July 1, 2010

Mr. W.S. Oxenford, Vice President,
Nuclear Generation and Chief
Nuclear Officer
Columbia Generating Station
Energy Northwest
MD PE08
PO Box 968
Richland, WA 99352

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE COLUMBIA GENERATING STATION LICENSE RENEWAL APPLICATION – SAMA REVIEW (TAC NO. ME3121)

Dear Mr. Oxenford:

By letter dated January 19, 2010, Energy Northwest submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), to renew operating license NPF-21 for Columbia Generating Station for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). The staff is reviewing the information contained in the license renewal application and the associated Environmental Report. The staff has identified, in the enclosure, areas where additional information is needed to complete the Severe Accident Mitigation Alternatives (SAMA) review. Further requests for additional information may be issued in the future.

Items in the enclosure were discussed with Mr. Abbas Mostala. A mutually agreeable date for the response is within 60 days from the date of this letter. If you have any questions, please contact me at 301-415-3748 or by e-mail at daniel.doyle@nrc.gov.

Sincerely,

/RA/

Daniel Doyle, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosure:
As stated

cc w/encl: See next page

July 1, 2010

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Letter to W. Oxenford from D. Doyle dated July 1, 2010

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE COLUMBIA GENERATING STATION LICENSE RENEWAL APPLICATION – SAMA REVIEW (TAC NO. ME3121)

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Request for Additional Information
Regarding the Analysis of Severe Accident Mitigation Alternatives
for the Columbia Generating Station License Renewal Review

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

   a. Environmental Report (ER) Section E.3 explains that the SAMA evaluation is based on PSA Revision 6.2 models for Level 1 and 2 internal, fire, and seismic events. Table E.3-1 shows the completion dates for these different models to range from 1/2004 to 2/2007 and shows these models to be based on incorporation of plant modifications that occurred up through 8/2006 and Columbia Generating Station (CGS) data/Bayesian updating through 6/2002. Identify any changes to the plant (physical and procedural modifications) since those dates that could have a significant impact on the results the SAMA analyses, and provide a qualitative assessment of their impact on the PSA and on the results of the SAMA evaluation. Identify whether a newer PSA model is available, and if so, provide a brief description of the major changes relative to the PSA Revision 6.2, and provide an assessment of the impact on the results of the SAMA evaluation (e.g., increased benefit or additional SAMAs if the baseline core damage frequency (CDF) has increased; any new candidate SAMAs for newly-identified dominant sequences or risk-significant basic events).

   b. ER Table E.3-3 shows the contribution of specific types of Transients and loss of coolant accidents (LOCAs) to core damage frequency (CDF) and identifies specific initiators leading to anticipated transient without scram (ATWS). In light of the fact that station blackout (SBO) contributes 33.1% to the CDF, identify the initiators that contribute to SBO.

   c. ER Section E.5.2 presents a list of seven technical reviews (covering internal events and fire, and Level 1 and Level 2) of the PSA (page E-31) and a list of four external peer reviews (page E-32) that contributed to updating the PSA models. Provide the following relative to these reviews:

      i) A summary of the scope of the 1997 owner's group peer review mentioned in Section E.5.5.
      ii) A brief description of all unresolved B Level facts and observations (F&Os) from the 2004 internal events PSA peer review discussed in Section E.5.5 and an assessment of their impact on the SAMA evaluation.
      iii) A summary of the scope of the other two peer reviews and the seven technical reviews discussed in Section E.5.2, a brief description of all unresolved issues/F&Os, and an assessment of their impact on the SAMA evaluation.

   d. Describe the quality control process for the PSA, including the process of monitoring potential plant changes, tracking items that may lead to model changes, making model changes (including frequency for model updates), documenting changes, software quality control, independent reviews, and qualification of PSA staff.

