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

August 28, 2015

Mr. Edward D. Halpin
Senior Vice President and
Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 56, Mail Code 104/6
Avila Beach, CA 93424

SUBJECT: LICENSE RENEWAL ENVIRONMENTAL SITE AUDIT REGARDING DIABLO CANYON POWER PLANT, UNITS 1 AND 2 – SEVERE ACCIDENT MITIGATION ALTERNATIVES (TAC NOS. MF4019 AND MF4020)

Dear Mr. Halpin:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing Pacific Gas and Electric Company's license renewal application for Diablo Canyon Power Plant, Units 1 and 2. The environmental site audit for the severe accident mitigation alternatives review will be conducted at Diablo Canyon Power Plant, Units 1 and 2, during the week of September 21, 2015, by NRC staff and its contractors. The environmental audit activities will be conducted in accordance with the environmental audit plan (Enclosure 1).

To develop the Supplemental Environmental Impact Statement, the NRC staff requests the information described in the environmental audit needs list (Enclosure 2) be made available, to the extent possible, during the environmental site audit. The NRC staff informally transmitted this information to your staff (Terry Grebel) by e-mail on August 19, 2015.

If you have any questions, please contact me by telephone at 301-415-6459, or by e-mail at michael.wentzel@nrc.gov.

Sincerely,
/RA/
Michael J. Wentzel, Project Manager
Projects Branch 2
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-275 and 50-323

Enclosure:
As stated

cc w/encl: Listserv

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NAME	IBetts	MWentzel	UShoop	JDanna	MWentzel
DATE	8/25/15	8/27/15	8/27/15	8/28/15	8/28/15

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Letter from M. Wentzel to E. Halpin dated August 28, 2015

SUBJECT: LICENSE RENEWAL ENVIRONMENTAL SITE AUDIT REGARDING DIABLO CANYON POWER PLANT, UNITS 1 AND 2 – SEVERE ACCIDENT MITIGATION ALTERNATIVES (TAC NOS. MF4019 AND MF4020)

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LICENSE RENEWAL ENVIRONMENTAL AUDIT PLAN
SEVERE ACCIDENT MITIGATION ALTERNATIVES
DIABLO CANYON POWER PLANT, UNITS 1 AND 2

1. Background

By letter dated November 24, 2009, Pacific Gas and Electric Company (PG&E or applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54) to renew the operating licenses for Diablo Canyon Power Plant, Units 1 and 2 (DCPP). In accordance with the requirements of 10 CFR Part 51, the NRC staff is reviewing the information contained in the environmental report (ER) submitted in conjunction with the license renewal application (LRA).

As part of its review of the ER, the NRC staff's will perform an environmental audit in San Luis Obispo. The purpose of this audit is to gain understanding, to verify information, and to identify information pertaining to the review of severe accident mitigation alternatives (SAMAs) that will require docketing to support the basis of the licensing or regulatory decision. Specifically, the NRC staff will identify pertinent data and obtain clarifications regarding information provided in the ER.

Per NRC guidance, the NRC staff prepares a regulatory audit plan that provides a clear overview of audit activities, scope, and team assignments.

2. Environmental Audit Bases

License renewal requirements are specified in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." Licensees are required by 10 CFR 54.23 to submit an ER that complies with the requirements in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," as part of the LRA. Review guidance for the NRC staff is provided in NUREG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Supplement 1 – Operating License Renewal."

The NRC staff is required to prepare a site-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants." During the scoping process required in 10 CFR Part 51, the NRC staff is required to define the proposed action, identify significant issues which must be studied in depth, and to identify those issues that can be eliminated from further study.

3. Environmental Audit Scope

The scope of this environmental audit for the DCPP license renewal review is to discuss NRC staff's specific questions regarding the SAMA analysis and results documented in ER. Audit team members will focus on reviewing the documents and requested information listed in the Environmental Audit Needs List (Enclosure 2) and discussing the information with PG&E's subject matter experts. Additional questions may develop during the audit.

