NEXTera ENERGY SEABROOK

September 13, 2012

SBK-L-12185
Docket No. 50-443

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Seabrook Station

Supplement 3 to Severe Accident Mitigation Alternatives Analysis

Response to RAI Request dated July 16, 2012

NextEra Energy Seabrook License Renewal Application

References:

1. NextEra Energy Seabrook, LLC letter SBK-L-10077, "Seabrook Station Application for Renewed Operating License," May 25, 2010. (Accession Number ML101590099)
2. NextEra Energy Seabrook, LLC letter SBK-L-11001, "Seabrook Station Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application," January 13, 2011. (Accession Number ML110140810)
3. NextEra Energy Seabrook, LLC letter SBK-L-12053, "Supplement 2 to Severe Accident Mitigation Alternatives Analysis" March 19, 2012, (Accession Number ML12080A137)
4. NRC Letter, Request For Additional Information For The Review Of The Seabrook Station License Renewal Application Environmental Review -SAMA Review (TAC No. ME3959), July 16, 2012, (Accession Number ML12180A355)

In Reference 1, NextEra Energy Seabrook, LLC (NextEra) submitted an application for a renewed facility operating license for Seabrook Station Unit 1 in accordance with the Code of Federal Regulations, Title 10, Parts 50, 51, and 54.

The original SAMA was submitted in May 2010 (Reference 1) and was based on Seabrook's base case PRA model of record SSPSS-2006 (model SB2006). In NextEra Letter SBK-L-11001 (Reference 2), the next periodic update to the PRA model was discussed. In Reference 3, NextEra completed the PRA update (SB2011) and provided a supplemental SAMA analysis based on PRA update SB2011. In Reference 4 the staff requested additional information to support the review of this supplement. Enclosure 1 provides NextEra responses to the requested additional information.

A144
NRR

The License Renewal Application, Appendix E, page F-6 contains a list of acronyms used in this supplement. If there are any questions or additional information is needed, please contact Mr. Richard R. Cliche, License Renewal Project Manager, at (603) 773-7003.

If you have any questions regarding this correspondence, please contact Mr. Michael O'Keefe, Licensing Manager, at (603) 773-7745.

Sincerely,

NextEra Energy Seabrook, LLC.

Kevin T. Walsh
Site Vice President

Enclosure

cc:

W.M. Dean,	NRC Region I Administrator
J. G. Lamb,	NRC Project Manager, Project Directorate I-2
J. Grieves,	NRC Resident Inspector
A.D. Cunanan,	NRC Project Manager, License Renewal
M. Wentzel,	NRC Project Manager, License Renewal

Mr. Christopher M. Pope
Director Homeland Security and Emergency Management
New Hampshire Department of Safety
Division of Homeland Security and Emergency Management
Bureau of Emergency Management
33 Hazen Drive
Concord, NH 03305

John Giarrusso, Jr., Nuclear Preparedness Manager
The Commonwealth of Massachusetts
Emergency Management Agency
400 Worcester Road
Framingham, MA 01702-5399

NEXTera ENERGY SEABROOK

I, Kevin T. Walsh, Site Vice President of NextEra Energy Seabrook, LLC hereby affirm that the information and statements contained within are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Sworn and Subscribed

Before me this

13 day of September, 2012

MICHAEL D. O'KEEFE MY COMMISSION EXPIRES FEB. 13, 2013 NOTARY PUBLIC NEW HAMPSHIRE

Notary Public

Kevin T. Walsh

Site Vice President

<u>Enclosure to SBK-L-12185</u>

NextEra Energy Seabrook

Responses to NRC Request for Additional Information

Regarding

Severe Accident Mitigation Alternatives Analysis, Supplement 3

SAMA RAI 1a

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

> The Initiating Event Contribution to core damage frequency (CDF) Table in Section 3.1.1 of the SAMA Supplement, Reference (3), presents initiating event contributors down to 2.5% of the total combined (i.e., internal and external) CDF. Please provide initiating event contributors down to 1.0% of the total CDF. If this addition includes contributors that did not previously appear, other than for the new flooding analysis, please discuss their new presence.

NextEra Energy Seabrook Response to SAMA RAI 1a

The table below provides the initiating event contribution to CDF down to 1% of CDF. The initiating events below 2.5% include internal event initiators LPCCA, LOSPP, FCRAC, LACPB and LOC1LG, and new internal flood initiators that were not included in the SB2006 model. All of the initiating events except for the SB2011 internal flood initiators were identified in the previous SB2006 SAMA. There is not a significant shift in the relative CDF contribution of the initiators contributing to the top 99% of CDF compared to the previous SB2006 PRA model results.

Initiating Events (IE) that Contribute 1% and greater to CDF (SB2011)

Initiating Event ID	Description	IE Frequency (per yr)	IE CDF Contribution (per yr)	IE Percent CDF Contribution (SB2011)	IE Previous Percent CDF Contribution (SB2006)
E7T	Seismic 0.7g Transient Event	9.30E-06	9.33E-07	7.6%	6.3%
E10T	Seismic 1.0g Transient Event	1.77E-06	8.88E-07	7.2%	5.9%
LOSPW	Loss of Off-Site Power due to Weather	7.65E-03	6.82E-07	5.6%	10.0%
F4TREL	Major Flood - Rupture of HELB / impact Relay Rm	2.73E-04	5.89E-07	4.8%	(a)
SGTR	Steam Generator Tube Rupture	4.09E-03	5.69E-07	4.6%	4.0%
RXT1	Reactor Trip – Condenser Available	7.38E-01	5.41E-07	4.4%	6.4%
LOC1MD	Medium LOCA Event	1.88E-04	5.31E-07	4.3%	2.3%
LOSPG	Loss of Off-Site Power -Grid-Related Events	1.15E-02	4.53E-07	3.7%	6.2%
F1SWCY	Rupture of SW Common Return Pipe in Yard	1.27E-05	4.06E-07	3.3%	(a)

Initiating Event ID	Description	IE Frequency (per yr)	IE CDF Contribution (per yr)	IE Percent CDF Contribution (SB2011)	IE Previous Percent CDF Contribution (SB2006)
E14T	Seismic 1.4g Transient Event	6.00E-07	3.64E-07	3.0%	2.5%
FCRPL	Fire in Control Room – PORV LOCA	4.51E-05	3.62E-07	3.0%	1.0%
FSGBE6	Fire SWGR Room B – Loss of Bus E6	1.00E-03	3.46E-07	2.8%	2.6%
LACPA	Loss of Train A Essential AC Power (4kV Bus E5)	4.40E-03	3.19E-07	2.6%	2.4%
FSGAE5	Fire in SWGR Room A – Loss of E5	1.10E-03	3.05E-07	2.5%	2.5%
LPCCB	Loss of Train B PCCW System	9.90E-03	3.03E-07	2.5%	1.8%
LPCCA	Loss of Train A PCCW System	9.98E-03	2.34E-07	1.9%	1.8%
F1PSWA	Major flood, rupture of SW Train A in PAB	1.10E-05	2.22E-07	1.8%	(a)
LOSPP	Loss of off-site power due to switchyard	5.66E-03	2.07E-07	1.7%	5.6%
F2PSWA	Large flood, rupture of SW Train A piping in PAB	2.63E-04	2.03E-07	1.7%	(a)
F2PSWB	Major flood, rupture of SW Train B piping in PAB	2.63E-04	2.00E-07	1.6%	(a)
F1PSWB	Large flood, rupture of SW Train B piping in PAB	1.10E-05	1.97E-07	1.6%	(a)
F4TFPB	Major flood, rupture of Fire Protection piping in TB impacting offsite power.	8.37E-05	1.81E-07	1.5%	(a)
FCRAC	Fire in Control Room – AC Power Loss	9.13E-07	1.79E-07	1.5%	1.5%
LACPB	Loss of Train B Essential AC Power (4kV Bus E6	4.40E-03	1.63E-07	1.3%	4.1%
F2PSWC	Large flood, rupture of SW common return piping in PAB	5.55E-06	1.46E-07	1.2%	(a)
LOC1LG	Large LOCA	3.14E-06	1.24E-07	1.0%	2.3%

Note (a) - Flood initiator not included in SB2006 model.

SAMA RAI 1b

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

> Section 3.1 states on pages 4-5 that an installation of a flow orifice in fire protection piping in control building is credited in the SB2011 probabilistic risk assessment (PRA) model update and is undergoing final acceptance testing. Please clarify when this design change will be implemented and whether it has passed final acceptance testing. In addition please verify that the as-built design change supports the PRA SAMA assumptions.

NextEra Energy Seabrook Response to SAMA RAI 1b

The fire protection flow orifice modification is identified as cost-beneficial SAMA #192 in the SAMA Supplement (Reference 3). Implementation of the engineering change for the flow orifice design is complete and acceptance testing satisfactory. The orifice as-built design is consistent with the PRA SAMA assumptions.