ENCLOSURE

e. ER Table E.3-2 presents the truncation limits used when quantifying the Internal Events and Fire PSA fault trees to be 1E-8 to 1E-14 with a footnote explaining that "the truncation limit was adjusted to assure sufficient capture of the contributing basic events." The meaning of and need for different truncation limits for fault trees, event trees and a category referred to as "Global" is not clear. Explain the basis for the truncation limits selected and the meaning of the entries shown in Table E.3-2. Clarify for which cases a truncation limit of 1E-8 versus a truncation limit of 1E-14 was used.

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

a. ER Sections E.4.1.1 and E.4.3 state that containment event trees (CETs) were developed to model accident progression for accident sequences from the Level 1 internal events, fire, and seismic analyses. Provide a description of the CETs used in the SAMA analysis, discuss the basis for their construction, and clarify the relationship between the internal events, fire and seismic CETs.

b. ER Section E.4.1.1 states that CETs were developed for each plant damage state (PDS) and that quantification of the CETs was supported by fault tree analysis and assignment of split fractions. Clarify how probabilities were assigned to branches using split fractions for branches. In the response, specifically address how split fractions were developed for phenomenological branch points.

c. ER Section E.5.5.1 lists peer review findings and other self-identified areas that are in progress for the next revision, and characterizes them as not expected to significantly alter the SAMA analysis findings. Yet, a number of the recommendations address non-conservatism in the Level 1 and 2 PSA model, including:

- upgrading the LOCA outside containment modeling;
- refining the inter-system (IS) LOCA modeling;
- incorporating an initiating event for common cause failure (CCF) of both 125-VDC power divisions;
- refining the impact of spray on equipment, the reactor core isolation cooling (RCIC) pump flood damage height, and flood isolation (human error probabilities) HEPs;
- including certain early phenomena that can lead to large early relief frequency (LERF);
- revising crew actions included in the LERF assessment;
- accounting for potential environmental impacts in the survivability of systems for Level 2 mitigation;
- reconsidering inclusion of source term scrubbing for non-LERF end states having no Modular Accident Analysis Program (MAAP) calculation.

Justify the conclusion that the unresolved findings are not expected to significantly alter the results of the SAMA analysis.

d. Section E.6.5 and Table E.6-5 indicate the correlation between (MAAP) runs and release categories but does not provide the basis for the MAAP run selection. Provide information on the selection of the MAAP case for each release category, in particular how scenarios of less than dominant frequency but larger potential consequences were considered.

e. Identify the version of MAAP used in the SAMA analysis.

f. The ER does not provide an importance list of either Level 1 or Level 2 basic events and so it is not possible to ascertain the significance of recovery events or operator actions in the PSAs. Discuss the extent to which recovery of systems or operator actions following the onset of core damage is credited in the Level 2 assessment and how recovery is modeled.

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

a. ER Section E.3.2.2 states that the seismic hazard analysis used for the seismic PSA is the same as submitted for the CGS Individual Plant Examination of External Events (IPEEE) except for an extrapolation from the maximum peak ground acceleration to 1.5g. The seismic hazard analysis used for the IPEEE was developed in 1994 and documented in "*Probabilistic Seismic Hazard Analysis WNP-2 Nuclear Power Plant Hanford Washington*". Justify the use of the seismic PSA model given: (1) since then the U.S. Geological Survey (USGS) has updated its assessment of seismic hazards across the U.S. including Washington State, (2) seismic hazard analysis was performed specifically for the Hanford area in 1994 which is documented in WHC-SD-W236A-TI-016, *Seismic Design Spectra 200 West and East Areas DOE Hanford Site, Washington*", to provide better evaluation of subsurface materials and (3) work was performed in 2005 which is documented in PNNL-15089, "*Site-Specific Seismic Response Model for the Waste Treatment Plant, Hanford Washington*" that better characterizes the effect from deep layers of sediments "interbedded" with basalt. Address whether consideration of the more current seismic hazard analysis could impact the results of the SAMA analysis (both SAMA identification and SAMA evaluation).