4. Information and Other Material Necessary for the Environmental Audit

As described in the Environmental Audit Needs List (Enclosure 2).

5. Tentative Team Assignments Area of Review Assigned Auditor

The environmental audit team members for the SAMA review are shown in Table 1. Those members of the team who are contractors from Pacific Northwest National Laboratory will have PNNL after their name.

Table 1 Environmental Audit Team Members and Resource Assignments

Discipline	Team Members
Environmental Project Manager	Michael Wentzel, NRC
SAMA	Jerry Dozier, NRC Bob Schmidt, PNNL Bruce Schmidt, PNNL

6. Logistics

The environmental audit for SAMA will be conducted in San Luis Obispo from September 21-23, 2015. An entrance meeting will be held with plant management at the beginning of the audit. An exit meeting will be held at the end of this audit.

7. Special Requests

The staff requests the applicant make available the information identified on the Environmental Audit Needs List (Enclosure 2). Additionally, staff request to interview knowledgeable PG&E staff or contractors on Levels 1, 2, and 3 probabilistic risk assessment (PRA) developments and results, as well as SAMA identification and evaluation. The interviews will discuss the information on the Environmental Audit Needs List (Enclosure 2) and any other questions that may arise from the review of material at the onsite audit.

8. Deliverables

An audit summary report is scheduled to be issued by NRC staff within 90 days from the end of the environmental audit.

DIABLO CANYON POWER PLANT, UNITS 1 AND 2
LICENSE RENEWAL ENVIRONMENTAL SITE AUDIT NEEDS LIST
SEVERE ACCIDENT MITIGATION ALTERNATIVES

Please be prepared to discuss the following issues and make the following available during the environmental site audit.

Provide copies of the following documents for the NRC staff to review:

1. The most recent probabilistic risk assessment (PRA) peer review and/or self-assessment reports for all hazards.

2. Documentation associated with other more recent reviews particularly of the Level 2 or and 3 PRAs for Diablo Canyon Power Plant (DCPP).

3. Supporting documentation for the core inventory calculation.

4. Windows based Methods for Estimation of Leakages and Consequences of Releases (MELCOR) Accident Consequence Code System (WinMACCS) calculation documentation.

SAMA Audit Questions:

1. Level 1 PRA

    a. Section F.2 (p. F-12) states

    "The CDF values for the models presented in Section F.2.1 are all point estimate values. The evaluation of base case benefits was based on point estimate values."

    The CDF values given for a number of the PRA models in subsequent subsections (F.2.1.6, p. F-23; F/.2.1.7, p. F-26; F.2.1.8, p. F-29; F.2.1.9, p. F-32; and F.2.1.10, p. F-36) are indicated to be mean values. Please clarify. (Note that a similar question was asked and responded to in PG&E letter of 8/27/2010, request for additional information (RAI) 1.n)

    b. Section F.2.1 describes the shared systems and/or the systems that can be cross-tied between Units 1 and 2. Discuss the treatment of the unavailability of Unit 2 components due to test, maintenance and refueling in the Unit 1 model. Discuss the potential for and the modeling of initiating events that can impact both Units 1 and 2. (Note that this was answered in the 8/27/2010 and the 12/6/2010 PG&E responses to RAI 1.f.)

    c. Section F.2.1.10 indicates that the DC03 Fire PRA includes the Westinghouse low leakage shutdown seals and an upgrade of the hot shutdown panel that are to be implemented in the future. Table 4 of the 7/1/2015 submittal (p. 34) indicates that the seals are not credited in the DC03 internal events model.