SAMA RAI 1c

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

> The CDF for Station Blackout (SBO) and Anticipated Transient Without Scram (ATWS) is not presented, and it is not clear whether these values have changed from the original 2009 submittal. Please provide CDF values for SBO and ATWS.

NextEra Energy Seabrook Response to SAMA RAI 1c

The approximate CDF contributions from SBO and ATWS events are as follows:

Event	**SB2006**	**SB2011**
SBO	5.24E-06/yr	3.31E-06/yr
ATWS	4.55E-07/yr	4.70E-07/yr

There is only a small change in the SBO and ATWS CDF contributions between the SAMA Supplement (SB2011) and the previous SAMA (SB2006).

SAMA RAI 1d

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

> Previously, the contribution from internal events and internal floods together was 1.1E-5/yr. This has dropped to 7.1E-6/yr (see p. 16 of 96). The severe weather contribution, which is not insignificant at 10.0%, was not previously provided. Please explain all these differences, at least qualitatively.

NextEra Energy Seabrook Response to SAMA RAI 1d

The previous SAMA evaluation was based on Seabrook PRA Model SB2006. This model quantified a total CDF of 1.45E-05/yr with internal events, internal flood events and weather events contributing to the CDF as follows:

Event	CDF SB2006	CDF SB2011
Internal Events	7.91E-06/yr	4.55E-06/yr
Internal Flood Events	7.79E-07/yr	2.61E-06/yr
Severe Weather Events	1.45E-06/yr	6.82E-07/yr

The internal events CDF in SB2011 decreased slightly as a result of model enhancements and incorporation of more recent data (plant-specific and generic data). The internal flooding CDF in SB2011 increased as a result of the comprehensive assessment of internal flood events and upgrade to the PRA model. The internal flood study produced 27 flood initiators compared to only 3 flood initiators in the earlier study. The severe weather CDF has decreased primarily due to incorporation of more recent data.

SAMA RAI 1e

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

> Among the basic event contributors to CDF and large early release frequency (LERF) (see pp. 17 and 19 of 96) are several that differ from those in the Jan. 13, 2011, RAI response. Please explain the increase in RRW values for HH.XOEFW1.FA, HH.XIONES3.FA and HH.OTSI3.FA and decrease in RRW value for FWP37A.FR for the LERF importance listing. Also, explain the basic events removed from and added to the LERF and CDF listings.

NextEra Energy Seabrook Response to SAMA RAI 1e

Changes in RRW (LERF) values are due to a number of small changes made in the PRA model between SB2006 and SB2011. HEP values for basic events HH.XOEFW1.FA and HH.OTSI3.FA increased from SB2006 to SB2011 due to a change in the process of calculating HEPs (from taking the maximum of time-based HEP and cause-based HEP to use of the sum of time-based and cause-based HEPs). An increase to the HEP value results in a larger RRW value. The HEP value for basic event HH.XIONES3.FA remain the same but its RRW increased as a result of Level 2 modeling of release category LE4 and credit for gravity drain of the RWST in containment. The failure rate for the Turbine-driven EFW pump FWP37A decreased from SB2006 to SB2011 due to improved plant-specific performance. A decrease in the pump's failure rate results in a decrease in RRW value.

The basic events added to and removed from the CDF and LERF listings are consistent with the changes made to the PRA model between SB2006 and SB2011. The modeling changes are summarized in response to RAI 1b3 of Reference (2) and Section 3.1 of Reference (3).

In the list of basic events contributing the CDF (page 17 of 96 to Reference 3), five basic events (ZZ.SY1.FX, [DGDG1A.FR3], [DGDG1B.FR3], SEPSDG2B.FR3 and SEPSDG2A.FR3) were also included in the previous list. Three HEP basic events (HH.OHSB1.FA, HH.OSGL3.FL and HH.OHSB6.FL) are new to the list because these HEP events were developed in SB2009 and were not part of the SB2006 SAMA model. Also, three common-cause basic events ([CCP11A CCP11B CCP11C CCP11D], [EDESWG5.FX EDESWG6.FX] and [EDESWG11A.FX EDESWG11B.FX]) were not in the previous list. The list of the top basic events in the SAMA Supplement included both independent and common-cause basic events to ensure that both are evaluated. In the previous SAMA evaluation, only independent failure modes were considered. The remaining new basic events on the list (HH.OALT1.FL, HH.OTSI3.FA, HH.OSEP2Q.FA and HH.OLPR2.FA) are the result of the model changes made between SB2006 and SB2011.

In the list of basic events contributing to LERF, (page 19 of 96 to Reference 3), five basic events (HH.XOEFW1.FA, ZZ.SY2.FX, HH.OTSI3.FA, HH.ORWMZ1.FA and FWP37A.FR) were also included in the previous top list for LERF (RAI 5b of Reference 2 and Table F.3.2.1-2 of Reference 1). There were no common-cause events in the top LERF list. The remaining basic events on page 19 of 96 are new as a result of the model changes made in SB2011.

In both the CDF and LERF top basic event lists, basic events that are removed compared to the previous lists are due to small changes in RRW that place them below the top 15.

SAMA RAI 2a

Please provide the following information relative to the Level 2 analysis:

> The discussion for source term group Small/Early Containment Penetration Failure to Isolate and Large/Late Containment Basemat Failure (SELL) identifies that SELL uses the source term from release category LL5a and frequency from release category SELL5a. The Table on page 6 identifies that LL5a is a contributor to source term group LL5. The discussion for LL5 identifies that MAAP Case #106f was used to provide a representative source term while the discussion for SELL identifies that MAAP Case #106g was used for this source group. Please clarify this apparent discrepancy.

NextEra Energy Seabrook Response to SAMA RAI 2a

LL5a provided the most significant source term compared to LL3b and LL4b. As a result, LL5a was used "in the development" of the new source term SELL, of which MAAP case #106 is used to characterize the specific SELL source term. The source term for release category LL5 is based on MAAP Case #106f while release category SELL is based on MAAP Case #106g. These two MAAP cases are identical station blackout sequences leading to long term containment failure due to basemat failure - except that, for SELL (Case #106g), an additional small containment penetration failure was added. Thus, SELL is based on a similar accident sequence as LL5, but uses a distinct source term from LL5.

SAMA RAI 2b

Please provide the following information relative to the Level 2 analysis:

The dose risk and Off-site Economic Cost Risk (OECR) results are different for the SB2006 and SB2011 PRA model results. The reason for these differences is not clear in every case. Using Table F.3.2.1-1 and requests for additional information (RAIs) 2g and 4a associated with the SB2006 environmental report (ER), and release category results from the SB2011 submittal, please discuss the model basis that caused the following observations:

i. LE1 – The CDF for this release category decreased from 1.1E-7/yr to 5.2E-8/yr, and the SB2011 release fractions for the noble gases, iodine (I) and cesium (Cs), are significantly delayed compared to their timing in the SB2006 model.

ii. LE2 – The CDF for this release category increased from 4.0E-9/yr to 1.8E-8/yr. The SB2011 noble gas release fraction is similar to the SB2006 model, but the I and Cs release fractions are reduced by half.

iii. SE3 – The dose risk and OECR for this release category decreased by a factor of about three. The new SELL source term group appears to be a sub-part of the original small early containment isolation failure source term group (i.e., SE3).

NextEra Energy Seabrook Response to SAMA RAI 2bi

Release category LE1 is defined as a large/early containment bypass due to steam generator tube rupture without scrubbing. The frequency for release category LE1 decreased from SB2006 to SB2011 due to the improvement in component reliability, specifically for the AFW pumps, as demonstrated by plant specific data. The source term timing for LE1 changed from SB2006 to SB2011 because of a more detailed accounting for the long term containment performance. For SB2006, the source term for LE1 was represented by a SGTR sequence with no containment spray, with the release stopping at 24 hours. For SB2011, the source term for LE1 was represented by a SGTR sequence with containment spray injection, but with the release continuing for 168 hours (7 days). In this sequence, the containment fails at about 39 hours due to overpressure with an additional release independent of the release through the ruptured SG tube. This sequence with successful containment spray represents a more realistic source term for LE1 while the longer release time better accounts for the complete release.

NextEra Energy Seabrook Response to SAMA RAI 2bii

Release category LE2 is defined as a large/early containment bypass due to an interfacing system LOCA through the RHR system, without scrubbing. The source term for LE2 in SB2006 was based on a generic analysis that relates back to WASH-1400. For SB2011, a Seabrook-specific analysis state-of-the-art source term calculation from MAAP4 was utilized.

NextEra Energy Seabrook Response to SAMA RAI 2biii

Release category SE3 (small, early containment failure) from SB2006 was divided into two release categories, SE3 and SELL, in the SB2011 update. This revision was based on more detailed modeling of the long term containment performance for sequences with a small early containment leak. Thus, in SB2011, release category SE3 is defined as "intact containment except for small penetration unisolated," that is, those core damage sequences where a small penetration is open but containment cooling is successful and the containment remains otherwise intact for the long term. In contrast, release category SELL is defined as "small penetration unisolated with long term containment failure via overpressurization or basemat melt-through," that is, those core damage sequences where a small penetration is open and containment cooling is not successful for the long term. As a result, the frequency and source term for SE3 decreased from SB2006 to SB2011 since the more severe "small-early" sequences are now represented by SELL.