b. ER Section E.3.2.1 states that the guidance in NUREG/CR-6850 was used to update the IPEEE Fire PSA to the current CGS Fire PSA. This section also states that extinguishment and propagation split fractions and likelihood information from NSAC/178L was used. Clarify to what extent NUREG/CR-6850 is used to update the IPEEE Fire PSA and, in particular, whether use of information from nuclear safety analysis center (NSAC)/178L represents a deviation from NUREG/CR-6850 or was used to augment NUREG/CR-6850. It is also stated that, in general, the Fire PSA results dominate the SAMA risk evaluation due to conservatisms from NUREG/CR-6850. Describe these conservatisms and how they compare to those that were in the IPEEE. Discuss whether there was any attempt to reduce these "conservatisms" by plant-specific analysis, e.g., fire modeling of specific configurations. If not, discuss whether any potential non-fire insights could be "masked" by this conservatism.

c. ER Section E.3.2.1 explains that for the screening fire event trees, scenarios in which equipment and/or cables were lost due to a fire (i.e., "loss scenarios") were simplified into loss of worst-case or all equipment and cables in a fire compartment. The section also explains later that hot shorts that could spuriously actuate components to undesired configurations were considered for the unscreened sequences. Explain how potentially screening out sequences that might have contained risk significant hot short events affects the results of the fire PSA and in turn the SAMA evaluation.

d. ER Section E.5.5.2 states that a number of recommended improvements to the fire PSA from the 2004 fire PSA peer review were outstanding but that none were expected to significantly alter the SAMA analysis findings. Yet, a number of the recommendations appear to be non-conservative in the fire PSA such as:

   - The PSA does not include all the cable routing for all conduits installed in the plant;
   - A hot short probability of 0.3 is used, which implicitly assumes all circuit failures are intracable for multi-conductor cables protected by controlled power transformers (from NUREG/CR-6850);
   - A transformer fire scenario must be re-evaluated for switchgear Division 2 to remove non-conservatism from current modeling;
   - The current fire PSA credits systems or trains that fire-related plant procedures instruct operators to defeat. In addition, a human error probability of 0.1 is used to indicate the need to restart the Division A or HPCS equipment;
   - The approach to quantify the approximately 130 individual hot short events corresponding to single spurious actuations from the internal events PSA is cited as capturing most, but not all, of the multiple spurious operations (MSOs) that need to be modeled.

   In light of these apparent non-conservatisms, justify the conclusion that the unresolved findings are not expected to significantly alter the results of the SAMA analysis.

e. ER Table E.3-7 shows the top 20 risk dominant “fire compartments” ordered by their contribution to the total CDF based on the most current version of the fire PSA. The IPEEE also presents a similar list of “fire compartments” ordered by percent contribution to the total CDF. Explain why the total CDF due to fire is different (7.40E-6/yr versus 9.16E-6/yr) and why the risk dominant fire compartments and the ordering of their risk contribution are different.

f. ER Section E.8.5 states that “the benefit from the “other” hazard group contribution was conservatively estimated to be equivalent to that of internal events.” Clarify the basis for this assumption.

g. ER Table E.5-1 reports a PSA Revision 3 Level 2 release frequency (9.94E-06/yr) that is significantly higher than the previous revisions while the release frequency for Revision 1 is significantly less than for Revision 0. Discuss the major model changes driving these differences between versions. Also, explain the major reasons for the CDF decrease by roughly a factor of 2.5 from Rev. 4.2 to Rev. 5.0.

h. ER Section E.5.5.3 does not identify any reviews of the Seismic PSA. Identify any internal and external reviews of the Seismic PSA and provide an assessment of the impact of any unresolved findings on the SAMA evaluation.

