UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 16, 2008

Mr. Randall K. Edington
Executive Vice President Nuclear/
Chief Nuclear Officer
Mail Station 7602
Arizona Public Service Company
P. O. Box 52034
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 – REQUEST FOR ADDITIONAL INFORMATION RE: GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED WATER REACTORS" (TAC NOS. MC4702, MC4703, AND MC4704)

Dear Mr. Edington:

By letter dated February 29, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080710546), Arizona Public Service Company (APS, the licensee) submitted a supplemental response to Generic Letter (GL) 2004-02 for Palo Verde Nuclear Generating Station, Units 1, 2, and 3. The Nuclear Regulatory Commission (NRC) staff has reviewed the information provided and determined that additional information is required in order to complete the evaluation. The request for additional information (RAI) was discussed between the NRC staff and Mr. Russell Stroud, Douglas Spaulding, and Thomas Engbring of APS on December 2, 2008.

By letter dated December 3, 2008 (ADAMS Accession No. ML083230937), the NRC staff provided an extension to APC to provide the revised supplemental response to GL 2004-02 by December 19, 2008. Based on discussions between the NRC staff and Mr. Russell Stroud of APS on December 12, 2008, the licensee may submit a single supplemental response incorporating the response to this RAI into the final response within 90 days from the date of this letter.

If you have any questions, please contact me at 301-415-3016.

Sincerely,

Balwant K. Singal

Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Enclosure:
As stated

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REQUEST FOR ADDITIONAL INFORMATION

ARIZONA PUBLIC SERVICE COMPANY, ET. AL.

PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

DOCKET NOS. STN 50-528, STN 50-529, AND STN 50-530

By letter dated February 29, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080710546), Arizona Public Service Company (APS, the licensee) submitted a supplemental response to Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors," for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. The Nuclear Regulatory Commission (NRC) staff has reviewed the information provided and determined that additional information is required in order to complete the evaluation. You are requested to provide the following additional information:

1. Describe in detail the basis for the assumed zone of influence (ZOI) of 17.0 D (break diameter) for Thermo-lag. If all the Thermo-lag in a steam generator (SG) compartment or the pressurizer compartment were within the ZOI, how much would the debris totals increase?

2. Provide a complete listing of the constituent materials that make up Thermo-lag 330, as well as the bulk and material densities of Thermo-lag 330 in its installed condition. In addition, please justify the similarity of any surrogate materials used to represent Thermo-lag 330 for head-loss testing with the properties of the actual material. Please provide a justification that any surrogate materials used would provide a prototypical or conservative head loss during testing.

3. The staff is uncertain that the 10-inch diameter refueling cavity drains would not be blocked during a loss-of-coolant accident (LOCA). Please justify that pieces of insulation or debris foreign material would not be ejected up and into the refueling canal, partially or completely block the drains, and create a hold-up volume affecting containment sump level. The response should address the potential for certain types of debris to float temporarily following a LOCA, transport toward the canal drain due to surface currents, and later sink on top of the canal drain. Also, please also identify the minimum flow restriction in the cavity drain line flowpaths.

4. Considering that the PVNGS units have relatively low amounts of fibrous insulation, please describe how your containment cleanliness and foreign material exclusion programs assure that latent debris in containment will be controlled and monitored to be maintained below the amounts and characterization assumed in the emergency core cooling system (ECCS) strainer design. In particular, what is planned for areas/components that are normally inaccessible or not normally cleaned (containment crane rails, cable trays, main steam/feedwater piping, tops of SGs, etc.)?

5. Identify and describe any programmatic procedures for the control of tags and labels inside containment.

The following request for additional information (RAI) is provided to assist the licensee with preparation of its final submittal. Some of these issues have been addressed through staff observation of vendor testing. However, the documentation should be provided in the final submittal for record purposes.

6. Provide verification that the fibrous size distribution used during testing was prototypical or conservative compared to the size distribution predicted by the transport evaluation.

7. Provide details of the debris addition procedures used. Please include a description of fibrous concentration during debris addition, the debris addition location, and the method of adding fibrous debris to the test tank. Please provide verification that the debris introduction processes did not result in non-prototypical settling, agglomeration, or deposition of debris.

8. Provide the amount of various debris types added during each test, or list each surrogate and verify that the amounts added to the test were scaled properly. Please provide scaling values used for testing.

9. Provide the flume flow values used during testing or verify that the flows were scaled properly based on plant design flow rates. Please provide the flow rate through the strainer during the boron precipitation/hot leg injection mode of operation (if applicable).