SAMA RAI 2c

Please provide the following information relative to the Level 2 analysis:

> The dose risk and OECR results for release category LL5 changed significantly between SB2006 and SB2011 (greater than a factor of 100). The text on page 33 indicates that the increase in SAMA case "MAB" is due to higher release category source terms (apparently referring to LL5). The CDF for LL5 increased from 3.2E-7/yr to 3.1E-6/yr, the SB2011 noble gas release fraction is similar to the SB2006 model, however the I and Cs release fractions are larger, and the release timing is significantly earlier. Please discuss the model basis that caused these changes.

NextEra Energy Seabrook Response to SAMA RAI 2c

The source term for release category LL5 for SB2011 is based on a Seabrook-specific MAAP run for a station blackout scenario without recovery. This results in a core damage event with long term containment failure due to basemat melt-through. The release category LL5 for SB2006 was based on a similar-plant (Zion) analysis using results from the IDCOR work from the 1980s. Thus, the SB2011 update provides a Seabrook-specific analysis in place of a similar-plant analysis and uses the current state-of-the-art source term calculations.

SAMA RAI 2d

Please provide the following information relative to the Level 2 analysis:

Please provide a general explanation of the differences in the release start times and durations from MAAP presented in the Table on page 12 from the release start times and durations presented in the Tables on pages 20-26 for MACCS. For example, for LE1, on page 12 the first puff release starts at 3.2 hr (~11,520 s) and the second puff starts at 39.3 hr (~141,800 s). However, on page 20 the first plume starts at 9328 s (~2.6 hr) and the fourth plume starts at 172,800 s (48 hr).

NextEra Energy Seabrook Response to SAMA RAI 2d

The MAAP table on page 12 of the SAMA Supplement (Reference 3) provides a summary representation of the scenario/releases from the MAAP cases used to characterize each release category. The MAAP releases assume a seven-day release duration. The release tables beginning on page 20 of the SAMA Supplement provide the MACCS2 release parameters used to characterize the release timing and radionuclide fractions provided by the MAAP cases. As noted in the SAMA Supplement, MACCS2 allows a maximum of four plumes, each with a maximum duration of 1-day. Thus, the MAAP seven-day release is divided into four plumes, each plume having an approximate start time and duration, to approximate the entire release in MACCS2. The release start time used in the summary MAAP table is set at roughly 10% of noble gas release. This was used to indicate when the major release began. The MACCS2 cases treated the release in more detail, with four plumes. The initial plume models the start of the release earlier, when the release has just begun.

SAMA RAI 3a

Please provide the following with regard to the SAMA identification and screening process:

Two Tables in Section 3.1.1, Top 15 Basic Events Contributing to CDF and Top 15 Basic Events Contributing to LERF, provide the Risk Reduction Worth (RRW) for CDF and LERF down to a value of 1.02. In Section 4.1 the Top 15 Basic Events Contributing to CDF, LERF, and release category (RC) contributing to 90% of the Public Risk provides the top 15 basic events for each of the following: CDF, LERF (which includes LE1, LE2, LE3, and LE4), and RCs LL-5, SE-3, and SELL. The RRW values for basic events importance to LL-5, SE-3, and SELL are not provided. In an RAI response dated January 13, 2011, the top 15 basic events were provided along with their corresponding RRW values for the risk dominant (i.e., contributing to 90 percent of the population dose) release categories (i.e., SE3, LL3, LE1, SE1, and LL4). From RAI response it could be determined that the maximum benefit that might be calculated from eliminating the 15th most important basic event resulted in benefits less than a simple hardware implementation cost of (i.e., $100K). Given the changes in release frequencies, such as the 10 fold increase in LL5, it is not clear whether all important basic events are identified as part of the 45 basic events presented in the Section 4.1 table. Please provide the RRWs for basic events contributing to LL-5, SE-3, and SELL down to a minimum RRW value that would ensure that the maximum possible benefit would exceed the cost of a simple hardware or administrative change (~$100K). If this requires addressing further basic events, please include their evaluation in Table 2 of Section 4.3.

NextEra Energy Seabrook Response to SAMA RAI 3a

Tables RAI-3-1-LL5, RAI-3-1-SELL and RAI-3-1-SE3 provide the basic events and associated RRW values that contribute to LL5, SELL and SE3. Basic events are evaluated down to an RRW value sufficient to ensure that SAMA candidates having a nominal benefit in the range of $100K to $200K are identified. In the case of release categories SELL and SE3, the previously evaluated basic events in each release category sufficiently capture the SAMA basic events down to a nominal benefit in the range of $100K to $200K and no additional basic events are evaluated.

In the case of release category LL5, 28 new SAMA basic events were evaluated for nominal benefit in the range of $100K to $200K. The corresponding basic event RRW value for this cost range is in the range of 1.005, which is consistent with industry guidance to distinguish risk significant SSCs and represents a reasonable threshold for this evaluation. This provides reasonable assurance that all important cost-beneficial SAMAs related to basic events have been identified. No new potentially cost beneficial SAMA candidates were identified. Table RAI-3-2 provides the Phase II evaluation of the new LL5 basic events.

SAMA RAI 3b

Please provide the following with regard to the SAMA identification and screening process:

Table 2 of Section 4.3 provides the benefit of SAMAs specifically devised for reducing the risk associated with each of the top 16 initiating events contributing to CDF and the top 15 initiating contributing to LERF. The RRW values for these initiating events are not provided, and because they are not provided it is not clear if all important initiators against CDF and LERF are addressed by SAMA evaluation. Please provide RRWs values for initiating events against CDF and LERF. Provide importance analysis listing down to a minimum RRW value that would ensure that the maximum possible benefit would exceed the cost of a simple hardware or administrative change (~$100K). If this requires addressing more than the 16 initiating events already considered against CDF and the 15 initiating events already considered against LERF please include their evaluation in Table 2 of Section 4.3.

NextEra Energy Seabrook Response to SAMA RAI 3b

Initiating Events Contributing to CDF:
The top initiating events contributing to CDF and their percent contribution are presented in the response to RAI 1a. The top 16 CDF initiators were evaluated in the SAMA Supplement (Reference 3). The remaining initiators are evaluated in Table RAI-3-3. No new cost beneficial SAMAs are identified. Evaluation of CDF initiators down to approximately 1% indicates that

the benefit is in the nominal range of $100K to $200K (and less) for many of these CDF initiators. Thus, evaluation of initiating events that contribute down to ~1% CDF provides a reasonable threshold to ensure that all important cost-beneficial SAMAs related to CDF initiating events have been identified.

Initiating Events Contributing to LERF:
The top 15 initiating events contributing to LERF and their percent contribution are presented in the table below. Evaluation of the LERF initiators that contribute down to approximately 1% indicates that the benefit is in the nominal range of $100K to $200K (and less) for many of these LERF initiating events. Thus, evaluation of initiating events that contribute down to 1% LERF provides a reasonable threshold to ensure that all important cost-beneficial SAMAs related to LERF initiating events have been identified.

Top 15 Initiating Events (IE) that Contribute to LERF (SB2011)

Initiating Event ID	**Description**	**IE Frequency** (per yr)	**IE LERF Contribution** (per yr)	**IE Percent of LERF Contribution**
SGTR	Steam Generator Tube Rupture	4.09E-03	4.45E-08	48.3%
LOC1VI	Interfacing Systems LOCA, RHR Injection Valves Failure	3.67E-06	1.80E-08	19.5%
E25L	Seismic 2.5g Large LOCA	9.86E-08	7.29E-09	7.9%
E18L	Seismic 1.8g Large LOCA	9.55E-08	4.36E-09	4.7%
E18T	Seismic 1.8g Transient Event	8.55E-08	3.83E-09	4.2%
E14A	Seismic 1.4g ATWS	6.00E-07	3.21E-09	3.5%
E18A	Seismic 1.8g ATWS	9.55E-08	2.83E-09	3.1%
E25A	Seismic 2.5g ATWS	9.86E-08	2.65E-09	2.9%
E25T	Seismic 2.5g Transient Event	9.86E-08	1.80E-09	2.0%
E10A	Seismic 1.0g ATWS	1.77E-06	1.32E-09	1.4%
MSLOB	Main Steam Line Break Outside Containment	1.00E-02	7.14E-10	0.8%
MSSVO	Main Steam Safety Valve Stuck Open	1.00E-03	2.79E-10	0.3%
E7A	Seismic 0.7g ATWS	9.30E-06	1.83E-10	0.2%
LOC1VS	Interfacing Systems LOCA, RHR Suction Valves Failure	3.14E-08	1.45E-10	0.2%
AMFW	ATWS – Main Feedwater Available	9.91E-01	9.49E-11	0.1%

SAMA RAI 3c

Please provide the following with regard to the SAMA identification and screening process:

> Step (b) in the general approach to the reassessment (Section 2.0) does not list at least three criteria by which SAMA candidates were previously eliminated: (1) being combined with another similar SAMA, (2) costing more than the MAB, and (3) being related to a non-risk significant system. Please provide additional information describing how these criteria were considered in the re-assessment. (Note that this RAI also applies to step 2 in Section 4.1 [see. p. 28 of 96].)