i. ER Section E.4.2 states that the Level 2 release categories for the Fire PSA indicate ~88% to be late and, therefore, non-contributors to LERF. Describe the phenomenology that causes more of the releases for fire occurring later than for internal events. Also, comparing Tables E.4-1 and E.4-4 indicates that the main difference between the Internal Events and Fire LERFs arises from PDS 1A3B, 1C, 4BA, 4BL, 5, 6A1A, and 6A1B. 1C is a flood PDS, so that difference is apparent. Others involve loss of offsite power (LOOP), ATWS, ISLOCA, and SBO, for which all but the LOOP LERFs are lower for Fire than Internal Events. Since fires often induce the same sequences as internal events, but with greater probability for fire-induced vs. random failures, describe the phenomenology that causes the LERF for most of these fire PDSs to be lower than for internal events, especially since Fire CDF is greater than Internal Events CDF.

4) Provide the following information concerning the Level 3 analysis:

a) ER Tables E.6-2 and E.6-3 do not appear to be consistent. For example, the year 2045 population in Table E.6-3 is 655,617, a more than 70% increase compared to the year 2030 population in Table E.6-2 (383,828) and considerably greater than the stated growth rate of 14.2%/decade. Table E.6-2 indicates a leveling off of the population by 2030 as well. Clarify this apparent discrepancy and provide the reference year used for escalating population to year 2045. Also, the CGS Final Safety Analysis Report (FSAR) Table 2.1-1 population growth rate is closer to 4.5%/decade. Given that the FSAR is stated to be the source of the population data used in the SAMA analysis, explain the differences in population growth rate between the ER and the FSAR.

b) The population distribution within sectors in ER Table E.6-3 is not consistent with the FSAR Table 2.1-1 distribution. The N sector at 40-50 miles shows ~100% growth from the FSAR year 2030 compared to year 2045, while other sectors show ~50%. Clarify the apparent different growth rates within sectors given the stated growth rate of 14.2%/decade.

c) ER Section E.6.3 states that the year 2006 meteorological data used in the base case contained the least amount of unusable data. Describe how gaps or missing data were filled and how unusable data were replaced with usable data.

d) ER Section E.6.4 states that the MELCOR Accident Consequence Code System 2 (MAACS2) default growing season was assumed. Clarify how this relates to the length of the growing season for the CGS locality and provide an assessment of the impacts of this assumption on the SAMA evaluation.

e) ER Sections E.6.5 and E.6.6.3, and Table E.6-6 identify the OALARM time to declaration of a General Emergency and the assumed time delay for evacuation. Section E.6.6.3 identifies that "it is not clear" what the 50 minute delay represents. One would typically expect some fixed delay time in declaration of an emergency requiring evacuation, and then an evacuation time based on various parameters (time of day, season, weather, etc). Provide additional discussion of the evacuation analysis and interpretation of the time delay.

f) ER Section 6.8 describes that much of the economic data used for the MACCS2 analyses were site-specific. However, the MACCS2 economic data provided in Table E.6-10 appear to be taken directly from MACCS2. Clarify whether a cost escalation or inflation factor was applied to MACCS2 default values to bring the costs up to year 2008 dollars.

g) Sensitivity case S1 uses the year 2060 population extrapolation to represent a high population growth case for the year 2045. The stated growth rate of 14.2%/decade would yield ~22% increase from year 2045 to 2060 (from 665,617 to ~812,000). This is then a sensitivity case that increases the year 2045 population by 22%. Clarify whether this interpretation is correct. If this estimated population is not correct, explain how the calculation is performed. It also is stated that the state-wide growth is conservatively applied to the county growths. However, the two most populous nearby counties (Benton and Franklin) had growth rates greater than the state average. Clarify.

h) ER Section E.7.2.3 Case A1 identifies that the "rain rate boundary condition was set at 0.0 mm/hour for the base case" is a bounding conservative value. Previous SAMA analyses have shown that assuming perpetual rainfall in the last segments (40-50 mile radius) is the most conservative assumption when estimating population dose and cost risk. Clarify the statement that no rainfall in the last boundary segments is a conservative assumption. In addition, provide the assumptions used for each of the meteorological boundary parameters used in this sensitivity case.

