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

October 13, 2017

Mr. William F. Maguire
Site Vice President
Entergy Operations, Inc.
River Bend Station, Unit 1
5485 U.S. Highway 61 N
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 - LICENSE RENEWAL SEVERE ACCIDENT MANAGEMENT ALTERNATIVES AUDIT (CAC NO. MF9778)

Dear Mr. Maguire:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing Entergy Operations, Inc. (Entergy), application for renewal of the operating license for River Bend Station, Unit 1 (RBS). As part of the review, a severe accident mitigation alternatives (SAMA) audit will be conducted at RBS, by NRC staff, during the week of October 23, 2017. The audit activities will be conducted in accordance with the enclosed SAMA audit plan (Enclosure 1).

To aid in developing the site-specific supplemental environmental impact statement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," the NRC staff requests the information described in the enclosed SAMA audit needs list (Enclosure 2) be made available, to the extent possible, during the audit. The NRC staff transmitted this information to Entergy staff, Mr. Rick Buckley, by e-mail on October 6, 2017.

If you have any questions, please contact me by telephone at 301-415-6223 or by e-mail at David.Drucker@nrc.gov.

Sincerely,

/RA/

David Drucker, Sr. Project Manager
License Renewal Project Branch
Division of Materials and License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosures:
1. Environmental Audit Plan
2. Environmental Audit Needs List

cc: Listserv

SUBJECT: RIVER BEND STATION, UNIT 1 - LICENSE RENEWAL SEVERE ACCIDENT MANAGEMENT ALTERNATIVES AUDIT DATED OCTOBER 13, 2017

DISTRIBUTION:
PUBLIC
RidsNrrDmlr Resource
RidsNrrDmlrMrpb Resource
RidsNrrDlrMenb Resource
RidsNrrPMRiverBendProject Resource
RidsOgcMailCenter Resource

DDrucker, NRR
ESayoc, NRR
BBeasley, NRR
WBurton, NRR
JDozier, NRR
KHsueh, NRR
TTran, NRR
LRegner, NRR
JSowa, RIV
BrianParks, RIV
BMaier, RIV
VDricks, RIV OPA
AMoreno, OCA
SBurnell, OPA

ADAMS Accession no.: ML17284A100

OFFICE	PM:DMLR:MRPB	LA:DMLR:MRPB	BC:DMLR:MRPB (A)	BC:DMLR:MENB	PM:DMLR:MRPB
NAME	DDrucker	YEdmonds (SLent for)	WBurton	BBeasley (WBurton for)	DDrucker
DATE	10/12/2017	10/12/2017	10/13/2017	10/13/2017	10/13/2017

OFFICIAL RECORD COPY

RIVER BEND STATION, UNIT 1
LICENSE RENEWAL ENVIRONMENTAL REVIEW
SEVERE ACCIDENT MANAGEMENT ALTERNATIVES AUDIT PLAN

1. Background

On May 31, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17153A286), the U.S. Nuclear Regulatory Commission (NRC) received the Entergy Operations, Inc. (Entergy, the licensee), application for renewal of operating license for River Bend Station, Unit 1 (RBS). In support of the application and in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 and Part 54, Entergy also submitted an environmental report (ER) for RBS.

As part of the license renewal review, the NRC staff will conduct a severe accident management alternatives (SAMA) audit at RBS. This audit is conducted with the intent to gain understanding, verify information, and identify information 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 and scope, team assignments, and schedule.

2. 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 license renewal application. 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."

3. Audit Scope

Audit team members will focus on reviewing the documents and requested information listed in the RBS SAMA Audit Needs List (Enclosure 2) and discussing the information with plant personnel subject matter experts.

4. Information and Other Material Necessary for the Audit

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

5. Audit Team Members

The audit team members are Jerry Dozier, NRC, Steve Short, Pacific Northwest National Laboratory (PNNL), and Bob Schmidt, PNNL. Please note that Ben Beasley, NRC, will attend part of the SAMA audit.

The SAMA audit will be October 23-25, 2017, at RBS. There will be an entrance meeting with plant management. There will also be an exit meeting at the end of the audit.