NextEra Energy Seabrook Response to SAMA RAI 3c

The Phase 1 SAMA candidates, which were qualitatively screened from further detailed assessment in the original SAMA assessment, were not reviewed further in the SAMA Supplement (Reference 3). This is because the SAMA Supplement (performed to include minor PRA model changes and revised release category source terms) does not change the conclusions of the previous qualitative screening of Phase 1 SAMA candidates, except for those SAMA candidates screened on MAB. The SAMA candidates that were previously screened on MAB were re-assessed in the SAMA Supplement. All other previously screened Phase 1 SAMA candidates continue to meet the qualitative screening criteria of: (a) "not applicable", (b) "already implemented or intent is met", or (c) "combined with another SAMA candidate". Criterion (d) "excessive implementation cost" and criterion (e) "very low benefit" were not used in the original Phase 1 screening so that their SAMA costs and benefits could be judged as part of the Phase 2 quantitative assessment. All Phase 2 SAMA candidates are re-assessed in the SAMA Supplement as are all SAMAs previously screened on MAB.

SAMA RAI 4a

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Section 4.2, on p. 34 of 96, it is stated that "[t]he sensitivity of the SAMA Supplement results to variations in other Level 3 parameters is expected to be consistent with previous sensitivity results." Please provide discussion comparing the updated results to the previous results confirming this expectation.

NextEra Energy Seabrook Response to SAMA RAI 4a

Except for the difference in source term release, the SAMA Supplement (Reference 3) evaluation did not change the Level 3 parameters used in the previous SAMA evaluation. As a result, the sensitivity of the updated results to variations in the Level 3 parameters is expected to be similar to the previous sensitivity results. This assertion is further supported based on inspection of the results of the sensitivity evaluations performed for the SAMA Supplement as provided below:

Sensitivity Case	Assessment
Meteorology Specification in the last Spatial Segment	The baseline SAMA Supplement conservatively assumes continuous rainfall imposed from 40 to 50 miles from release to force conservative population exposure. The updated sensitivity case removes this conservative assumption and allows the 40-50 mile segment to follow the site meteorology. This resulted in a reduction to the dose and cost risks of approximately 85% of the baseline. This dose and cost risk reduction is consistent with the reduction calculated in the previous SAMA sensitivity evaluation. This evaluation implies that this one assumption adds 15 percent conservatism to the baseline results.
Sea-breeze Effects	The sea-breeze effect on dose and cost risks was re-evaluated in the SAMA Supplement. The results of this sensitivity evaluation indicated a small increase in the dose and cost risks when conservatively accounting for sea-breeze effects. This result is consistent with risk increase calculated in the previous SAMA sensitivity evaluation of sea-breeze effects.
No Evacuation – Release Category LE4	Release category LE4 is used to represent extreme seismic events where evacuation of the population could be delayed. A sensitivity evaluation in the SAMA Supplement assumed no evacuation for this release category and this resulted in a small increase in the total LE4 dose consequence. This result is consistent with the previous SAMA sensitivity evaluation, Fraction of Population Evacuating, which performed a similar sensitivity of no evacuation for release category SE3. In the previous SAMA, release category SE3 was used to represent extreme seismic events, similar to LE4 in the updated model.

SAMA RAI 4b

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Section 4.2, on p. 35 of 96, it is stated that "[n]o new potentially cost-beneficial SAMAs were [sic] identified as a result of the 3% and 8.5% sensitivity calculations." Is this relative to the original analysis (submittal plus RAI responses) or to the re-analysis provided here for cost-beneficial SAMAs?

NextEra Energy Seabrook Response to SAMA RAI 4b

No new potentially cost-beneficial SAMAs were identified as a result of the 3 percent and 8.5 percent sensitivity calculations relative to the updated SB2011 re-analysis for cost-beneficial SAMAs.

SAMA RAI 4c

Please provide the following with regard to the Phase II cost-benefit evaluations:

> Section 4.2 provides the new Maximum Averted Benefit (MAB) (i.e., $3.05M) using the SB2011 PRA model. Also please provide the Averted Public Exposure (APE) costs, Averted Off-site Property Damage Costs (AOC), Averted Occupational Exposure (AOE) costs, and Averted Onsite Costs (AOC).

NextEra Energy Seabrook Response to SAMA RAI 4c

The SB2011 SAMA Supplement re-analysis estimated the following nominal averted costs:

Description	Cost
Averted Public Exposure (APE) Cost	$815,072
Averted Off-site Property Damage Cost (AOC)	$1,950,586
Averted Occupational Exposure (AOE) Cost	$4,642
Averted Onsite Cost (AOC)	$278,210
Total (MAB)	**$3,048,510**

SAMA RAI 4d

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 1 of Section 4.3, neither the risk reduction values nor PRA modeling assumptions for SAMA case MAB are provided. The evaluation for SAMA 77 incorrectly states that "Cost to engineer and implement installation of large passive air cooling system is far in excess of the attainable benefit". The original SAMA evaluation submittal estimated the cost of implementing this SAMA to be >$3M. Please provide the risk reduction values and PRA modeling assumptions for SAMA case MAB. Also, please provide justification of the cost of SAMA 77 and explain why it was necessary to increase this cost estimate.

NextEra Energy Seabrook Response to SAMA RAI 4d

Table 1 of the SAMA Supplement (Reference 3) identified "MAB" in the PRA Case column for SAMAs 65 and 77. MAB is used to indicate that the "maximum attainable benefit" is assumed as the basis for cost-benefit worth. A specific PRA case is not used because MAB represents the total averted cost assuming complete elimination of the total plant risk, hence the risk reduction is 100%. The MAB total benefit is $15M when considering uncertainty (95 percentile) and seismic multiplier of 2.1.

As noted in the SAMA Supplement, Section 2.0 paragraph f), the implementation cost of each SAMA was reassessed as necessary to ensure that the cost continues to be representative of the SAMA scope. The scope of SAMA #77 is to install a passive, secondary-side heat rejection loop consisting of a condenser and heat sink. This is a significant and complex design change in that the new system would operate "passively" and independent of other systems, and that it would consist of a closed "loop" to limit inventory losses eliminating the need for makeup systems and with proper height and elevation to allow operation by natural circulation and conduction. This type of system is similar to a BWR isolation condenser. The cost to engineer and implement a similar system in an existing PWR plant is estimated to significantly exceed $15M.

SAMA RAI 4e

Please provide the following with regard to the Phase II cost-benefit evaluations:

> Table 1 of Section 4.3 presents revised SAMA case CONTX1 which is defined to eliminate alternating current (AC) and direct current (DC) power and Primary Component Cooling Water (PCCW) support system failures for one division of Containment Building Spray (CBS). The evaluation for this SAMA case explains that this case more realistically represents the potential risk reduction benefit than the case it replaced (i.e., CONT01 - Installation of an independent division of containment spray). It is not clear that the PRA assumption for this case (CONTX1), which consists of eliminating support system failures, bounds the SAMAs represented by this case (i.e., #91, #94, #99, #102, and #107). In light of the potentially high cost benefit (the current cost benefit with uncertainty and the seismic multiplier is >$5.7M), please provide justification for why this case is representative of each SAMA grouped under it and clarify whether a less restrictive or different case may be more appropriate. If a less restrictive or different case may be more appropriate please provide the corresponding evaluations.

NextEra Energy Seabrook Response to SAMA RAI 4e

SAMAs #91, #94, #99, #102 and #107 have been reevaluated using a sensitivity PRA case different from case CONTX1 to ensure that the cost-benefit of these SAMAs is adequately characterized for the given SAMA scope. Table RAI-4-1 identifies the PRA cases used in the sensitivity assessments and provides the results of each evaluation. Based on the sensitivity cases, these candidate SAMAs are not cost beneficial. A summary of the sensitivity results is provided below.

SAMA # 91 - Passive Containment Spray System: SAMA sensitivity benefit could be higher than the previous CONTX1 evaluation. The sensitivity benefit is less than the previously reported cost estimate.

SAMA # 94 - Filtered Containment Vent System: SAMA benefit could be higher than the previous CONTX1 evaluation. The sensitivity benefit is significantly less than the revised cost estimate. The cost estimate for implementation of a filtered vent is revised to ensure a realistic estimate and is based on more recent industry cost information.

SAMA # 99 – Strengthen Containment: SAMA benefit could be significantly lower than the previous CONTX1 evaluation and is significantly less than the previously reported cost estimate.