Provide the status of the hot shutdown panel in all of the DC03SA models and of the low leakage seals in the internal flooding and seismic models. Describe the differences between the current and new seals and the features of the hot shutdown panel upgrade and their impact on the PRA models, the identification and scope of relevant potential SAMAs, and the SAMA cost-benefit analysis.

d. The original 2009 SAMA analysis submittal and responses to NRC staff RAIs were based on PRA models DC01A and DC01B. These two models are not described in Section F.2.1, but the seismic initiating event frequencies are cited in the discussion of the DC03 interim model. Briefly discuss these models and clarify any differences between their descriptions and/or results and that provided in the 2009/2010 submittals and the current models such as the statement in the 2009 ER Section F.2.1.9 that the charging pumps were replaced with centrifugal pumps, which is not mentioned in the current submittal.

e. The initiating event contributors to the internal events core damage frequency (CDF) shown in Figure F.2-1 do not include loss of offsite power (LOOP). Provide the CDF due to LOOP initiators. If included in the "others" category (which would appear to indicate that LOOP contributes less than 2% to the total internal events CDF), explain why it is so low. Note that the 2010 LRA indicated that the CDF due to grid related LOOP was 8.9E-07/year which corresponds to 8% of the current internal events CDF (excluding internal flooding).

f. Provide the station blackout (SBO) and anticipated transient without scram (ATWS) contributions to the internal events and total CDF.

g. Provide the “freeze date” or the date which corresponds to the DCPP design and operation incorporated into the DCPP PRA used for the SAMA analysis. Identify any design or operational (including fuel cycle) changes that have or, are planned, since this freeze date that might impact the SAMA analysis.

h. The discussion in Section F.2.3.1 (p. F-47) regarding the PRA maintenance and update procedures states:

"These procedures delineate the responsibilities and guidelines for updating the full power internal events PRA models at the Diablo Canyon Power Plant."

Although guidelines for full power, internal and external events are mentioned, it is not clear whether these are included in the cited procedures or other documentation. Clarify the applicability of the cited procedures to other than internal events PRA models and if not applicable, identify the procedures that are applicable.

i. Section F.3.2.2 (p. F-48) lists the dates of the peer reviews of the various DCPP PRAs. Identify the specific model revisions listed in Section 2.1 reviewed by each of the peer reviews, the scope of each review and the number of findings (or Level A and B Facts and Observations (F&Os)) where Capability Category II or better is not met resulting from each review. (Note that except for the fire and

seismic model revision that was peer reviewed, this information is available in Attachments U and V of DCPP NFPA 805 LAR.)

j. Confirm that no changes have been made to the DCPP PRA model used in the SAMA analysis since the Peer Reviews that would constitute an upgrade as defined by ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2.

k. Section F.2.3.5, CONCLUSION REGARDING PRA CAPABILITY FOR SAMA IDENTIFICATION AND EVALUATION, discusses and concludes that the DCPP PRA Model DC03 results are suitable for use as a resource in the SAMA identification process. Clarify why the discussion and conclusions does not address the suitability for the SAMA cost-benefit evaluation process.

l. With regard to Addendum 1:

   i. For the first item “Internal flooding -NRC IN 98-31 ISER 3-98, A0468801” confirm that this has not been closed in the DC02 update of internal flooding and if not provide more information on the basis for the conclusion that no direct impact on the current model is anticipated.

   ii. For the fourth item, “Address anchorage of relay panels in cable spreading rooms,” confirm that the requested analysis has been performed or otherwise justify that this is only a documentation issue.

   iii. For the fifth item, “Address potential for d/g lockout from cardox,” provide the basis for the conclusion that the impact of this issue is expected to be minor.

2. Level 2 PRA

   a. Section F.2.2 describes the Level 1 to Level 2 mapping and the need for plant damage states (PDSs) and key plant damage states (KPDSs). Is the transfer of information from Level 1 to Level 2 done directly in the logic models or are the numerical PDS frequency results of the Level 1 analysis added and input into the Level 2 analysis (the CETs) as a frequency?

   b. Section F.2.2.3 discusses the development of the KPDSs and Table F.2-3. This table presents the ranking of PDSs based on PRA model DCPRA-1991and states that “the relative ranking of PDSs and states that “the relative ranking of PDSs and therefore the definition of KPDSs is not expected to change significantly from DCPRA-1991 to DC03.” Provide further support for the final statement and discuss the role of relative ranking in the definition of KPDSs. Are all PDSs that result from the Level 1 analysis assigned to a KPDS or are some grouped together as a remainder group and if so how is the remainder considered in the Level 2 analysis?

c. The discussion of release category binning in Section F.2.2.4.1 includes the statement:

> "For early-small containment failures, the medium pressure sequences are binned with the high pressure sequences because containment pressures may be greater later in the event and high RCS retention then becomes a liability."