6. Special Requests

The NRC staff requests the applicant make available the information identified on the Audit Needs List. Plant staff who are subject matter experts in the disciplines listed on the Audit Needs List should be available for interviews.

RIVER BEND STATION, UNIT 1
LICENSE RENEWAL ENVIRONMENTAL REVIEW
SEVERE ACCIDENT MITIGATION ALTERNATIVES AUDIT NEEDS LIST

GENERAL

The purpose of the River Bend Station, Unit 1 (RBS) severe accident mitigation alternatives (SAMA) audit is to review the SAMA analysis and results as documented in Entergy's License Renewal Environmental Report (ER) and supporting documents, and to review the Level 1, 2 and 3 probabilistic risk analysis (PRA) as described in the ER and supporting documents. The specific questions to be discussed and/or addressed at the audit are shown below. Note that additional questions may be developed and provided several days before the audit or during the audit.

DOCUMENTS REQUESTED TO BE AVAILABLE FOR REVIEW

Please make available the documents provided on the Certrec portal, including:

1. The most recent PRA Peer Review and/or self-assessment reports for all hazards.

2. Documentation associated with the Level 2 model reviews described in ER Section D.1.2.1 as well as any other RBS PRA reviews, particularly of the Level 2 and 3 PRAs.

3. Reference D.1-5, PSA-RBS-01-L2-01, Revision 0, “River Bend Level 2 PRA.”

4. Available documentation of the review of the results of the RBS Level 2 PRA by the team of RBS experts representing various site organizations (e.g. Operations, System Engineering, Mechanical/Safety Analysis, PRA and License Renewal) to confirm that the model is representative of the plant and the results are reasonable as cited in ER Section D.1.2.1.

5. Reference D.2-19, PRA-RBS-06-01, Revision 0, Cost-Benefit Analysis of Severe Accident Mitigation Alternatives (SAMA) Analysis, (ENERCON report ENTGRB174-REPT-003, R0)

6. Documentation of the identification and disposition of SAMAs identified from the review of SAMAs from 13 other BWR SAMA analyses and from the review of the RBS individual plant examination (IPE) and individual plant examination for external events (IPEEE).

7. Reference D.1-2, PSA-RBS-01-L3-02, Revision 0, “RBS WinMACCS Assessment of Severe Accident Consequences.”

INTERVIEWS

The nuclear regulatory commission (NRC) staff will need to interview Entergy/contractor personnel knowledgeable of RBS Level 1, 2 and 3 PRA development and results, as well as SAMA identification and evaluation. Interviews will discuss the attached questions and any other questions that may arise from the material reviewed during the audit.

TOUR

No specific site tour will be needed for the SAMA audit.

1. Provide the following information regarding the Level 1 PRA used for the SAMA analysis. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff evaluates the applicant's treatment of internal events and calculation of core damage frequency in the Level 1 PRA model. The requested information is needed for the NRC staff to determine the sufficiency of the applicant's Level 1 PRA model for supporting the SAMA evaluation.

    a. Section D.1.1 states, "This model reflects the RBS as-built, as-operated configuration as of April 30, 2009 [D.1- 4]. No other planned major plant modifications, which could adversely impact the SAMA analysis results, have been identified." Clarify the intent of this statement relative to any changes made to plant operations, procedures and/or physical modifications in the eight years since the stated configuration date and any planned future changes and their potential impact on the SAMA analysis.

    b. Section D.1.4.8 indicates that plant specific data and initiating events frequencies through April and May 2009 were incorporated in the RBS Revision 5 (R5) PRA. Section D.1.4.9 did not cite any further data updates made to RBS R5A. Section D.1.4.11 states, "Plant specific initiating event frequencies, failure rates, and maintenance unavailabilities are updated regularly. EN-DC-151 suggests an update frequency of approximately every four years." Discuss the current status of the plant specific data and initiating event frequency updates and the potential impact on the SAMA analysis.

    c. Identify the RBS PRA revision that was reviewed in the 2011 peer review. If not RBS R5, provide additional information on the revision reviewed including core damage frequency (CDF), large early release frequency (LERF), and major changes to produce PRA RBS R5A.

    d. Confirm that no changes have been made to the RBS model used in the SAMA analysis since the peer review that would constitute an upgrade as defined by American society of mechanical engineers (ASME)/American nuclear society (ANS) RA-Sa-2009, as endorsed by RG 1.200, Revision 2.