SAMA # 102 – Construct Containment Ventilation Building: SAMA benefit could be higher than the previous CONTX1 evaluation. Sensitivity benefit is significantly less than the previously reported cost estimate.

SAMA # 107 – Redundant Containment Spray System: SAMA benefit could be significantly lower than the previous CONTX1 evaluation. Sensitivity benefit is significantly less than the previously reported cost estimate.

SAMA RAI 4f

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 1 of Section 4.3, the expected cost of SAMA 162 (Increase the capacity margin of the condensate storage tank (CST)) is >$2.5M. In the original submittal the expected cost of this SAMA was presented as >$100K. The evaluation of this SAMA in the supplement states that the "Cost of expanding capacity of the CST is based on project scope of installing a new (larger) safety grade CST, which is judged necessary to achieve full benefit." In light of the fact that the new cost benefit with uncertainty and the seismic multiplier is 171K, please explain the basis for the earlier cost estimate and why it was necessary to increase this cost estimate by a factor of 25.

NextEra Energy Seabrook Response to SAMA RAI 4f

As noted in the SAMA Supplement (Reference 3), the implementation cost of each SAMA was reassessed as necessary to ensure that the costs are representative of the SAMA scope. The implementation cost estimate for SAMA #162 was reassessed and was increased to more accurately reflect the expected cost of the SAMA. The previous cost estimate of >$100K for SAMA #162, was based on a conservative minimum cost estimate for a noncomplex hardware change. This minimum cost estimate was significantly greater than the previously calculated SAMA benefit therefore, it was not necessary to perform a detailed cost estimate in the previous assessment. The scope of SAMA #162 is the same as the previous SAMA assessment.

SAMA RAI 4g

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 1 of Section 4.3, the expected cost of SAMA 189 (Modify or analyze supplemental emergency power supply (SEPS) capability; 1 of 2 SEPS for loss of off-site power (LOSP) non-safety injection (SI) loads, 2 of 2 LOSP SI loads) is >$2M. In the original submittal the expected cost of this SAMA was presented as >$300K. The SAMA appears that it could primarily be an analytical task. In light of this and the fact that the new cost benefit with uncertainty and the seismic multiplier is 311K, please explain why it was necessary to increase this cost estimate by a factor of 7.

NextEra Energy Seabrook Response to SAMA RAI 4g

As noted in the SAMA Supplement (Reference 3), the implementation cost of each SAMA was reassessed as necessary to ensure that the costs are representative of the SAMA scope. The implementation cost estimate for SAMA #189 was reassessed and was increased to more accurately reflect the expected cost of the SAMA. The updated cost estimate is based on a Seabrook engineering estimate and covers the expected costs of analysis, hardware modifications and testing. The previous cost estimate of >$300K for SAMA #189, was based on a conservative minimum cost estimate. The previous minimum cost estimate was significantly greater than the previously calculated SAMA benefit therefore, it was not necessary to perform a detailed cost estimate in the previous assessment. The scope of SAMA #189 is the same as the previous SAMA assessment.

SAMA RAI 4h

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 2 of Section 4.3, the cost benefit for SAMA case OHSB0 (for BE #5) is presented as >1M in the "Expected SAMA cost" column, yet the discussion in the "Evaluation" column states that the cost was estimated to be $1.5M. Please clarify this apparent discrepancy.

NextEra Energy Seabrook Response to SAMA RAI 4h

This was an editorial error in Table 2 of the SAMA Supplement (Reference 3). The expected cost for SAMA BE #5 is $1.5M consistent with the cost basis evaluation for SAMA BE #5 provided in Table 2 of the SAMA Supplement. Table 2, as shown on page 69, of Reference 3 is revised as follows:

BE #5 HH.OHSB1.FA	CDF LL5	Operator action to maintain stable plant conditions with SG cooling during transients	Hardware change to improve ability to maintain stable primary and secondary conditions with plant in hot standby.	OHSB 0	4	5	143K (301K)	335K (705K)	~~>1M~~ ***> 1.5M***	Not cost beneficial. The SAMA concept is to incorporate hardware change to improve operator's ability to control/maintain stable hot standby conditions following transient/accident events. Operator must monitor and control primary and secondary conditions including PZR level and pressure, RCS temperature and SG levels to maintain stable hot standby conditions for extended cooling using the SG. PRA case OHSB0 assumes guaranteed success of "all" actions OHSB1 (trans), OHSB2 (SBO), OHSB3 (SLOCA/SLB) and OHSB4 (SGTR) for maintaining stable hot standby conditions. Procedures directing these actions are sufficiently detailed and evaluated in the PRA human reliability analysis. Any changes to procedures are judged not to have a significant beneficial impact on release risk. Cost to engineer and implement plant modifications and analysis judged comparable in scope and complexity to Davis Besse SAMA CC-19 to automate controls for injection switch over is similar in magnitude and complexity was estimated at $1.5 M.

SAMA RAI 4i

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 2 of Section 4.3, the evaluation for BE #34 states that the PRA case "conservatively assumes that elimination of Bus E5 and E6 random failures that could cause an initiating event.... and/or fail the associated power division during mission time". Please clarify whether the PRA assumptions for this modeling case (i.e., SWGE561) include elimination of initiators, basic events or both.

NextEra Energy Seabrook Response to SAMA RAI 4i

PRA case SWGE561 considers elimination of both initiating events and basic events associated with 4kV Essential Buses E5 and E6.

SAMA RAI 4j

Please provide the following with regard to the Phase II cost-benefit evaluations:

> In Table 2 of Section 4.3, the event description for BE #38 refers to operator actions after loss of coolant accident (LOCA) and steam generator tube rupture (SGTR), but the evaluation refers to actions after a small LOCA (SLOCA) and interfacing system LOCA (ISLOCA). Please clarify this apparent discrepancy.

NextEra Energy Seabrook Response to SAMA RAI 4j

BE #38 considers operator action to maintain stable primary and secondary plant conditions for extended steam generator cooling after small LOCA (SLOCA), interfacing system LOCA (ISLOCA) and steam generator tube rupture (SGTR) events.

SAMA RAI 4k

Please provide the following with regard to the Phase II cost-benefit evaluations:

In Table 2 of Section 4.3, the entries for IE #8 and #9 appear to be duplicates. Please clarify.

NextEra Energy Seabrook Response to SAMA RAI 4k

Table 2, rows IE #8 LOSPG and IE #9 LOSPG provide duplicate information. Row IE #9 can be disregarded.

SAMA RAI 4l

Please provide the following with regard to the Phase II cost-benefit evaluations:

In Table 2 of Section 4.3, the cost benefit analyses provided for IE #16 is a hardware installation to improve Component Cooling Water (CCW) reliability. In the evaluation for IE #16 on page 93 the associated SAMA case (i.e., CCTE1) is not identified as a cost beneficial SAMA. Yet, CCTE1 is identified as cost beneficial in Table 1 on page 65. Please clarify this apparent discrepancy.

NextEra Energy Seabrook Response to SAMA RAI 4l

PRA case CCTE1 provides the benefit basis for SAMA BE #9 (and BE #9A) and IE #16. These SAMAs are correctly shown to be potentially cost beneficial and are combined as new SAMA #195 in Table 1 on page 65. Table 2, SAMA IE #16 incorrectly refers to SAMA #59 and SAMA BE #2 as being related SAMAs. Table 2 as shown on page 65 of Reference 3 is revised as follows:

IE #16 LPCCB	CDF	Loss of PCCW Train B	Related SAMA ~~#59, BE #2 and~~ BE #9. Install hardware to improve the reliability of the CCW, thus reduce potential for loss of CCW initiators.	CCTE1	3	5	144K (302K)	337K (709K)	300K	This IE SAMA is related to ~~SAMA #59, SAMA BE #2~~ and SAMA BE #9. ~~SAMA #59 and SAMA BE #2 are not cost beneficial~~. Refer to SAMA BE #9 for evaluation of potential cost beneficial SAMA.

SAMA RAI 4m

Please provide the following with regard to the Phase II cost-benefit evaluations:

In Table 2 of Section 4.3, cost benefit analyses are provided for IE #23, #24, #25, #26, and #27, which are seismic initiators of different levels, (0.7g, 1.0g, 1.4g, 1.8g, and 2.5g) that lead to ATWS events (SAMA case NOATWS). No description of the associated SAMA is provided nor is the basis for the presented cost estimate (i.e., >500K). Table 2 shows that IE #28, which is an ATWS event with loss of Main Feedwater, is also grouped into this SAMA case. It is not clear why this initiating event (i.e., IE#28) can be grouped as part of a seismic upgrade related SAMA case. Please provide the SAMA description and basis for the cost estimate for these six initiator cases.

NextEra Energy Seabrook Response to SAMA RAI 4m

PRA case NOATWS conservatively considers the risk reduction assuming all ATWS initiating events (non-seismic and seismic) are eliminated. For convenience, seismic ATWS initiators #23 through #27 are evaluated under IE #23. ATWS initiator IE #28 is not a seismic-induced ATWS event and is evaluated separate from the seismic ATWS initiators.

