September 30, 2009

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE ENVIRONMENTAL REVIEW OF THE PALO VERDE NUCLEAR GENERATING STATION LICENSE RENEWAL APPLICATION (ME0261, ME0262, AND ME0263)

Dear Mr. Edington:

By letter dated December 11, 2008, Arizona Public Service Company (APS) submitted an application to renew Operating License Nos. NPF-41, NPF-51, and NPF-74 for the Palo Verde Nuclear Generating Station, Units 1, 2, and 3. The staff is reviewing the information contained in the environmental report of the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review. Further requests for additional information may be issued in the future.

Items in the enclosure were discussed with APS staff on September 3, 2009, and a mutually agreeable date for your response was determined to be 45 calendar days from the date of this letter. If you have any questions, please contact me at 301-415-1906 or by e-mail at Lisa.Regner@nrc.gov.

Sincerely,

/RA/

Lisa M. Regner, Sr. Project Manager
Projects Branch 2
Division of License Renewal
Office of Nuclear Reactor Regulation

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

Enclosure:
As stated

cc w/encl: See next page

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DATE	09/21/09	09/17/09	09/30/09	09/30/09

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Letter to Mr. Randall K. Edington from Lisa M. Regner dated September 30, 2009

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE ENVIRONMENTAL REVIEW OF THE PALO VERDE NUCLEAR GENERATING STATION LICENSE RENEWAL APPLICATION (ME0261, ME0262, AND ME0263)

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Request for Additional Information
Regarding the Analysis of Severe Accident Mitigation Alternatives
for Palo Verde Nuclear Generating Station Units 1, 2, and 3 (PVNGS)

1. Provide the following information regarding the Level 1 Probabilistic Risk Assessment (PRA) used for the Severe Accident Mitigation Alternatives (SAMA) analysis:

   a. Section D.2.3 provides a detailed description of the PRA model changes made since the IPE (individual plant examination) Level 1 model. For each "major" version of the PRA model since the IPE, identify the model changes listed in Section D.2.3 that correspond to each version, identify the model changes that most impacted the change in core damage frequency (CDF) and large early release frequency (LERF), and provide the CDF. Two of the "major" PRA versions should be the version that was peer reviewed in November 1999 and Revision 15 used in the SAMA evaluation.

   b. Section D.2.1.4 states that the Palo Verde Nuclear Generating Station (PVNGS) PRA model Revision 15 used for the SAMA analysis reflects PVNGS as designed and operated up to August 2008. Identify any changes to the plant (physical and procedural modifications) or open PRA issues identified since August 2008 that could have a significant impact on the results of the PRA and/or the SAMA analyses. Provide a qualitative assessment of their impact on the PRA and on the results of the SAMA evaluation.

   c. Section D.2.1.9 states that a Combustion Engineering Owner's Group (CEOG) peer review was performed on the PVNGS PRA model in November 1999. Identify the version of the PRA model that was reviewed in this peer review and describe the scope of the peer review including whether the Level 2 and 3 model was included in the review. Provide a brief description of the results of this peer review and the status of the findings. Provide an assessment of the impact of any unresolved findings on the results of the SAMA analysis.

   d. Identify and discuss any additional internal and external reviews of the Level 1 and Level 2 PRA models. Describe any significant review comments, their resolution, and the potential impact of any unresolved comments on the results of the SAMA analysis.

   e. Figure D.2-1 provides the contribution to CDF by 15 initiators as a percentage of the internal events CDF (5.07E-06/yr). Section D.2.2 identifies that the internal events model consists of 28 initiating events. Clarify the difference between initiators and initiating events in this context. In addition, provide in a table the actual numerical value for the internal events CDF contribution for each of the 28 initiators.

   f. Section D.1.4 (p. D-4), identifies that static transfer switches for the Vital Alternating Current (AC) on Unit 1 never received the modifications that Units 2 & 3 did, but then claims that the switch failure and human error probability would be the same order of magnitude and thus "there is no material impact resulting from this plant difference." Explain why the human action is as reliable (on same order of magnitude) as the transfer switch. Provide an assessment of the cost and benefits of implementing the modifications on the Unit 1 static transfer switches for the Vital AC.