2. Provide the following information relative to the Level 2 PRA analysis. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff evaluates the applicant's treatment of accident propagation and radionuclide release in the Level 2 PRA model. The requested information is needed in order for the NRC staff to determine the adequacy of the applicant's Level 2 PRA model for supporting the SAMA evaluation.

    a. Section D.1.2.3 states "The following numbering scheme was used for the major release categories:" This is followed by a listing of the 13 source term categories (STCs). The use of the word "major" implies that there are non-major release categories. Clarify this and describe the basis for the selection of the 13 STCs used for grouping the containment event tree (CET) end points and their adequacy for the SAMA analysis.

b. STCs 5 and 6 are for large ruptures of containment while STCs 7 through 14 are for penetration failures. Briefly discuss the analysis of containment integrity that lead to these STC assignments and how this was modeled in the Level 2 PRA.

c. Section D.1.2.3.2 states that "...that the frequency for STC 1, Intact Containment, has been increased to account for the difference between the Level 1 CDF and the total calculated Level 2 frequency." The difference being due to the impact of truncation on the Level 2 cutsets. Provide support for the assignment of this difference to STC 1, which has a low risk compared to other STCs, and discuss the impact of assigning these unaccounted for sequences to other STCs.

d. The discussion of the representative Modular Accident Analysis Program (MAAP) cases for STCs 9 and 10 (containment failed prior to vessel breach, late molten core concrete interactions (MCCI)) cite MAAP cases S2A-6, T-TB-1, T-TB-2, T-14 and T1-4. Similarly, for STCs 11 through 14 (containment intact at vessel breach, with and without MCCI) MAAP cases T-TB-3, RCIC-Inj, T-TB-6, T-TB-9, and T-51and T-51-CV are cited. Provide a description of each of these cases including how late molten core concrete interaction (MCCI) is modeled, the frequency of the sequences that they represent, and discuss if there are any other sequences that could be important for evaluating the benefit of potential SAMAs.

e. The discussion of the representative MAAP cases for STCs 7 through 10 indicates that the same MAAP case (T-14) was used for both no MCCI categories, as well as those with MCCI. Similarly, for STCs 11 through 14, the same MAAP case (T-TB-3) was used for both no MCCI categories, as well as those with MCCI. However, the release fractions for otherwise similar categories (STC 7 and 9, STC 8 and 10, STC 11 and 13; as well as STC 12 and 14) are different, even though from the same MAAP case. From the discussion in the ER, it appears that the results prior to MCCI were used for the no MCCI categories while the results at the end of the run were used for the MCCI categories. Please clarify this and justify the use of MAAP results prior to MCCI occurring for the no MCCI categories rather than the end of run result for a MAAP case without MCCI.

f. Table D.1-7 gives a noble gas release fraction of 0.018 for STCs 11 and 12 (containment intact at vessel breach, no MCCI) as obtained from MAAP case T-TB-3. This result is much less than that for STC 1, intact containment. Discuss the modeling of no MCCI scenarios and explain this low noble gas release fraction result.

g. Section D.1.2.3.1, with regard to the MAAP analysis of fission product release, states "In general, cases were run to a minimum of 140 hours to ensure that any late MCCI effects are understood. Provide the MAAP run times for each STC, as well as the time of declaration of a general emergency, the time of core damage, the time of containment failure and the time of the start of release. Also, clarify the meaning/definitions for the plume durations and plume delays given in Table D.1-21. If any of the run times are less than 48 hours after the time of declaration of general emergency justify the duration of the run time.

h. Section D.1.4.10 states that the LERF model was peer reviewed in July 2011. Section D.1.2.1 states, with regard to the Level 2 PRA, that "It was prepared and reviewed by qualified personnel in accordance with existing industry standards" and further...a team of RBS experts representing various site organizations (e.g. Operations, System Engineering, Mechanical/Safety Analysis, PRA and License

Renewal) performed a review of the results to confirm that the model is representative of the plant and the results are reasonable." Discuss the results of any self-assessment of the LERF portion of the Level 2 PRA model against the LERF requirements of the ASME/ANS PRA standard.