Seismic ATWS initiating events IE #23 - 27 (0.7g, 1.0g, 1.4g, 1.8g, and 2.5g) lead to ATWS primarily due to support buckling of the reactor internals causing the control rods to jam and fail to insert for reactor shutdown. Potential modifications to reduce the seismic ATWS risk would include structural upgrades to the reactor internals to increase the seismic capacity. Modifying reactor internals would include detailed and complex analysis, procurement and installation. The cost of implementing structural modifications to the reactor internals is expected to be significantly greater than $500K based on comparison to other less complex hardware changes performed at Seabrook.

ATWS initiator IE #28 (AMFW) is an ATWS event with main feedwater initially available. The description in Table 2 of Reference 3 for AMFW incorrectly identified this event as ATWS with loss of main feedwater. The AMFW event is dominated by failure of the control rod assemblies to insert and failure to initiate emergency boration of the RCS. Possible hardware modifications to reduce the risk of this ATWS event would also include changes to reactor internals and emergency boration system with a cost to implement expected to be significantly greater than $500K. It is noted that PRA case NOATWS is used to estimate the benefit of elimination of initiating event AMFW. Assuming that only ATWS event AMFW is completely eliminated, the maximum benefit would be approximately $20K. Table 2 as shown on page 95 of Reference 3 is revised as follows:

IE #28 AMFW	LERF	ATWS with ~~Loss of~~ Main Feedwater **Initially Available**	Related SAMA #130, #131, #132, #174	NOATWS	4	2	60K (126K)	139K (292K)	>500K	Not cost beneficial. Related SAMAs are #130, #131, #132, #174. PRA case NOATWS conservatively assume that ATWS events do not occur (including seismically initiated ATWS). Cost of installing upgrades to significantly reduce the risk of ATWS is based on related SAMA costs.

TABLE RAI-3-1-LL5

Seabrook SAMA - Basic Event RRW for Release Category LL5

Basic Event (BE)	BE Description	RRW	Disposition / Evaluation
HH.OALT1.FL	Operator Action - Manual Alignment of Alternate Cooling to Charging Pumps before RCP seal LOCA	1.154	Evaluated in Reference 3 Table 2, BE #1
CCP11A/B/C/D	PCCW Pumps A, B, C, D Common Mode Failure to Start	1.139	Evaluated in Reference 3 Table 2, BE #2
EDESWG11AB	DC Power Panels A, B Common Mode Failure	1.121	Evaluated in Reference 3 Table 2, BE #3
HH.XOINE1.FA	Operator fails to start containment injection early to prevent RPV failure	1.060	Evaluated in Reference 3 Table 2, BE #4
HH.OHSB1.FA	Operator action to maintain stable plant conditions with SG cooling during transients	1.043	Evaluated in Reference 3 Table 2, BE #5
HH.XOINE3.FA	Operator Fails to start containment injection early without AC power (gravity drain of RWST)	1.038	Evaluated in Reference 3 Table 2, BE #6
ZZ.SY1.FX	Loss of offsite power subsequent to plant trip initiator	1.038	Evaluated in Reference 3 Table 2, BE #7
CCTE2171.FZ	PCC Train A Temperature Element CC-TE-2171 transmits false low	1.029	Evaluated in Reference 3 Table 2, BE #9
CCTE2271.FZ	PCC Train B Temperature Element CC-TE-2171 transmits false low	1.027	Evaluated in Reference 3 Table 2, BE #9A
CCE17A.RT	PCC Ht Ex 17A rupture/excessive leakage during operation	1.024	Evaluated in Reference 3 Table 2, BE #10
HH.ORHPI2.FA	Operator action to restore charging/HPI/RCS for long term makeup after recovery of support systems during various trans/accidents	1.023	Evaluated in Reference 3 Table 2, BE #11
CCE17B.RT	PCC Ht Ex 17B rupture/excessive leakage during operation	1.022	Evaluated in Reference 3 Table 2, BE #12
SWAFN64.FS	CT SWGR Train A FAN SWA-FN-64 fails to start on demand	1.018	Evaluated in Reference 3 Table 2, BE #13
SWFN51A.FS	SW Cooling Tower FAN SW-FN-51A fails to start on demand	1.015	Evaluated in Reference 3 Table 2, BE #14
SWAFN63.FS	CT SWGR Train B FAN SWA-FN-63 fails to start on demand	1.015	Evaluated in Reference 3 Table 2, BE #15
SWAFN71.FS	CT Pump Area Train A Fan FWA-FN-71 fails to start on demand	1.014	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #15 (SWAFN63.FS), PRA Case SWAFN. The SWAFN71 SAMA scope, cost estimate and risk reduction are comparable to BE #15.
HH.ORHPI1.FA	Operator restores normal changing given recovery w/o SI	1.014	NewLL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE#11 (HH.ORHPI1.FA), PRA Case ORHPI0.
FWP37A.FR	Turbine Driven Pump FW-P-37A fails to run	1.014	New LL5 BE SAMA. Not cost beneficial. This BE

TABLE RAI-3-1-LL5

Seabrook SAMA - Basic Event RRW for Release Category LL5

Basic Event (BE)	**BE Description**	**RRW**	**Disposition / Evaluation**
			previously evaluated in Reference 3 Table 2, SAMA BE #27 (FWP37A.FR), PRA Case TDAFW.
HH.OCSTM1.FL	Operator established makeup to CST for long term SG cooling	1.012	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
SWAFN70.FS	CT Pump Area Train B Fan FWA-FN-70 fails to start on demand	1.012	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #15 (SWAFN63.FS), PRA Case SWAFN. The SWAFN70 SAMA scope, cost estimate and risk reduction are comparable to BE #15.
EDESWG6.FX	4kV Bus E6 fault	1.011	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #34 (EDESWG56.FX), PRA Case SWGE561.
HH.SWOCCT.FA	Operator fails to transfer SW from Ocean to CT	1.011	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
HH.OHSB3.FL	Operator action to maintain stable plant conditions with SG cooling during SLOCA/SLB	1.011	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #5 (HH.OHSB1.FA), PRA Case OHSB0.
SWADP66.FTO	CT SWGR room relief damper SWA-DP-66 fails to open	1.011	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
HH.OFCR1.FL	Operator fails to restore PCC from RSS before RCP seal failure (CR fire)	1.010	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
DGDG1B.FR3	DG-1B fails to run for 24 hours	1.010	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #19 ([DGDG1B.FR3), PRA Case NOSBO1.
SWV64.TONO	SW Intake Return MOV SW-V-64 transfers open	1.010	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
SWADP65.FTO	CT SWGR room relief damper SWA-DP-65 fails to open	1.009	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
HH.OSGLC3.FL	Operator fails to control SG level locally, with EFW thru EFW Discharge	1.008	New LL5 BE SAMA. Evaluated in Reference 3 Table 2, BE #33.

TABLE RAI-3-1-LL5

Seabrook SAMA - Basic Event RRW for Release Category LL5

Basic Event (BE)	BE Description	RRW	Disposition / Evaluation
FWP37A.FS1	Turbine Driven Pump TURBINE FW-P-37A fails to start on demand	1.008	New LL5 BE SAMA. Evaluated in Reference 3 Table 2, BE #27A (FWP37A.FS1), PRA Case TDAFW.
[SWAFN70.FS SWAFN71.FS]	CT Pump Area Fans FWA-FN-70 & 71 common mode failure to start on demand	1.008	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
[SWAFN63.FS SWAFN64.FS]	CT SWGR Area Fans FWA-FN-63 & 64 common mode failure to start on demand	1.008	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
[EAHFN180A.FS EAHFN180B.FS]	EAH Fans FN-180A & 180B common mode failure to start	1.007	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
2SWFN51B.FRNO	SW CT Fan 2SW-FN-51B fails to run	1.007	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #14 (SWFN51A.FS), PRA Case SWFN. The 2SWFN51B SAMA scope, cost estimate and risk reduction are comparable to BE #14.
SWFN51B.FRNO	SW CT Fan SW-FN-51B fails to run	1.007	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #14 (SWFN51A.FS), PRA Case SWFN. The SWFN51B SAMA scope, cost estimate and risk reduction are comparable to BE #14.
2SWFN51B.FS	SW CT Fan 2SW-FN-51B fails to start on demand	1.007	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #14 (SWFN51A.FS), PRA Case SWFN. The 2SWFN51B SAMA scope, cost estimate and risk reduction are comparable to BE #14.
SWFN51B.FS	SW CT Fan SW-FN-51B fails to start on demand	1.007	New LL5 BE SAMA. Not cost beneficial. Similar to Reference 3 Table 2, SAMA BE #14 (SWFN51A.FS), PRA Case SWFN. The SWFN51B SAMA scope, cost estimate and risk reduction are comparable to BE #14.
SWFN51A.FRNO	SW CT Fan SW-FN-51A fails to run	1.007	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA

TABLE RAI-3-1-LL5

Seabrook SAMA - Basic Event RRW for Release Category LL5

Basic Event (BE)	BE Description	RRW	Disposition / Evaluation
			BE #14 (SWFN51A.FS), PRA Case SWFN.
DGDG1A.FR3	DG-1A fails to run for 24 hours	1.007	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #18 (DGDG1A.FR3), PRA Case NOSBO1.
EDESWG5.FX	4KV BUS E5 fault	1.007	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #34 (EDESWG56.FX), PRA Case SWGE561.
HH.OHSB7.FL	Operator fails long term control of RCS inventory & SG cooling	1.006	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #32 (HH.OHSB6.FL), PRA Case OHSB670.
2SWFN51B.FS SWFN51A.FS SWFN51B.FS	SW CT Fans 2SW-FN-51B, SW-FN-51B and SW-FN-51A common mode failure to start	1.006	New LL5 BE SAMA. Not cost beneficial. Refer to Table RAI-3-2 for evaluation.
HH.OSEP1.FA	Operator fails to close SEPS breaker from MCB	1.005	New LL5 BE SAMA. Not cost beneficial. This BE previously evaluated in Reference 3 Table 2, SAMA BE #20 (HH.OSEP2Q.FA), PRA Case OSEPS.

