 90DP-0IP10, Appendix B, indicated that if the condition required immediate action to ensure the safety of plant personnel or equipment, the originator shall provide verbal notification to his or her leader and to the appropriate shift manager. In addition, it required a CRDR to be completed as soon as practical.

Contrary to the above, on October 4, 2002, the SFHM operator failed to notify the shift manager and department leader for fuel operations that he took actions which he felt were necessary to place the fuel assembly in a "safe" condition. Additionally, it appears that details regarding the seriousness of the incident and steps taken by the SFHM operator immediately following the incident were not communicated to appropriate levels of plant management (See Section 4OA2 1.b). The failure to notify the shift manager and department leader for fuel operations resulted in an inappropriate organizational response to the Fuel Assembly P1M316 event that did not involve station management in the decision-making process. (AV 05000528; 05000529; 05000530/2004011-03)

.4 *Corrective Actions*

Introduction. The inspectors noted a number of failures to correct the operational issues associated with refueling activities. This contributed to the damage to Fuel Assembly P1M316 and was a self-revealing Green noncited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action."

Description. The inspectors reviewed condition reports, root cause analyses, interviews, and evaluation reports that revealed a broad pattern of operational issues that had not been corrected before the damaged Fuel Assembly P1M316 event. These previous operational issues included: failure to conduct adequate pre-job briefs, moving the spent fuel handling machine with a fuel assembly without the "UPLIMIT" light, no second/peer checker, lack of oversight at the spent fuel pool, failure to use the "Event Check List" for notification of off normal issues, and failure to reset the SFHM overload setpoint. The licensee identified all (except moving the SFHM without the "UPLIMIT"

light, which became self-revealing after damage occurred to Fuel Assembly P1M316) of the above operational issues after the fall 2001 and spring 2002 refueling outages. The licensee took corrective actions to address each of these issues; however, while specific fuel handling program issues were addressed, the corrective actions were not adequate to correct broad operational issues. For instance, the licensee instituted pre-job briefs, but the briefs failed to identify the occurrence of hoist overloads and necessity to ensure the fuel assembly was clear of the upender. In addition, a peer checker was assigned to the SFHM, but no procedural requirements or guidance was given to or discussed with the peer checker. In fact, this peer checker was relatively new to the site and had never done fuel movement and was not aware of his responsibilities as a peer checker. The inspectors found that these same issues contributed to the damage to Fuel Assembly P1M316.

The licensee implemented a number of corrective actions before the Fuel Assembly P1M316 event to address the operational issues. As noted by the licensee's investigation, the corrective actions taken before October 4, 2002, were ineffective at preventing the Fuel Assembly P1M316 event.

As discussed in Section 4OA2 b.1, the procedural requirements to verify that the indicated weight of a fuel assembly being moved is within $\pm$ 50 lbs. of the expected weight could not be effectively implemented. The problem was, in part, due to no documentation being provided to the fuel handlers as to the expected weight of the assembly. In addition, the different assembly weights combined with one set of alarm setpoints resulted in a number of overload alarms when no overload condition existed. Preconditioning of operators to alarms resulted in a decrease in the sensitivity to potential abnormal conditions. The licensee had in fact identified the differences in fuel assembly weights and had reset the refueling machine overloads to a higher setpoint, but did not reset the SFHM overload setpoints.

Analysis. The inspectors identified a noncited violation associated with a failure to properly implement corrective actions associated with previous conditions adverse to quality. This finding was more than minor because damage to irradiated Fuel Assembly P1M316 occurred as a result of identified adverse conditions not being corrected. The operational issues associated with fuel handling operations and Fuel Assembly P1M316 post event actions could be reasonably viewed as precursors to a more significant event affecting the barrier integrity cornerstone. The finding is of very low safety significance because all mitigation systems were available and should have prevented an unplanned release of radioactive material to the environment above the limits of 10 CFR Part 100. The finding had crosscutting aspects in the area of problem identification and resolution.

Enforcement. Criterion XVI of 10 CFR Part 50, Appendix B, states, in part, that, "Measures shall be established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected."

Contrary to the above, the licensee failed to effectively correct conditions adverse to quality that contributed to the damage of irradiated Fuel Assembly P1M316. Because the damage to Fuel Assembly P1M316 did not involve damage to the cladding, the

ineffective corrective actions were of very low safety significance and have been entered into the licensee's corrective action program as CRDR 2711971. This violation is being treated as a noncited violation consistent with Section VI.A of the NRC Enforcement Policy: Noncited Violation 05000528; 05000529; 05000530/2004011-04, *Ineffective Corrective Actions.*

4OA6 Meetings, Including Exit

On June 10, 2004, the inspectors presented the inspection results to Greg Overbeck and other members of his staff who acknowledged the findings. The inspectors confirmed that proprietary information was not provided or examined during this inspection

ATTACHMENT

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel

G. Overbeck, Senior Vice President
David Mauldin, Vice President Engineering and Support
D. Smith, Plant Manager
W. Chapin, Nuclear Fuel Management Department Leader
S. Bauer, Regulatory Affairs Department Leader
J. Taylor, Operations Department Leader
P. Crawley, Life Cycle Management Director
C. Seaman, Nuclear Fuel Management Director
R. Henry, Site Representative
R. Buzzard, Regulatory Affairs Senior Consultant
K. Manne, Senior Attorney
J. Gutierrez, Attorney