Table F.2-5 indicates that for small early release categories, the medium pressure sequences are binned with the low pressure sequences. In addition, Table F.3-11 describes the MAAP case RC16U as low pressure core melt while the description of the small early release category in Section F.2.2.4.2 states "Other cases within this release category group would either have medium to low RCS pressure..." Explain this binning and the selection of the representative MAAP case for the small early release category.

d. Table F.3-11 identifies the representative MAAP case for ST3 as RC10 and describes it to include "CS OK". RC10 is indicated in Table F.2-5 to not have containment sprays available. The Section F.2.2.4.2 description of ST3 indicates that containment fails due to prolonged core-concrete interaction, while RC10 is indicated to have coolable debris. Please clarify.

e. Section F.2.2.4.2 provides a discussion of assigning non-isolated steam generator tube rupture (SGTRN) with Auxiliary Feedwater (AFW) success to the interfacing system loss of cooling accident (ISLOCA) release category. Provide a further discussion of these sequences and the basis for this assignment. The discussion includes the statement "RC18 was reviewed to see if there are any sequences with AFW successful that should be allocated to the Containment Bypass group. None were found." Since RC18 is composed of ISLOCAs it is not clear why AFW availability is relevant. Explain.

f. Table F.2-7 gives the frequency of RC17 as 3.59E-06/year and the frequency of RC18 as 1.28E-08/year. Fifty percent of RC17 yields 1.79E-06/year for the frequency of ST4, in agreement with the frequency for ST4 in Table F.3-13. Fifty percent of RC17 added to the above value for RC18 yields 1.8E-06/year which is different from the value for ST5 given in Table F.3-13 of 2.97E-06/year. Explain.

g. Provide an updated version of Table F.2-7 based on the results of the DC03SA PRA.

h. Table F.3-11 provides the MAAP run times for each of the release category source term cases. Justify that the source term release fractions from these run durations represents the maximum release whenever the run end time is less than 48 hours after the declaration of general emergency.

i. It is noted that the sum of DC03 model release categories ST1 and ST5, both leading to a large early release, is 1.02E-05 per year while the quoted value for Large Early Release Frequency (LERF) for unit 1 is 1.20E-05 per year. Explain

the reasons for the difference. If this is due to Level 2 model changes compared to a LERF only model, describe the changes from the peer reviewed LERF model to the current full Level 2 model.

j. Provide a discussion of the development of the Level 2 model, particularly the containment event trees (CET), the basis for the CET split fractions, and updates since the Individual Plant Examination (IPE) to represent the current state of the art. (Note the PG&E response to 2010 SAMA RAI 2.a provides the requested information.)

3. External events

a. Provide the seismic CDF for the DC03SA model and the contribution to the seismic CDF by initiating event. Include the contribution from the new initiating event for ground motion accelerations greater than 4.0g for both the DC03 as well as DC03SA models.

b. Section F.2.3.2 indicates that a peer review of the seismic events model was conducted in January 2013 and states:

> "The update of the seismic fragilities of PRA SSCs is currently in progress. Once the update is completed in 2015, the seismic F&Os will be resolved followed by the update of the Seismic model."