3. Provide the following information with regard to the treatment and inclusion of external events in the SAMA analysis. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff evaluates the applicant's treatment of external events in the PRA models. The requested information is needed in order for the NRC staff to determine the sufficiency of the applicant's PRA models for supporting the SAMA evaluation.

    a. In response to NRC requests following the accident at the Fukushima Dai-ichi Nuclear Power Plant, new seismic hazard curves have been developed for each nuclear power plant site. Based on this information, Electric Power Research Institute (EPRI) has produced updates to the GI-199 seismic CDFs (see Nuclear Energy Institute (NEI) letter dated March 12, 2014) (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML14083A596). Provide the RBS seismic CDF (SCDF) from this analysis and discuss the impact and appropriateness of using this seismic CDF on the RBS SAMA analysis.

    b. In the ER, Entergy reported a RBS SCDF of 2.5E-06/Rx-yr using more realistic plant specific fragility values instead of the more conservative values used by the NRC in the GI-199 safety/risk assessment. Provide more information on, and support for, these more realistic fragility values as well as the value cited using the 2010 EPRI seismic hazard curves.

    c. Section D.1.3.4 indicates that the internal flood analysis was revised and updated in 2012. Identify the internal events model used in this updated flood analysis, characterize it with respect to the internal events model used in the SAMA analysis (RBS 5A), and assess the impact of any difference between the two models.

    d. Section D.1.4.10 indicates that the majority of the supporting requirements assessed as "not met" in the 2011 peer review were related to internal flooding. Further Section D.1.4.11 states "... following each periodic PRA model update, Entergy performs a self-assessment to assure that the PRA quality and expectations for all current applications are met." Discuss the results of the self-assessment of the 2012 internal flood model as well as the status of meeting those requirements "not met" in the 2011 peer review. For any internal flood requirements "not met" discuss the impact on the SAMA analysis.

    e. Following the accident at the Fukushima Dai-ichi nuclear power plant, Entergy responded to an NRC 10 CFR 50.54(f) request for information. This response included a reevaluation of the external flood hazards, the development of mitigating strategies for external floods and a focused evaluation of the external flooding mechanisms for which the re-evaluated flooding hazards is not bounded by the current design basis. Entergy's evaluations concluded that permanent passive protection is in place for the Probable Maximum Flood (PMF) on West Creek and PMF on the Mississippi River and the Local Intense Precipitation (LIP) flood-causing mechanisms (Entergy, June 28, 2017, ADAMS Accession No. ML17207A105). This focused evaluation was a deterministic (that is, not a probabilistic) evaluation.

Provide a discussion of these external flood hazards and the associated impact on RBS to support the conclusion that they would not contribute to the external events multiplier nor lead to any cost-beneficial SAMAs.

4. Please provide the following information regarding the Level 3 PRA used in the SAMA analysis. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs, if not previously considered, in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analyses, NRC staff evaluates the applicant's analysis of accident consequences in the Level 3 PRA. The requested information is needed in order for the NRC staff to reach a conclusion on the sufficiency of the applicant's Level 3 PRA model for supporting the SAMA evaluations.

    a. ER Table D.1-32 provides the results of several sensitivity analyses. The change in population dose risk is reported to be unchanged from the base case (1.21 person-rem/year) for all of the sensitivity analyses. No explanation is provided for this non-intuitive result, especially for those sensitivity cases that would have been expected to have some impact on the population dose risk (i.e., evacuation speed, fraction of public evacuating, and time to declaration of a general emergency). For each of the sensitivity cases, explain why there is no impact on the population dose risk. Also, provide the decontamination time (TIMDEC) value assumed in the baseline SAMA analysis.

    b. Table D.1-16 provides the estimated core inventory input to the Level 3 analysis. Clarify whether adjustments of the core inventory values are necessary to account for differences between fuel cycles expected during the period of extended operation and the fuel cycle upon which the Level 3 analysis is based (e.g., to account for any changes in future fuel management practices or fuel design).

    c. Section D.1.5.2.6 indicates that meteorological data for the year 2013, the most conservative data set for the years 2008 through 2014, was used in the consequence analysis. Discuss the basis for the conclusion that the year 2013 data is the most conservative, the extent to which there was missing data, and how missing data was accounted for in the SAMA analysis.