ENCLOSURE

2. Provide the following information relative to the Level 2 analysis:

   a. Section D.2.2 states that the Level 2 analysis was recently revised to provide a "more realistic treatment of thermal and pressure induced steam generator tube rupture." Explain how the revised treatment is "more realistic." Clarify whether these results have been included in the SAMA analysis.

   b. Section D.2.2 states that the updated Level 2 model used for the SAMA analysis is also capable of evaluating power uprates. Clarify whether power uprates are currently anticipated and, if so, how power uprates would affect the SAMA analysis.

   c. Provide a description of the process used to map the Level 1 results into the Level 2 analysis. Describe the plant damage states and how they were applied.

   d. Provide a description of the process used to group the containment event tree (CET) end states into release categories. Identify the number of CETs developed for the Level 2 analysis and describe how they correlate to release categories and plant damage states. Provide a typical CET showing release categories assigned to each end state.

   e. The information provided in Sections D.2.7 and D.3.3 does not sufficiently describe how the fission product release fractions were developed for each release category.

      i. Identify and describe the number of Modular Accident Analysis Program (MAAP) calculations made to obtain the fission product release fractions for each release category.

      ii. Clarify the basis for selecting representative accident sequences.

      iii. Describe how the release fractions obtained from the MAAP calculations were used to develop release fractions for each CET sequence.

      iv. Clarify whether the MAAP calculations were performed before or after the Level 2 update and identify the version of the MAAP code used in the SAMA evaluation.

3. Provide the following information with regard to the treatment and inclusion of external events in the SAMA analysis:

   a. Section D.5.1.6.1 provides the fire CDF (Total 2.72E-06/yr) for the top 10 contributing fire compartments. The reported values are substantially reduced from those reported in the Individual Plant Examination of External Events (IPEEE) (i.e., a total fire CDF of 8.67E-05 per year).

      i. Provide a description of the fire PRA development since the IPEEE. Identify the model changes that most impacted the reduction in fire CDF.

ii. Provide a description of the quality controls applied to the development of the fire PRA model. Identify and discuss any internal and external reviews since the 2003 fire PRA peer review. Describe any significant review comments, their resolution, and the potential impact of any unresolved comments on the results of the SAMA analysis.

iii. For each of the dominant fire compartments, explain what measures, if any, have already been taken (since the IPEEE) and credited in the fire PRA to reduce fire risk. Include in the response specific improvements to fire detection systems, enhancements to fire suppression capabilities, changes that would improve cable separation, and improvements to processes/procedures for monitoring and controlling the quantity of combustible materials in critical areas.

iv. The table on page D-39 indicates that one of the reasons the PVNGS internal fire model is overly conservative is that it is more detailed than other models. The main motivation for increasing the level of detail in failure models is to reduce the conservatism (e.g., make the model more realistic). Explain how more detail in the PVNGS fire model introduces more conservatism.

b. The SAMA analysis assumes that risks posed by external and internal events is approximately equal (page D-54). Based on this assumption, the estimated benefit from reduction of internal event risk was doubled to account for a corresponding reduction in external event risk (with the exception that fire risk was removed from the external event multiplier and calculated separately). However, page D-54 estimates the CDF from external events to be 6.72E-06 per year, a factor of 1.3 greater than the internal events CDF (5.07E-06 per year) used in the SAMA analysis. Furthermore, in "Request for Amendment to Technical Specification 5.5.16, Containment Leakage Rate Testing Program" (Arizona Public Service Company [APS] Letter to NRC #102-05902-JHH/DFS, dated October 1, 2008), APS estimated the seismic CDF for PVNGS to be about 7.49E-06 per year using the approximation method described in a paper by Robert P. Kennedy, "Overview of Methods for Seismic PRA and Margin Analysis Including Recent Innovations," and using seismic hazard curve data for Palo Verde. Based on this, provide justification for why a multiplier of 3.6 [(5.72E-06 + 7.49E-06) / 5.07E-06 + 1] shouldn't be used to account for the additional risk of all external events (seismic, fire, high winds, etc.) rather than the multiplier of two used in the SAMA analysis.

c. Provide an assessment of the impact on the initial and final SAMA screenings if the internal events benefits are increased by a factor of 3.6, or a revised multiplier developed by APS based on the more realistic estimate of seismic CDF. Provide a Phase II analysis for any Phase I SAMAs that were screened out in the Environmental Report (ER) but would not have been screened out using the revised multiplier.