Page 1 of the 7/1/2015 submittal states

> "The DC03SA model uses the same fragilities as the DC03 model. The Long Term Seismic Program (LTSP) fragility curves are acceptable for use in DC03SA because no scaling is necessary for use with the updated hazard spectral information from the March 2015 50.54(f) response."

i. The first statement indicates that changes to seismic fragilities were being made subsequent to the DC03 (interim) model, yet the second statement indicates that no changes were made from those used in the LTSP. Explain.

ii. The first statement implies that the only seismic F&Os unresolved involve the seismic fragilities. Confirm that all the findings from the 2013 peer review have been resolved.

iii. Page 1 of the 7/1/2015 submittal provides a comparison of the LTSP uniform hazard spectrum with the updated spectral information indicating that in one frequency range the shapes may differ by plus or minus 14%. Provide an additional discussion of this comparison and of the potential impact of a 14% difference in spectral shapes on seismic risk in general and the SAMA analysis in particular.

iv. The 7/1/2015 page 1 discussion indicates that at other hazard levels relevant to the PRA model (1E-03 to 1E-05) the shape does not differ

significantly from the shape at 1E-04 hazard level. Since the new (greater than 4.0 g) seismic initiating event has a frequency on the order of 1E-06, are the conclusions in the ER concerning the spectral shape at this lower hazard level?

c. Provide a further description of the development of the current fire PRA, including its relationship to the Individual Plant Examination – External Events (IPEEE) model and the model revision(s) that incorporated the guidance of NUREG/CR-6850.

d. Does the fire PRA include the changes resulting from and/or required by the NRC review of transition to NFPA 805 application? If not, provide the CDF and LERF results by hazard class from PG&E's response to the NFPA 805 transition integrated analysis RAI.

4. Level 3 PRA

a. In Section F.3.1 it is stated that "The MACCS2 code is being used in a slightly updated fashion ..." Clarify what is meant by 'updated fashion'.

b. In Section F.3.1, uncertainty is discussed. Briefly describe/expand why the mean consequence is expected to be minor (e.g., there are no single contributing effects that could significantly impact the mean).

c. In Section F.3.2, it is stated that "Individual growth rates were calculated for each grid element based on the county growth rate and the proportion of land in each grid element associated with the applicable counties." Clarify that this is the county population averaged over the county area, and the population is then partitioned to the spatial elements by the land fraction? Also, address whether there were any high population density regions near the edges of a spatial element that could distort the spatial assessment.

d. In Section F.3.3, what is the "year 2012 CPI"?

e. In Sections F.3.5 and F.4.5, the original SAMA analysis used an electrical net power output of 1138 MWe and thermal output of 3411 MWt. The current SAMA analysis uses an electrical net power output of 1180 MWe and thermal output of 3411 MWt. Discuss why the thermal power is not increased with the increased electrical output. If the thermal power should be increased, address the potential impact on the core inventory and the SAMA analysis results.

f. In Section F.3.6, it is stated that "An additional 15 minutes is added to the ETE evacuation times to account for processing time by offsite officials." Briefly describe the processing required by offsite officials.

5. SAMA identification and Screening

a. Section 5.1.2 indicates that the types of strategies called for in the DCPP Severe Accident Mitigation Guidelines to mitigate and recover from severe accidents are

not included as SAMAs because they are already implemented at the site. Is credit for these strategies included in the current DCPP PRA model (DC03SA)?

b. Review of Importance analysis

i. In a number of the discussions of potential SAMAs from review of importance lists, phrases such as “In most of the scenarios...”, "The significant sequences...” or “Some of the larger contributors...” are used. Discuss in general terms what is meant by these phrases and the possibility of identifying potential SAMAs from the portion of the event impact that is not included in “most of the scenarios,” “the significant sequences” or “some of the larger contributors.”

ii. For events PRB1A and PRC1A (Table 4, pp. 10 and 19), both involving fire induced loss of cooling accidents (LOCAs), would additional fire barriers be a feasible SAMA to limit the impact of the relevant fires?