5. Provide the following information with regard to the selection and screening of Phase I SAMA candidates. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff evaluates the applicant’s basis for the selection and screening Phase I SAMA candidates. The requested information is needed for the NRC staff to determine the adequacy of the applicant’s Phase I SAMA selection and screening process for the SAMA evaluation.

    a. The ER indicates that, based on the best available information, the CDF for each of the external events (seismic, internal fire and internal floods) are approximately equal to, or greater than, the internal events CDF. Discuss the steps taken to identify potential SAMAs that would mitigate the RBS specific risks due to these hazards.

    b. Address the following with respect to the review of the importance analysis in ER Table D.1-2

i. Event E12-MDP-MA-C002A "[Residual heat removal] RHR pump A is unavailable due to maintenance" is addressed by a number of SAMAs that are either not applicable to this event (SAMAs 79 and 198) or involve costly new systems (SAMAs 110, 115 and 120). Consider other alternatives to mitigate this event such as eliminating or reducing on-line maintenance of the RHR pump or adding an additional standby pump.

ii. Event FPW-XHE-LO-T2SBO "operator fails to follow attachment 2 for [station black out] (SBO)" is addressed by several hardware modifications. This event is given a failure probability of 0.5 and has a fairly high RRW of 1.117. Discuss the potential for a SAMA to improve the procedure or training. [Note: Phase I SAMA 72 to improve training on alternate injection via the fire water system was screened out as already installed. Also, it would appear that fire water injection into the reactor vessel would be important for increasing the likelihood of preventing molten core concrete interaction.]

iii. For Event IE-T3C "Initiator, Inadvertent opening of SRV," is addressed by SAMA 108 - Improve [safety relief valve] SRV and [main steam isolation valve] MSIV pneumatic components and SAMA 160 - Increase SRV reseat reliability. It is not clear that either of these SAMAs address this event. Discuss the potential for other SAMAs that address or mitigate this event.

iv. It is noted that the table includes a number of standby service water (SSW) pumps B and D failure events but not any events for failure of SSW pumps A or C. Explain the reasons for this difference and discuss if the reasons suggest any potential SAMAs.

v. Event SWP-MOV-CC-F055A "motor operated valve [MOV] 1SWP*MOV55A fails to open on demand" is said to be addressed by SAMAs 75 and 80, both of which pertain to the service water pumps. Discuss the potential for a SAMA for the operator to manually open the valve.

vi. For ADS-XHE-FO-INDIV "operator fails to start ADS by opening individual ADS valves or SRVs," consider improvements in procedures and training.

c. The disposition of a number of late large release Level 2 risk significant terms in Table D.1-5 states, "This item is a split fraction. No SAMAs need to be correlated." While these events are in some cases related to deterministic phenomenological analysis or assumptions and not hardware or other failures, they do indicate the importance of a number of these events and the associated assumptions. In addition, as indicated by the base case risk results, source term categories (STCs) 9 and 10 dominate the risk and involve penetration failures with and without scrubbing in the auxiliary building. It would therefore appear that steps that could be taken to reduce the impact of these STCs should be considered. For example, consideration of means to increase the likelihood or effectiveness of scrubbing in the auxiliary building in the area of the penetrations would appear worthwhile. Discuss this particular example and the more general question addressing potential SAMAs suggested by review of the Level 2 split fractions.

d. From the information in Tables D.1-1 and D.1-2 the frequency of initiating event IE-TNSW, Failure of the Normal Service Water (NSW)/Service Water Cooling (SWC) System, is an input into the internal events PRA as a value rather than as a fault tree model. The basic events that contribute to this frequency will therefore not appear in

the list of risk significant terms in Table D.1-2. Describe NSW and SWC systems, their operation, and modeling in the PRA, particularly with respect to operation in hot weather and discuss the identification of candidate SAMAs, other than SAMA 197 (Generation Risk Assessment implementation into plant activities), that would mitigate the risk of this initiator.