TABLE RAI-3-1- SELL

Seabrook SAMA - Basic Event RRW for Release Category SELL

Basic Event (BE)	BE Description	RRW	Disposition / Evaluation
HH.XOINE3.FA	Operator Fails to start containment injection early without AC power (gravity drain of RWST)	2.458	Evaluated in Reference 3 Table 2, BE #6
HH.XOSMP1.FA	Operator aligns containment recirculation after core melt	1.230	Evaluated in Reference 3 Table 2, BE #16
ZZ.CIS.PRE.EXIST	Small pre-existing unidentified containment leakage	1.136	Evaluated in Reference 3 Table 2, BE #17
ZZ.SY1.FX	Loss of offsite power subsequent to plant trip initiator	1.072	Evaluated in Reference 3 Table 2, BE #7
DGDG1A.FR3	DG-1A fails to run for 24 hours	1.018	Evaluated in Reference 3 Table 2, BE #18
DGDG1B.FR3	DG-1B fails to run for 24 hours	1.018	Evaluated in Reference 3 Table 2, BE #19
HH.OALT1.FL	Operator Action - Manual Alignment of Alternate Cooling to Charging Pumps before RCP seal LOCA	1.018	Evaluated in Reference 3 Table 2, BE #1
HH.OSEP2Q.FA	Operator fails to close SEPS breaker from MCB, given seismic event with SI signal	1.016	Evaluated in Reference 3 Table 2, BE #20
CCP11A/B/C/D	PCCW Pumps A, B, C, D Common Mode Failure to Start	1.015	Evaluated in Reference 3 Table 2, BE #2
EDESWG11AB	DC Power Panels A, B Common Mode Failure	1.014	Evaluated in Reference 3 Table 2, BE #3
SEPSDG2A.FR3	1-SEPS-DG-2-A fails to run within 24 hours	1.011	Evaluated in Reference 3 Table 2, BE #21
SEPSDG2B.FR3	1-SEPS-DG-2-B fails to run within 24 hours	1.011	Evaluated in Reference 3 Table 2, BE #22
DGDG1A/1B.FR3	DG1A and DG1B common mode failure to run for 24 hours	1.008	Evaluated in Reference 3 Table 2, BE #23
HH.OSEP1Q.FA	Operator fails to close SEPS breaker from MCB, given seismic event	1.007	Evaluated in Reference 3 Table 2, BE #24
HH.XOINE1.FA	Operator fails to start containment injection early to prevent RPV failure	1.006	Evaluated in Reference 3 Table 2, BE #4
HH.OCI2Q.FL	Operator fails to close CSV-167 manually/locally	1.005	Evaluated in Reference 3 Table 2, BE #25
HH.OHSB1.FA	Operator action to maintain stable plant conditions with SG cooling during transients	1.005	Evaluated in Reference 3 Table 2, BE #5
CSV167.FTC	Penetration X-37 Isolation MOV CS-V-167 fails to close on demand	1.004	Evaluated in Reference 3 Table 2, BE #26
CCTE2171.FZ	PCC Train A Temperature Element CC-TE-2171 transmits false low	1.004	Evaluated in Reference 3 Table 2, BE #9
FWP37S.FR	Turbine Driven Pump FW-P-37A fails to run	1.004	Evaluated in Reference 3 Table 2, BE #27
CCTE2271.FZ	PCC Train B Temperature Element CC-TE-2171 transmits false low	1.003	Evaluated in Reference 3 Table 2, BE #9A
CE17A.RT	PCC Ht Ex 17A rupture/excessive leakage during operation	1.003	Evaluated in Reference 3 Table 2, BE #10
EDESWG56.FX	4kV Emergency Buses 5 and 6 Fault (Common mode failure)	1.003	Evaluated in Reference 3 Table 2, BE #34.

TABLE RAI-3-1- SE3

Seabrook SAMA - Basic Event RRW for Release Category SE3

Basic Event (BE)	BE Description	RRW	Disposition / Evaluation
ZZ.SY1.FX	Operator Action - Manual Alignment of Alternate Cooling to Charging Pumps before RCP seal LOCA	1.099	Evaluated in Reference 3 Table 2, BE #7
HH.OSEP2Q.FA	Operator fails to close SEPS breaker from MCB, given seismic event & SI signal	1.029	Evaluated in Reference 3 Table 2, BE #20
DGDG1A.FR3	DG-1A fails to run for 24 hours	1.027	Evaluated in Reference 3 Table 2, BE #18
ZZ.CIS.PRE.EXIST	Small pre-existing unidentified containment leakage	1.026	Evaluated in Reference 3 Table 2, BE #17
DGDG1B.FR3	DG-1B fails to run for 24 hours	1.026	Evaluated in Reference 3 Table 2, BE #19
SEPSDG2A.FR3	1-SEPS-DG-2-A fails to run within 24 hours	1.014	Evaluated in Reference 3 Table 2, BE #21
SEPSDG2B.FR3	1-SEPS-DG-2-B fails to run within 24 hours	1.014	Evaluated in Reference 3 Table 2, BE #22
HH.OSEP1Q.FA	Operator fails to close SEPS breaker from MCB, given seismic event	1.011	Evaluated in Reference 3 Table 2, BE #24
HH.OCI2Q.FL	Operator fails to close CSV-167 manually/locally	1.011	Evaluated in Reference 3 Table 2, BE #25
DGDG1A/1B.FR3	DG1A and DG1B common mode failure to run for 24 hours	1.011	Evaluated in Reference 3 Table 2, BE #23
EDESWG56.FX	4kV Emergency Buses 5 and 6 Fault (Common mode failure)	1.004	Evaluated in Reference 3 Table 2, BE #34
CSV167.FTC	Penetration X-37 Isolation MOV CS-V-167 fails to close on demand	1.004	Evaluated in Reference 3 Table 2, BE #26
FWP37A.FR	Turbine Driven Pump FW-P-37A fails to run	1.003	Evaluated in Reference 3 Table 2, BE #27
SEPSDG2A.FS	1-SEPS-DG-2-A fails to start on demand	1.003	Evaluated in Reference 3 Table 2, BE #28
SEPSDG2B.FS	1-SEPS-DG-2-B fails to start on demand	1.003	Evaluated in Reference 3 Table 2, BE #29

TABLE RAI-3-2

Seabrook SAMA – Phase II Evaluation of New LL5 Basic Event SAMA Candidates

Basic Event (BE)	RC Group	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
					CDF	Pop. Dose	Internal & External	With Uncert.		
HH.CSTM1.FL	LL5	Operator established makeup to CST for long term SG cooling	Related SAMA #164. Hardware and procedural changes to improve the reliability of the CST makeup for long term SG cooling	CST01	1	1	35K (73K)	81K (171K)	>500K	Not cost beneficial. The SAMA concept is to enhance the operator's ability to reliably align and initiate makeup water to the CST during extended SBO conditions. The scope includes connection of an alternate portable, diesel-driven pump and valves to an independent water source. The PRA case conservatively assumes a continuous, successful CST suction source for EFW. The cost of hardware and procedural changes to allow the alternate makeup capability is expected to exceed the benefit. It is noted that related SAMA #164 "Modify 10" Condensate Filter Flange" was shown to be potentially cost beneficial in Reference 3 Table 1. It is also noted that Seabrook is pursuing options for long term CST makeup in response to the post Fukushima FLEX requirements. Cost to engineer and implement plant hardware and procedure modifications is based on Seabrook FLEX estimates.