5) Provide the following with regard to the SAMA identification and screening process:

a. ER Section E.9.1 identifies 12 industry SAMA analyses that were reviewed and Table E.9-3 identifies which of these analyses was the source for many of the CGS SAMA candidates. However, it is unclear why some of the cost-beneficial SAMAs from the industry analyses do not appear to be included in Table E.9-3, i.e., providing redundant ventilation for residual heat removal pump rooms, high pressure core spray pump room, and reactor core isolation cooling pump room (Nine Mile Point SAMAs U2-23a-c), reduce unit cooler contribution to emergency diesel generator unavailability (Nine Mile Point SAMAs U2-221a-b), etc. Provide an assessment of the applicability of each of the cost-beneficial SAMAs from the 12 industry SAMA analyses to CGS and a further evaluation for those that are applicable.

b. The conclusion to ER Section 9.1 is that “no additional candidates were identified by the review of the supplements to NUREG-1437.” However, Table E.9-3 identifies NUREG-1437 Supplements 21 and 30 as the source for SAMAs AT-13 and AT-14, respectively. Clarify this discrepancy.

c. Table E.9-3 identifies four SAMA candidates based on CGS PSA insights (all others were identified from review of industry data). Section E.3.1 discusses Level 1 basic event importance analysis and presents high level insights but does not provide the results of a basic event importance analysis that show the potential risk reduction associated with specific basic events. A level 2 importance analysis is not discussed or presented. Provide a basic events importance list, in decreasing order of risk reduction worth (RRW), for the Level 1 and Level 2 internal, fire and seismic PSA results that includes a description of each basic event, identifies the RRW and probability of each basic event, and identifies the SAMA(s) that address each basic event and how. Provide the information for all basic events having an RRW benefit value greater than the minimum cost of a procedure change at CGS.

d. ER Table E.3-8 presents the results of an RRW importance analysis of the top 30 basic events from the Fire PSA. No SAMAs were identified to address any of the basic events in this table. Similarly, Table E.3-7 identifies the contribution to fire CDF from each of the CGS fire compartments, but no SAMAs were identified to address the most risk important compartments. Identify and evaluate SAMAs to address all of the basic events and fire compartments having an RRW benefit value greater than the minimum cost of a procedure change at CGS. In the response, describe how the SAMA addresses the basic event, fire compartment, or equipment in the fire compartment.

e. ER Section E.9.3 discusses significant contributors to the top 100 Level 1 PSA cutsets. Table E.9-1 shows that there are a number of operator errors and non-recovery actions that occur in this listing of dominant cutsets. Given that there are operator errors that repeat in a large number of cutsets (e.g. "Operator Fails to Initiate Depressurization during Non-ATWS Event") and that operator errors often have relatively high failure probabilities explain why no operator errors were identified as the basis for a plant-specific SAMA (e.g., an improvement to a specific procedure). Explain how human errors identified in the PSA were considered in the candidate SAMA identification process.

f. ER Section E.9.5 identifies the major contributors to each release category but does not identify SAMAs to address the major contributors. Clarify how these specific risk contributors were considered to identify potential candidate SAMAs. Identify and evaluate SAMAs to address all of the major contributors having an RRW benefit value greater than the minimum cost of a procedure change at CGS.

g. The source of SAMA AC/DC-29 is not identified in ER Table E.9-3. In light of the fact that AC/DC-29 was one of the few plant-specific SAMAs identified, specify how SAMA AC/DC-29 was identified.

h. ER Section E.9.2, page E-66, states that a cost-benefit analysis was performed on increasing the capacity of the 230 kV/115 kV plant bus transfer and found this modification to not be cost effective. Provide a summary of the scope and results of this analysis and clarify the criteria used to determine the cost effectiveness of the modification.