iii. For event RF3Z (Table 4, p. 12), Fire: switchover to recirculation after SLOCA degraded instrumentation, SAMA 7 to automate the swap is proposed. Discuss if the fire procedures provide guidance specific to these fires and if they do not, the potential for developing these procedures as a viable alternative SAMA?

iv. SAMA 9, identified to mitigate event AW4, support for both motor-driven (MD) pumps unavailable (Table 4, p. 14), includes spray barriers to protect the turbine-driven (TD) AFW pump as well as MD pumps that can operate submerged. Discuss the potential and effectiveness for a SAMA that would only include the TD pump spray barriers.

v. SAMA 11, to install a swing Residual Heat Removal (RHR) pump, is proposed to mitigate events LA1 and LB2 (Table 4, pp. 15 and 16), involving failure of RHR pumps to start and run which results in loss of recirculation capability and containment heat removal. Consider improvements in the feed and bleed capability and other, less expensive means for providing containment heat removal capability.

vi. SAMAs 2 and 18, both involving engine driven pumps, are identified to mitigate fire induced failures of 4 kV Bus F (event AZAF3, Table 4, p. 16). Discuss the potential for SAMAs to directly impact the causes or severity of the relevant fires.

vii. For event AWFZ (Table 4, p. 18), no support for AFWP2, AFWP3 and fire impacts AFWP1, would additional fire barriers be a feasible SAMA to limit the impact of the relevant fires?

viii. For events SDS1, RCP shutdown seals fail to actuate (Table 4, p.23), SAMA 18, consisting of engine driven high pressure RCS and steam generator (SG) injection pumps is evaluated. For event SPCET3 (Table 5, p. 35), RCP seal cooling unavailable, SAMA 2, an engine driven SG

injection pump is evaluated. Consider a SAMA that provides only alternative seal cooling.

ix. Event OR1 (Table 4, p.23), operator cooldown and depressurize RCS, indicated to be associated with SGTRs combined with failure to isolate the ruptured SG, and Event OX1 (Table 5, p. 36), operator decides to isolate the ruptured SG, are both mitigated by SAMA 19 to install primary side SG isolation valves. Consider a SAMA for improving the procedures and training or automating the ruptured SG isolation function.

x. The top contributor to Event CD1FL (Table 4, p. 31) is described as a flood sequence from RWST breaks in the fuel handling building. SAMA 18, portable engine driven high-pressure RCS and SG injection pumps, is identified to mitigate this event. Consider the potential for alternative SAMAs involving use of flood barriers and alternate supplies to make up for the loss of RWST.

xi. The top contributors to Event GXH (Table 5, p. 48) are described as flooding events in the AFW rooms. Consider the potential for flood barriers to mitigate these floods.

c. The discussion in Section F.5.1.3.7 of Grand Gulf SAMA 59 indicates that, except for the third non-safety centrifugal charging pump, high head injection and low pressure pumps are dependent on the component cooling water (CCW) system. Also Figure F.2-1 indicates that loss of the CCW leads to 13 percent of the internal events CDF. Consider a SAMA similar to Grand Gulf's SAMA 59, Increase operator training for alternating operation of the injection and low pressure pumps for loss of CCW scenarios in addition to the alternate means described for DCPP.

d. For SAMA 10, provide an alternate DC generator, discuss the availability of such a generator as part of other programs such as B.5.b and Diverse and Flexible Coping Capability (FLEX).

e. For a number of the Phase I SAMAs included in Table F.5-3, the statement "This SAMA is addressed by elements of the DCPP FLEX strategy." Discuss the implications of this relative to the inclusion of credit for this in the DCPP PRA, the cost of and further consideration of the associated SAMAs.