6. Provide the following information with regard to the Phase II cost-benefit evaluations. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff evaluates the applicant's cost-benefit analysis of Phase II SAMAs. The requested information is needed in order for the NRC staff to determine the acceptability of the applicant's cost estimations for individual SAMAs and cost-benefit evaluation

    a. Describe what changes/modifications are associated with the implementation of SAMA 38 - Protect service transformers from failure evaluated by Case 9.

    b. Case 19 evaluates the benefit of SAMA 87, Install digital feedwater upgrade, by setting the loss of feedwater system initiating event (IE-T3B) to false in the base model Level 1 and Level 2 cutsets. Discuss the potential for additional benefit of the upgrade resulting from the reduction in the potential for loss of feedwater following other initiators. Note also that Table D.2-1 indicates a 2.2 percent reduction in CDF versus the 2.46 percent contribution to total CDF by this initiator in Table D.1-1.

    c. Case 28 evaluates the benefit of SAMA 59, Implement ability to cross-tie safety-related power to control rod drive (CRD) pumps for vessel injection during loss of station power (LOSP), by eliminating CRD injection events and the loss of CRD initiator from the PRA. Use of the CRD for injection into the reactor vessel in the event of loss of other means of injection is included in the RBS Emergency Operating Procedures. If this is credited in the RBS PRA then the above modeling changes would appear to eliminate this credit. Discuss this apparent discrepancy.

    d. SAMA 183, add automatic fire suppression (specifically, addition of incipient detection and suppression division 1 switchgear (Div 1 Swgr) Room), and SAMA 185, upgrade the ASDS panel to include additional system controls for opposite division, were evaluated in Cases 36 and 37 by eliminating the contribution to CDF from the respective fire zones. Address the following with respect to these two SAMA and Cases:

        i. Case 37, Reduce Risk From Fires That Require Control Room Evacuation, was used to evaluate the benefit for SAMA 185 by assuming this SAMA eliminated Control Room fires from the RBS fire CDF. It is noted that fires other than in the control room may require control room evacuation and could benefit from the upgrade of the ASDS panel. Identify the other control room abandonment areas and discuss the impact on the cost-benefit analysis of SAMA 185 from crediting the risk reduction benefit of this SAMA for the identified abandonment areas.

        ii. The benefit for these two fire related cases was determined based on the assumption that the percentage reduction in person-rem risk and offsite economic risk (OECR) is the same as the percentage reduction in CDF. An examination of the results for the risk reductions given in Table D.2-1

indicates that this assumption is not necessarily conservative. Depending on the case, the reduction in OECR is often a factor of 1.1 to 1.4 times the CDF reduction. For Case 17 the OECR reduction is 2.4 times the CDF reduction. Discuss the impact of this assumption on the cost-benefit analyses of SAMAs 183 and 185.

7. For certain SAMAs considered in the RBS Environmental Report, there may be lower cost or more effective alternatives that could achieve much of the risk reduction. In this regard, provide an evaluation of the following SAMAs. The basis for this request is as follows: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the RBS SAMA analysis, NRC staff considers additional SAMAs that may be more effective or have lower implementation costs than the other SAMAs evaluated by the applicant. The requested information is needed in order for the NRC staff to determine the adequacy of the applicant's determination of cost-beneficial SAMAs.

    a. SAMA 34, Provide alternate feeds to essential loads directly from an alternate emergency bus, is evaluated using a plant-specific cost estimate of $2.3M. Case 4, evaluating this SAMA, is stated in ER Section D.2.3 to assume an added independent AC [alternating current] power source to each safety-related 4160v bus. Clarify the scope of the design used for the cost estimate and, if it includes independent supplies to all safety-related buses, consider the cost-benefit of a design that included a supply to only a single safety-related 4160v bus.

    b. SAMAs 80, 110, 115, and 120 all involve major new systems to mitigate loss of cooling events and are cited for a large number of significant basic events in Table D.1-2 including, for example: SWP-XHE-FO-RETRN, Operator fails to open SWP manual isolation valve before containment over-pressurization failure, SWP-XHE-RE-F055A, operator fails to restore XOV downstream of F055A, and E12-MOV-OO-F048A, water diverted from RHR A HXS because bypass valve MOV F048A fails to close. Describe these events and other similar events regarding the possibility of lower cost alternatives such as: simpler hardware changes, changes in system operation in order that fewer changes in valve position are necessary, and/or procedure and training improvements.