i. ER Section E.9.2 presents the status of improvements identified by Revision 1 of the IPE, with the exception of the suggestion to modify back-up air supply to the mainstream isolation valves (MSIVs) and containment vent valves. Section 6.2 of Revision 1 of the IPE identifies that potential improvement as marginally cost effective but notes that the improvement could increase in importance as the other improvements were implemented. Given that other improvements have been implemented and that the importance of the closure of these valves is still indicated by the current PSA, provide a cost-benefit analysis of a SAMA to modify to provide redundant air supply to the MSIVs and containment event valves.

j. ER Section E.3.2.4, in the discussion of seismic-related improvements, states that a cost-benefit analysis was performed on strengthening the motor control centers (MCC) base connections and found this modification to not be cost effective. Provide a summary of the scope and results of this analysis and clarify the criteria used to determine the cost effectiveness of the modification. Justify why this improvement should not be addressed as a SAMA in light of more recent seismic hazard curve data (see RAI 3.a).

k. ER Section 9.2 under the discussion of IPEEE insights indicates that two seismic SAMA candidates were evaluated. Tables E.11-2 through E.11-5 appear to provide Phase II evaluation results for only one seismic SAMA, SAMA SR-03 (which was identified from the NEI 05-01 generic SAMA list). Clarify this discrepancy.

l. ER Section 9.2 under the discussion of IPEEE insights states "the dominant fire sequences render containment venting, power conversion system (PCS), and one train of RHR or service water unavailable." SAMAs FR-07a and FR-07b were identified to address protecting the containment vent valve cables and transformer E-TR-S cables, respectively, from fires. In light of the fact that these two SAMAs are cost-beneficial at a 3 percent discount rate, provide a cost-benefit analysis of a SAMA(s) to protect RHR and service water cables from fires.

m. ER Table E.10-1 screens outs several candidate SAMAs using the code, Criterion E (Very Low Benefit). Provide the following relative to these screened SAMAs:

    i) It is not clear how the risk of particular failures can be determined to be insignificant without an importance analysis that includes specific consideration of related basic events. By way of illustration, in Table E.10-1 for SAMA CC-09, opening a SRV is stated to be very reliable and not a significant contributor to risk. Clarify the basis for stating that opening a SRV is not a significant contributor to risk, clarify like-kind statements in Table E.10-1, and provide RRW to support the "very low benefit" conclusion.
    ii) The basis for screening SAMA FW-04 appears to presume that feedwater unavailability is more sensitive to loss of flow from the condensate and condensate booster pumps than from independent or common cause failures of the feedwater pumps themselves, such that additional redundancy of the latter would not significantly improve FW availability. Clarify if this understanding is correct and provide the RRW for the different systems (i.e., condensate booster pumps and feedwater pumps).

n. The internal events, fire, and seismic CDF, annual dose, and annual property loss results in ER Table E.11-1 through E.11-4 are shown to be 0.00E+00 for many cases. Insufficient information is provided to ascertain whether these results are truly 0.00E+00 or are negligible. For all instances in which these results are shown to be 0.00E+00, clarify whether the results are actually zero (SAMA has no impact) or whether the results are negligible (SAMA has a negligible impact). In addition, justify the assignment of zero risk reduction for the following Cases: AC/DC-01 (Fire), CC-20 (all), CB-01 (all), and AT-14 (Fire and Seismic).

6) Provide the following with regard to the Phase II cost-benefit evaluations:

   a. On ER page 3-1 it is stated that the net and gross electrical power outputs are 1,190 and 1,230 MWe, respectively. However, on page E-62 a CGS rated electrical power of 1107 MWe is used in estimating replacement power costs. Provide the rationale for using 1107 MWe in estimating the replacement power cost used in the SAMA analysis. In addition, provide an assessment of the impact on the SAMA analysis of using 1,190 MWe in estimating power replacement cost.