NRC personnel

N. Salgado, Senior Resident Inspector
J. Melfi, Resident Inspector

LIST OF ITEMS OPENED AND CLOSED

Opened and Closed

05000528; 05000529; 05000530/2004011-01	NCV	Failure to Follow Refueling Procedure 78OP-9FX03, "Spent Fuel Handling Machine," Revision 16, resulting in damage to irradiated Fuel Assembly P1M316 (Section 40A2 1.b.1.a)
05000528; 05000529; 05000530/2004011-02	NCV	Inadequate Procedure 40AO-9ZZ22, "Fuel Damage," Revisions 1 through 6 (Section 40A2 1.b.1.b)
05000528; 05000529; 05000530/2004011-04	NCV	Inadequate corrective actions contributed to damage to fuel assembly. (Section 40A2 1.b.4)

Opened

05000528; 05000529; 05000530/2004011-03	AV	Failure to effectively notify the shift manager and department leader for fuel operations resulted in an inappropriate organizational response to the Fuel Assembly P1M316 event that did not involve station management in the decision-making process (Section 40A2 1.b.3)

LIST OF DOCUMENTS REVIEWED

Procedures

78OP-9FX03 Spent Fuel Handling Machine, Revision 14
78OP-9FX03 Spent Fuel Handling Machine, Revision 15
78OP-9FX03 Spent Fuel Handling Machine, Revision 16
78OP-9FX03 Spent Fuel Handling Machine, Revision 17
78OP-9FX03 Spent Fuel Handling Machine, Revision 18
78OP-9FX03 Spent Fuel Handling Machine, Revision 19
78OP-9FX03 Spent Fuel Handling Machine, Revision 20
78OP-9FX03 Spent Fuel Handling Machine, Revision 21
78OP-9FX02 Fuel Transfer Machine, Revision 7
78OP-9FX02 Fuel Transfer Machine, Revision 8
78OP-9FX02 Fuel Transfer Machine, Revision 9
78OP-9FX01 Refueling Machine Operations, Revision 12
78OP-9FX01 Refueling Machine Operations, Revision 13
78OP-9FX01 Refueling Machine Operations, Revision 14
78OP-9FX01 Refueling Machine Operations, Revision 15
78OP-9FX01 Refueling Machine Operations, Revision 16
78ST-9FH02 Fuel Building Crane Travel, Revision 5
40DP-9AP18 Abnormal Operating Procedures Users Guide, Revision 2
40DP-9OP33 Shift Turnover, Revision 12
72IC-9RX03 Core Reloading, Revision 15
72IC-9RX03 Core Reloading, Revision 16
72IC-9RX03 Core Reloading, Revision 17
72IC-9RX03 Core Reloading, Revision 18
72IC-9RX03 Core Reloading, Revision 19
72IC-9RX03 Core Reloading, Revision 20
72IC-9RX03 Core Reloading, Revision 21
40AO-9ZZ22 Fuel Damage, Revision 1
40AO-9ZZ22 Fuel Damage, Revision 2
40AO-9ZZ22 Fuel Damage, Revision 3
40AO-9ZZ22 Fuel Damage, Revision 4
40AO-9ZZ22 Fuel Damage, Revision 5

40AO-9ZZ22 Fuel Damage, Revision 6
40AO-9ZZ22 Irradiated Fuel Damage, Revision 0
40DP-9OP02 Conduct of Shift Operations, Revision 17
40DP-9OP02 Conduct of Shift Operations, Revision 18
40DP-9OP02 Conduct of Shift Operations, Revision 19
40DP-9OP02 Conduct of Shift Operations, Revision 20
40DP-9OP02 Conduct of Shift Operations, Revision 21
40DP-9OP02 Conduct of Shift Operations, Revision 22
40DP-9OP02 Conduct of Shift Operations, Revision 23
40DP-9OP02 Conduct of Shift Operations, Revision 24
40DP-9OP02 Conduct of Shift Operations, Revision 25
40DP-9OP02 Conduct of Shift Operations, Revision 26
40DP-9OP02 Conduct of Shift Operations, Revision 27
40DP-9OP02 Conduct of Shift Operations, Revision 28
78TI-9RX01 Spent Fuel Inspection, Revision 1
30DP-9MP12 Overhead Hoisting Systems, Revision 10
90DP-0IP10 Condition Reporting, Revision 15
84DP-0RM30 Record Control and Turnover, Revision 15
72DP-9NF01 Control of SNM and Inventory, Revision 9
40ST-9ZZM6 Operations Mode 6 Surveillance Logs, Revision 5
70DP-0OP18 Engineering Test Conduct
01DP-0EM10 Fitness for Duty Program, Revision 13
40OP-9ZZ23 Outage GOP, Revision 25

Limited Senior Reactor Operator Initial Training Program

Fuel Handlers Training Program
Training Records for Fuel Handlers
Training Records for Reactor Engineers
Training Records for LSRO's
Qualification Records for various operators
Palo Verde Nuclear Fuel System Design Dimensions Fuel Assembly plus Rod Assemblies
Condition Report Deficiency Reports related to Refueling from 27 April 2001 to 24 January 2004.
Work Orders associated with refueling equipment
Controlled Work Packages for refueling equipment