8. Other Audit Questions

    a. Discuss the various systems available to RBS that were not part of the original design basis or have been added as part of various industry programs to address beyond-design-basis events and the extent they are credited in the SAMA PRA.

    b. Table D.1-12 gives LERF for the 2015 RBS R5A PRA as 2.30E-08 per reactor year (Rx-yr) at a truncation of 1E-14 per yr, while Section D.1.2.1 (p. D-23) gives the LERF frequency as 2.32E-08/Rx-yr at a truncation of 1E-12/Rx-yr. Explain the difference.

    c. Section D.1.2.2 states that, "Each Level 1 CDF accident sequence was grouped into one of six groups for use in the Level 2 analysis. Discuss how Level 1 station blackout (SBO) sequences were treated in the Level 2 analysis.

    d. Section D.2.1 indicates that the initial list of SAMA candidates was developed from the review of a list of industry documents. Provide additional information on how this

review was performed and how the decision was made to include individual items in the Phase I list. Specifically address:

i. Which potential plant improvements from the 13 other SAMA evaluations were considered,

ii. The inclusion of items from the RBS IPE or IPEEE or NUREG-1742,

iii. How the RBS updated PRA list of significant contributors (the RRW correlation tables) were examined to identify RBS plant specific SAMA candidates as opposed to generic or other plant SAMAs.

e. It is not clear how event E12-MOV-CC-F024A, "RHR-A Test return to Suppression Pool E12MOVF024A fails to open" leads to core damage. Explain and discuss the potential for operators to mitigate this by manually opening this valve.

f. The RBS IPEEE did not identify any fire related vulnerabilities or improvements, however, five "enhancements" were identified. Discuss the status of the implementation of these "enhancements."

g. From the review of the identification and disposition of Phase I SAMA candidates:

i. SAMA 31, to use the DC [direct current] generator to operate switchyard breakers, is said to be already installed. RBS has a backup propane generator to supply chargers, but this is not directly connected to the switchgear as indicated in the SAMA. Provide further support for not retaining this SAMA.

ii. SAMA 93 regarding heating ventilation and air conditioning (HVAC) discusses a recent analysis of control building shows reduced HVAC importance and that this SAMA does not consider the control building loss of HVAC. This is also stated for SAMA 94 involving enhanced loss of HVAC procedures. Clarify the results of the recent analysis that supports this disposition.

iii. SAMA 114 to create a reactor cavity flooding system is considered as already installed based on the existence at RBS of procedures to flood the cavity. Consider if this should be retained to evaluate the benefit of adding a system (perhaps not dependent on AC power) not just using existing systems.

iv. SAMA 119, to restrict flooding to below the top of core, is intended to reduce forced containment venting since higher flooding results in blocking the vent path. Discuss this relative to vent paths available at RBS.

v. SAMA 120, to install a hardened containment vent, cites a containment vent study. Describe this study, its scope and results. In addition, Section D.1.4.8 mentions the deletion of credit for a 3-Inch containment vent. Describe and discuss the current status of this vent path.

vi. SAMA 135, to institute simulator training for severe accident scenarios, is said to be already installed since it is included for emergency response

organization personnel. Consider the benefit of severe accident simulator training for operators for actions/activities prior to the availability of emergency response organization.

vii. SAMA 170 to increase seismic ruggedness of plant components is stated to be already installed based on improving RBS components whose seismic ruggedness could be improved and was identified in the IPEEE. The RBS IPEEE does not identify any such components. Discuss the potential for reducing seismic risk by improving seismic ruggedness of selected RBS components.

viii. SAMA 182 to improve alternate shutdown training and equipment says RBS already have adequate alternate shutdown procedures and training for fires. The RBS fire CDF as evaluated for use in the SAMA external event multiplier is more than 3 times the internal events CDF. Provide support for not improving the fire related shutdown training.