   b. ER Table E.10-1 identifies many Phase I SAMAs that were subsumed into other Phase I SAMAs and not analyzed in the Phase II evaluation. However, the SAMAs that were subsumed may have a lower cost of implementation than the SAMA actually evaluated (i.e., subsumed SAMA AC/DC-03 appears to have a lower cost than SAMA AC/DC-01 which was evaluated). Provide a cost estimate and Phase II cost-benefit evaluation for all subsumed SAMAs or, alternatively, justify that the implementation cost of the subsumed SAMA is higher than the implementation cost of the evaluated SAMA.

   c. With regard to the modeling assumptions for each SAMA described in ER Table E.11-1, provide the following:

      i) SAMA AC/DC-01 – time available to recover offsite power in the baseline PSA.
      ii) SAMAs AC-DC-10, CW-02, CW-03, CW-07, HV-02, AT-05, SR-03 – description of model changes in layman terms.
      iii) SAMA AC/DC-27 – description of the changes made to the PSA fault tree to model the 500 kV power source.
      iv) SAMA CC-03b – meaning of parenthetical phrase “see RCIC FTR tab”
      v) SAMAs FR-07a, FR-07b – description of the specific changes made to the fire model, in layman terms

   d. ER Section E.6 and Table E.11-6 state that plant personnel developed CGS-specific implementation cost estimates for many of the SAMAs. Provide a description of: the process Energy Northwest used to develop the SAMA implementation costs and the level of detail used to develop the cost estimates (i.e., the general cost categories considered).

   e. ER Section E.11.2 also states that the SAMA implementation cost estimates accounted for inflation when using estimates from other SAMA analyses. Clarify how other cost factors were treated in these estimates and in the development of the site-specific cost estimates. Specifically address contingency costs associated with unforeseen implementation obstacles, replacement power during extended outages required to implement the modifications, and maintenance and surveillance costs during plant operation.

f. The estimated implementation cost of $375,000 for SAMA AC/DC-23 seems high for what appears to be procedure development. Justify the cost estimate.

g. The estimated cost for SAMA CC-03b is indicated to be $82K in ER Table E.11-6 and $160K in Table E-11-7. Clarify the discrepancy. Furthermore, either cost estimate seems high for what appears to be a minor software change. Justify the cost estimate.

h. For certain Phase II SAMAs listed in Table E.11-6, the information provided does not sufficiently describe the associated modifications and what is included in the cost estimate. Provide a more detailed description of both the modification and the cost estimate for SAMAs AC/DC-27, CW-04, FR-07a, FR-07b, and HV-02.

i. ER Section E.12 discusses six sensitivity cases. Insufficient information is provided to understand the specific changes made to the baseline analysis assumptions for Cases 1 and 6. Provide a more detailed description of the analysis assumptions and methodology for these two cases.

j. ER Section E.12 states that "no explicit uncertainty was performed since the number of conservative assumptions and input account for any uncertainties in the calculations" and goes on to delineate several sources of conservatism in the SAMA analysis. This is not consistent with NEI 05-01 wherein the delineation of conservatisms is used to offset an uncertainty factor based on the 95th percentile CDF. Given that the 95th percentile values are typically a factor of two to five higher than point estimates, identify and provide a further evaluation of those SAMAs that are within a factor of two to five of being cost-beneficial. This evaluation can be based on more realistic estimates of risk reduction and implementation costs, and deterministic considerations, including potential negative implications of candidate SAMAs.

7) For certain SAMAs considered in the Environmental Report, there may be lower-cost alternatives that could achieve much of the risk reduction at a lower cost. In this regard, provide an evaluation of the following SAMAs:

a. Establishing procedures for opening doors and/or using portable fans for sequences involving room cooling failures, such as the emergency diesel generator room. Clarify if this is the intent for SAMA HV-03 or not.

b. Utilizing a portable independently powered pump to inject into containment.

c. Using the security diesel generator and/or EDG-4 to extend the life of the 125-V DC batteries.

d. Using a portable generator to provide power to individual 125-V DC MCCs upon loss of a DC bus to improve availability of HPCS.