6. Cost-benefit Analysis

a. Provide further information regarding the RISKMAN software quantification options mentioned on page 4 of the July 1, 2015 submittal including the option originally used for SAMAs 2, 9, 10 and 12 and the option used in the updated results.

b. The July 1, 2015 submittal describes a revised evaluation of the benefit of SAMA 8 "Protect RHR cables in fire areas 6-A-2 and 6-A-3." It is understood that the revised evaluation eliminates credit taken in the original evaluation for preventing

damage to equipment not protected by SAMA 8. It is noted that the revised evaluation appears to include additional fire impact deletions from the base case model (changes to ELECPWR and FELECPWR) than the original analysis. This would be expected to increase rather than decrease the averted cost-risk. Provide a further discussion of the revised evaluation including the differences in model changes that lead to the reduced credit.

c. Section F.6.3 indicates that SAMA 5 reduces the CDF by 0.7 percent. This SAMA is identified in Table F.5-1 (p. F-178) to mitigate Event ZTDPHD which has a risk reduction worth (RRW) of 1.05. Since this RRW corresponds to a CDF reduction of approximately 5%, SAMA 5 would appear to not be very effective in mitigating this event. Discuss the reasons for this benefit quantification result and the potential for more effective SAMAs for this event.

d. The evaluation of SAMA 9 in Section F.7.2.1.4 (p. F-119) indicates that protecting the pumps is simulated by removing the fire initiators from the impacted areas. Discuss how this simulates providing spray barriers and waterproof pumps. If this is due to flooding due to fire protection system initiation in response to a fire, discuss the potential for flooding due to fire protection system ruptures in these areas.

e. Section F.7.4 states "In order to assess the impact on the Phase 2 screening, the truncated frequency was assumed to be proportional to the CDF, and for each SAMA quantification, the truncated frequency was likewise binned to the ST5 release category." Provide further information on this process including the assumed reduction in ST5 release category frequency caused by a SAMA. Illustrate with a numerical example.

f. Table 11 provides the averted cost risk for SAMA 17 with the DC03 model to be $529,599 compared to that on page F-142 of $1,091,397. Since both include the 95th percentile uncertainty and the impact of binning the truncated frequency to ST5, it is expected that the values would be identical (as they are for all the other SAMAs). Explain.

g. As indicated in ER Section 4.20, the original SAMA found that when the 95th percentile PRA results were considered, SAMAs 12, 13, 24, and 25 were potentially cost beneficial. These original analysis SAMAs are:

   - SAMA 12: Improve fire barriers for auxiliary saltwater and component cooling water equipment in the Cable Spreading Room

   - SAMA 13: Improve cable wrap for the power operated relief valves in the Cable Spreading Room

   - SAMA 24: Prevent clearing of reactor coolant system Cold Leg Water Seals

   - SAMA 25: Fill or maintain filled the Steam Generators to scrub fission products

Discuss the current relevance of these SAMAs and their potential for being cost-beneficial in the updated analysis. If appropriate, identify plant or modeling changes that made these SAMAs no longer applicable.

7. Potential Lower Cost Alternative SAMAs

   a. For SAMA 1, install a Minimum CCW Cooling Flow Line around the RHR Heat Exchanger Outlet Valve, consider a modification to the outlet valve internals to allow a minimum CCW flow even when the valve is closed.

   b. SAMA 2, provide an engine drive SG makeup pump, is proposed to mitigate event AWR1, Failure to supply water from fire water storage tank or raw water reservoir (non-seismic). This SAMA is screened in Phase I as having a cost well in excess of Maximum Averted Cost-Risk (MACR). Discuss the potential for less expensive SAMAs such as procedure changes, automating the backup water supply or increasing the capacity of the condensate storage tank (CST).

   c. SAMA 4, provide a seismically qualified response system, is proposed to mitigate a number of sequences involving seismic Alternating Current (AC) and/or Direct Current (DC) system failures. Consider the potential for strengthening the weakest link in these systems to provide at least one source of AC and/or DC power at a considerably lower cost than SAMA 4.

   d. SAMA 9 and 17, install spray barriers to protect the TD AFW pump and install a waterproof AFW pump, and install flood sensors to mitigate fire protection system pipe breaks. As a low cost alternative for flooding in general, discuss the potential for using mobile sump pumps (including hose/pipes and power supply).