4. Provide the following information concerning the MELCOR Accident Consequence System 2 analyses:

a. Section D.2.2 states, “A Level 3 (Dose Consequence) analysis was done to support the IPE, but has not been maintained.” Section D.3 describes the Level 3 analysis performed for the SAMA evaluation. Clarify the relationship between the two Level 3 analyses. In the response, specifically address whether the Level 3 analysis performed for the SAMA evaluation is a completely new analysis or an update to the IPE analysis.

b. Section D.3.1, Supplement 1, describes the projected population growth as “using an exponential growth rate.” However, the overall growth rates appear to be exponential only from years 1980 to ~2005, and then approaches a more linear growth (and even tapers off) from years 2005 to 2040. Discuss how the population estimates were developed for the various timeframes and clarify what is meant by “exponential growth rate”.

c. Section D.3.4 describes the population evacuation assumptions used for the SAMA analysis.

   i. Provide a table of the sector population distribution within the 10 mile emergency planning zone (EPZ), and out to 50 miles at 10 mile intervals, for the projected population in year 2040.

   ii. The scaled evacuation speed for year 2040 is ~13 percent lower than the base evacuation speed. However, the general population growth is roughly double from year 2006 to year 2040. Clarify this discrepancy.

   iii. Provide the reference year EPZ population for the evacuation study (2005).

5. Provide the following with regard to the Phase II cost-benefit evaluations:

   a. In estimating the benefit of the reduction in risk from external events, PVNGS provides a separate analysis to estimate the benefit of the reduction in fire risk. Since a Level 2 type model was not developed for the fire model, the benefit from the reduction in fire risk is calculated by multiplying the reduction in fire CDF by the maximum internal events benefit (assumes external risk = internal risk). However, this approach is not necessarily conservative for SAMAs in which the benefit is dominated by the reduction in population dose risk or off-site economic cost risk (OECR) and not CDF. This is the case for SAMAs 4, 8, and 15.

      i. Explain why the percent reduction in dose-risk and OECR for SAMAs 4, 8, and 15 are so much greater than the percent change in CDF.

      ii. Provide revised cost-benefit evaluations for SAMAs 4, 8, and 15 that account for the higher reduction in dose-risk and OECR than CDF.

b. SAMAs 6, 11, and 13 have no fire CDF reduction. Explain why these SAMAs (the spurious bus lockout events in SAMA 6, loss of essential cooling water flow to the shutdown cooling heat exchangers in SAMA 11, and loss of turbine-building cooling water in SAMA 13) do not impact internal fire CDF.

c. The cost of implementation of new or modified procedures for SAMAs 6, 17, and 23 is estimated to be $363,374, $410,473, and $415,620, respectively. These costs are significantly higher than the $50,000 generally used in SAMA analyses and appear to be based on a detailed cost analysis (based on the number of significant figures reported). Section D.5.1.1 states that the reason for this difference is that the scope accounted for in the PVNGS estimates "is greater than the scope corresponding to the types of changes used to establish the minimum expected cost of implementation." Clarify this statement and provide additional justification for these PVNGS estimates.

d. The cost of implementation of SAMAs 5 and 12, install an automatic transfer switch, are assumed to be the same at $2,267,254 per unit. Clarify why the cost of implementation of the non-safety automatic transfer switch in SAMA 5 is the same as for implementation of the safety-related automatic transfer switch in SAMA 12. Justify the cost estimate for these SAMAs.

e. SAMA 4 (station blackout mitigation, gas turbine generators not available) has an estimated cost of $1.8M for implementation of a portable 480 V AC generator to power the division 1 station batteries. The implementation costs of similar SAMAs in three other plants were $230,000, $489,000, $494,000. Justify the cost estimate for SAMA 4.

6. For certain SAMAs considered in the ER, there may be lower-cost alternatives that could achieve much of the risk reduction at a lower cost. In this regard, discuss whether any lower-cost alternatives to those Phase II SAMAs considered in the ER, would be viable and potentially cost-beneficial. Evaluate the following SAMAs (previously found to be potentially cost-beneficial at other plants), or indicate if the particular SAMA has already been considered. If the latter, indicate whether the SAMA has been implemented or has been determined to not be cost-beneficial at PVNGS:

   a. Modify procedures to shed component cooling water (CCW) loads on loss of essential raw cooling water to extend component cooling water heat-up time.

   b. Install backwash filters in place of existing service water pump discharge strainers to reduce probability of common cause failures.