10. If agitation was utilized to prevent debris settling, please verify that the debris bed was not non-conservatively disturbed by the agitation and that non-prototypical transport did not result.

11. Provide an overview of the test procedures used during testing for all thin-bed, chemical effects and full-fiber load tests.

12. Provide any extrapolation or scaling performed on the test data to account for flow rates or temperatures different from those present during testing. If temperature scaling was used, please discuss consideration made for bore holes or channeling that may have occurred during testing, or how it was verified that these phenomena did not occur (e.g., conducting flow sweeps).

13. Provide the test termination criteria and the methodology by which the final head-loss values were extrapolated to the ECCS mission time or some predicted steady state value. Please include enough test data so that the extrapolation results can be verified by the staff.

14. Provide the methodology used for calculation of clean strainer head loss (CSHL).

15. Provide the calculated CSHL value.

16. Provide the chemical effects information requested by the NRC content guide for chemical effects as provided in Enclosure 3 of a letter from the NRC to Nuclear Energy Institute (NEI) dated March 28, 2008 (ADAMS Accession No. ML080380214). The head-loss review requires (at least) a graph of head loss over time, test termination criteria, and any extrapolation that was performed using the test data.

17. Provide the calculated void fraction downstream of the strainer.

18. Provide an evaluation of the potential for flashing within the debris bed or internal to the strainer based on the head-loss values obtained during final head-loss testing. In this evaluation, please consider containment sump pool levels and the possible range of flow rates through the strainer.

19. Considering that Tests 2 and 3 were run identically, please provide an evaluation of the differences in test results. [The licensee pointed out that the two tests were performed with identical conditions but resulted in markedly different behavior. One test seemed to be affected by boreholes, similar to what was observed at Control Components, Incorporated (CCI) testing for Salem Nuclear Generating Station. The other test was stated to have formed a thin bed more gradually and resulted in an eventual head loss that was over twice as great.]

20. Provide information that establishes that the strainer is fully submerged during all accident conditions including small-break LOCAs (SBLOCAs). Otherwise, provide evaluations for head loss and air entrainment considering that the strainer is not fully submerged. Please note that strainer failure criteria from NRC Regulatory Guide 1.82, Revision 3, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," may be more restrictive than existing PVNGS net positive suction head (NPSH) margin calculation procedures.

21. The supplemental response discussed a "straw effect" at the containment sump considering a 14-inch low temperature over-pressure (LTOP) sparger line that enters the sump pit. This line is a shutdown cooling relief valve discharge line. This line is not open to the containment atmosphere above the minimum water level. The NRC staff questioned whether air could enter the sump from this line through the following process: rapidly following a LOCA, air and steam would pressurize the sparger line up to the first closed valve up to a value near the peak containment pressure. Soon afterward, water would flood the containment and cover the holes on the sparger line. Later, as the containment is gradually depressurized, the pressurized gases in the LTOP line could depress the column of water in the LTOP sparger line and potentially escape into the sump. Please discuss whether the pressurized gases in the LTOP line are forced out of the sparger holes and into the sump, and whether the resultant potential effect of air ingestion by ECCS and Containment Spray System pumps has been evaluated.

22. Provide a description of any changes made to the NPSH calculation and minimum NPSH margins as a result of completion of strainer head-loss testing.

23. Provide the information requested under item (m) in the Revised Content Guide for Generic Letter 2004-02 Supplemental Response dated November 21, 2007 (ADAMS Package Accession No. ML073110389).

24. The NRC staff considers in-vessel downstream effects to not be fully addressed at PVNGS as well as at other pressurized-water reactors. The supplemental response refers to draft WCAP-16793-NP, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous, and Chemical Debris in the Recirculating Fluid." The NRC staff has not issued a final safety evaluation (SE) for WCAP-16793-NP. The licensee may demonstrate that in-vessel downstream effects issues are resolved for PVNGS by showing that the PVNGS plant conditions are bounded by the final WCAP-16793-NP and the corresponding final NRC staff SE, and by addressing the conditions and limitations in the final SE. The licensee may alternatively resolve this issue by demonstrating without reference to WCAP-16793-NP or the staff SE that in-vessel downstream effects have been addressed at PVNGS. In any event, the licensee should report how it has addressed the in-vessel downstream effects issue within 90 days of issuance of the final NRC staff SE on WCAP-16793-NP. The NRC staff is developing a Regulatory Issue Summary to inform the industry of the staff's expectations and plans regarding resolution of this remaining aspect of Generic Safety Issue (GSI)-191.

If you have any questions, please contact me at 301-415-3016.

Sincerely,
/RA/

Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

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