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SUBJECT: Provides status rept of progress to eliminate possibility of multiple CEA drop events.

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WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
NUCLEAR

Docket Nos. STN 50-528/529/530

Document Control Desk
U. S. Nuclear Regulatory Commission
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Washington, D. C. 20555

Dear Sirs:

Reference: NRC Letter Dated April 6, 1990, Subject: Multiple Control Element Assembly (CEA) Drop Events - Palo Verde Nuclear Generating Station (PVNGS)

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Status of Improvements to Eliminate the Possibility of Multiple CEA Drop Events
File: 90-056-026

The referenced letter requested the status of activities and implementation schedule for improvements outlined in "Justification for Continued Operation - Control Element Assembly (CEA) Drop Events, Revision 3." This letter provides the status of progress made to date and the schedule for future enhancements to the system.

Substantiation of Root Cause of Failure

In the Justification for Continued Operation (JCO), letter to the NRC dated October 25, 1989, APS concluded that the root cause of the multiple CEA slip in Unit 1 was insulation damage to the coil lead wires from a manufacturing deficiency. This defect combined with motion of the lower lift coil during CEA movement resulted in intermittent grounding of the lower lift coil lead wires. This intermittent grounding introduced noise into the Control Element Drive Mechanism Control System (CEDMCS) circuitry which interfered with the holding voltage of another CEA and eventually resulted in the only observed double CEA slip. This root cause determination has been substantiated by inspection and testing of those coils which exhibited intermittent grounding in Units 1 and 2. Inspection has shown that all coils which had previously exhibited grounding had evidence of arcing between the lead wire and the area where the lead wire penetrates the coil housing assembly (nipple).

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The motion of the coils may have contributed to the insulation damage, but there is no evidence to date which indicates that coil motion alone could cause insulation wear to the extent that arcing could occur between the lead wire and nipple assembly. Inspection of coils in the manufacturers test facility with the equivalent of 18 years of operation showed no insulation damage that would lead to arcing of the wires to ground.

Status of Corrective Actions

To eliminate existing manufacturing defects in CEA coil insulation APS committed, in the JCO, to implement a program to inspect coil insulation, replace defective coils (coils which have greater than minor surface damage to the leads) with new coils which have been sleeved, and sleeve all CEDM coil leads (not limited to the lower lift coils). This program will be completed in accordance with the following schedule:

Unit 1 - Coil lead sleeving is complete. Of the 89 CEDM stacks inspected, 14 lower lift coils, 3 upper lift coils, and 1 lower gripper coil required replacement due to insulation damage. All CEAs have been stepped following sleeving and no CEDMCS grounds were detected.

Unit 2 - Coil lead sleeving in progress with 69 of 89 coils completed. All work will be completed prior to restart from the current outage.

Unit 3 - Inspection program to be performed at the next scheduled refueling outage.

The above inspection, replacement of coils with damaged insulation, and modification of coil lead insulation by sleeving reduces the possibility that future CEDM coil lead ground faults will occur.

APS, with the assistance of Combustion Engineering, has performed lower lift coil motion tests to determine methods of minimizing the lower lift coil motion associated with CEA movement and eliminating wear as a contributor in coil lead grounding. These tests concluded that coupling of the lower latch and lift magnetic fields by reversing the polarity of the lower latch coil minimizes lower lift coil motion. APS Engineering is currently preparing a permanent design change for reversing coil polarity to further eliminate the causes of intermittent grounding and improve long term coil life. This design change will be completed for implementation during the next series of refueling outages.

The aforementioned sleeving of coil leads, replacement of defective coils, and implementation of the design change for polarity reversal will correct the root cause of intermittent coil grounding.

To detect future ground faults within CEDMCS, APS has developed a modification to the CEDM ground fault detection system to assure continuous monitoring and

annunciation of any future CEDM ground faults. This eliminates the need for monitoring the ground detector by operations personnel during CEA movement, as required by the current JCO, and allows automatic CEDMCS operation.

This enhancement to the ground fault detector is currently installed in Unit 1. The modification has been functionally tested and proven to be capable of providing Control Room alarms in response to CEDMCS grounds. The modified ground fault detector will be installed in Unit 2 prior to startup from the current refueling outage. Since installation of the ground fault detector modification requires the CEDMCS to be deenergized, Unit 3 will not have the modified detector installed until the next outage of sufficient duration. Until that modification is complete in Unit 3, CEDMCS will remain in manual control, and operations personnel will monitor for grounds at the CEDM ground fault detector meter during CEA movement.

To ensure that any future ground faults are properly responded to, Control Room alarm response procedures have been changed to direct operations personnel to cease CEA motion in the event of an alarm, except to place the Unit in a safe condition, and to contact Engineering for evaluation of the nature of the ground. This action provides early detection of existing ground faults within the CEDMCS and ensures corrective action prior to an existing ground fault deteriorating to a point where it could interfere with the operation of other CEAs.

Long Term System Enhancements

In the long term APS will continue to investigate if any enhancements such as reducing CEDMCS sensitivity to noise, and/or modifications to the protection system are needed. These efforts are as follows:

- A change to the silicon controlled rectifier firing circuitry is being investigated as a modification of the CEDMCS design to reduce its sensitivity to noise.

- A proposal has been received from Combustion Engineering for modifying CEAC software such that a reactor trip occurs on all multiple rod drops or slips beyond Technical Specification limits. This proposal has not been executed pending the evaluation of design modifications to the CEDMCS to reduce its' susceptibility to noise.

Conclusion

The corrective actions outlined above will virtually eliminate the only source of noise to have caused a multiple CEA slip/drop event. The sleeving of the coil leads will return the coils to the as designed condition. Reversing the polarity of the lower latch coil will minimize coil motion, enhance coil life, and reduce the possibility of intermittent grounding. The changes to operations procedures to ensure APS Engineering evaluates future ground indications and the improvement

in the CEDM ground detector circuitry will allow detection and correction of future ground faults prior to their deteriorating to a point where they could cause a multiple CEA slip/drop event. All these actions represent the defense in depth approach taken by APS to prevent any future CEA multiple slip/drop events. In addition to these corrective actions APS is investigating long term enhancements which, while not required for continued operation, may decrease the likelihood of any other source of noise interfering with CEDMCS operation.

Sincerely,

cc: T. L. Chan
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