TABLE RAI-3-2

Seabrook SAMA – Phase II Evaluation of New LL5 Basic Event SAMA Candidates

Basic Event (BE)	RC Group	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
					CDF	Pop. Dose	Internal & External	With Uncert.		
HH.SWOCCT.FA	LL5	Operator fails to transfer SW from Ocean to CT	Hardware and procedural changes to improve the reliability of transferring SW system function from Ocean to CT	SWOC6	<1	1	28K (59K)	66K (139K)	>1.5M	Not cost beneficial. The context of the operator action is to initiate a transfer of the ocean SW to the cooling tower given failure of the operating ocean pump with concurrent failure (or unavailability) of the standby pump. The SAMA concept is to improve the SW ocean to cooling tower transfer through implementation of enhanced automatic controls. PRA case SWOC6 conservatively assumes success of the transfer. This would require a complex control system to enhance the existing transfer control system. The cost to engineer and implement new controls is estimated to exceed $1.5M based on comparison to other SAMAs having similar scope and complexity (Davis Besse SAMA CC-19).
SWADP66.FTO	LL5	CT SWGR room relief damper SWA-DP-66 fails to open	Hardware changes to improve the reliability of the SWCT SWGR ventilation system	SWA6	<1	1	22K (46K)	52K (109K)	>240K	Not cost beneficial. The SAMA concept is to provide hardware changes to add redundant dampers within in the SWCT SWGR ventilation system. The PRA case conservatively assumes the damper is guaranteed successful. This is similar to reliability improvements for BE #15 (Reference 3 Table 2), but with a focus of improving damper reliability with installation of redundant capability. Cost to engineer and implement plant modifications and analysis judged comparable in scope and complexity to about half of the previously reported estimate in Reference 3 Table 2, BE #15.

TABLE RAI-3-2

Seabrook SAMA – Phase II Evaluation of New LL5 Basic Event SAMA Candidates

Basic Event (BE)	RC Group	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
					CDF	Pop. Dose	Internal & External	With Uncert.		
HH.OFCR1.FL	LL5	Operator fails to restore PCC from RSS before RCP seal failure (CR fire)	Hardware and procedure changes to improve operator capability to restore PCC at RSS panel.	OFCR0	<1	1	27K (56K)	62K (131K)	>200K	Not cost beneficial. The SAMA concept is to provide hardware/procedure changes that would significantly improve reliability of restoring PCCW from the Remote Safe Shutdown (RSS) panel after a control room fire. This would involve installing an automatic control system to initiate PCC. The PRA case conservatively assumes the operator action is guaranteed to be successful. Cost to engineer and implement plant modifications to improve the reliability of PCCW restoration is judged comparable to implementation of other Seabrook projects.
SWV64.TONO	LL5	SW Intake Return MOV SW-V-64 transfers open	Hardware changes to reduce the probability of spurious valve opening	SW64	<1	1	25K (52K)	58K (121K)	>300K	Not cost beneficial. SW-V-64 is normally closed with power breaker locked open. The PRA conservatively considers a low probability that the valve is inadvertently opened causing a possible flow diversion of SW discharge to the SW ocean intake. This could lead to an eventual heat up of SW. The scope of the SAMA is to provide a remote monitoring and alarm system of the valve position to guard against inadvertent opening. Cost to engineer and implement a valve monitoring and alarm system is judged comparable to implementation of other Seabrook projects.
SWADP65.FTO	LL5	CT SWGR room relief damper SWA-DP-65 fails to open	Hardware changes to improve the reliability of the SWCT SWGR ventilation system	SWA6	<1	1	22K (46K)	52K (109K)	>240K	Not cost beneficial. The SAMA concept and evaluation are similar to SWADP66.FTO, for hardware changes to add redundant dampers within in the SWCT SWGR ventilation system.

TABLE RAI-3-2

Seabrook SAMA – Phase II Evaluation of New LL5 Basic Event SAMA Candidates

Basic Event (BE)	RC Group	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
					CDF	Pop. Dose	Internal & External	With Uncert.		
SWAFN70.FS SWAFN71.FS	LL5	CT Pump Area Fans FWA-FN-70 & 71 common mode failure to start on demand	Improve reliability of SWCT pump room ventilation fans; eliminate potential for common mode failure	SW7071C	1	3	84K (176K)	196K (412K)	>480K	Not cost beneficial. The SAMA concept is to provide hardware changes to add a redundant fan within in the SWCT pump room ventilation system. The PRA case conservatively assumes success of both fans FN-70 and FN-71 when support systems are available. Cost to engineer and implement plant modifications and analysis judged to exceed the scope and complexity of Reference 3 Table 2, BE #15, and is expected to significantly exceed the benefit.
SWAFN63.FS SWAFN64.FS	LL5	CT SWGR Area Fans FWA-FN-63 & 64 common mode failure to start on demand	Improve reliability of SWCT SWGR room ventilation fans; eliminate potential for common mode failure	SW7071C	1	3	84K (176K)	196K (412K)	>480K	Not cost beneficial. The SAMA concept is to provide hardware changes to add a redundant fan within in the SWCT SWGR ventilation system. The PRA case SW7071C is representative of fans 63 and 64. The PRA case conservatively assumes success of both fans FN-63 and FN-64 when support systems are available. This SAMA evaluation is similar to BE # 13 and BE #15 (Reference 3 Table 2) for improving SWCT SWGR ventilation reliability. Cost to engineer and implement plant modifications and analysis judged to exceed the scope and complexity of Reference 3 Table 2, BE #15, and is expected to significantly exceed the benefit.
EAHFN180A.FS EAHFN180B.FS	LL5	EAH Fans FN-180A & 180B common mode failure to start	Improve reliability of the EAH ventilation fans; eliminate potential for common mode failure	EA180C	1	2	58K (121K)	136K (285K)	>480K	Not cost beneficial. The SAMA concept is to provide hardware changes to add a redundant fan within in the Emergency Air Handling (EAH) system. The PRA case conservatively assumes that both EAH fans are success when support systems are available.

TABLE RAI-3-2

Seabrook SAMA – Phase II Evaluation of New LL5 Basic Event SAMA Candidates

Basic Event (BE)	RC Group	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
					CDF	Pop. Dose	Internal & External	With Uncert.		
										Cost to engineer and implement plant modifications and analysis judged to exceed the scope and complexity of Reference 3 Table 2, BE #15, and is expected to significantly exceed the benefit.
2SWFN51B.FS SWFN51A.FS SWFN51B.FS	LL5	SW CT Fans 2SW-FN-51B, SW-FN-51B and SW-FN-51A common mode failure to start	Improve reliability of the cooling tower fans; eliminate potential for common mode failure	SW51C	1	3	87K (184K)	205K (430K)	>1M	Not cost beneficial. The SAMA concept is to provide hardware changes to improve the reliability of the three SW Cooling Tower fans. This SAMA scope is to install an additional fan, similar to the evaluation for BE #14 (Reference 3 Table 2). The cost to engineer and implement this change is similar to that reported previously in Reference 3 Table 2, BE #14.

TABLE RAI-3-3
Seabrook SAMA – Phase II Evaluation of New CDF Initiating Event SAMA Candidates

Initiating Event (IE)	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
LPCCA	Loss of PCCW Train A	Related SAMA IE #16 (LPCCB). Install hardware to improve the reliability of the CCW, thus reduce potential for loss of CCW initiators.	CCTE1	3	5	144K (302K)	337K (709K)	300K	IE SAMA LPCCA is the same as IE#16 (LPCCB) in Reference 3 Table 2, except that it is for PCCW Train A. The proposed SAMA is a modification to improve the reliability of CC-TV-2171/2271-1 & 2 (PCCW-A and PCCW-B). The SAMA is described in SAMA BE #9 and as a new potentially cost beneficial SAMA #195 in the SAMA Supplement, Reference 3.
F1PSWA	Major flood due to rupture of SW Train A in PAB	Improve reliability of SW isolation in the event of a large pipe break – install automatic isolation initiation and control logic	SWPI	4	11	339K (712K)	795K (1.7M)	>2.5M	Not cost beneficial. The SAMA concept is to improve the reliability of SW pipe break isolation for flood events occurring in the PAB via installation of control and initiation instrumentation logic. PRA case SWPI assumes a failure probability of E-02 to reflect improved isolation of SW flood initiators F1PSWA, F1PSWB, F2PSWA, F2PSWB and F2PSWC (all located in the PAB). It is noted that installation of a SW isolation system would be complex and would introduce negative affects on SW reliability, e.g., potential for inadvertent isolation causing a plant trip and potential for a complicated recovery due to loss of plant cooling. This negative risk impact is not considered in the PRA case. The cost to engineer and implement a complex isolation system is estimated to exceed $2.5M based on comparison to other SAMAs having similar scope and complexity. Estimate assumes a control

TABLE RAI-3-3
Seabrook SAMA – Phase II Evaluation of New CDF Initiating Event SAMA Candidates

Initiating Event (IE)	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
									system previously evaluated for BE#5 at >1.5M plus the cost of engineering and hardware changes to the system estimated at > 1.0M.
LOSPP	Loss of off-site power due to switchyard hardware or maintenance	Related SAMA #13, #14, #16, #24, #154, #156, #160, #190 - all are hardware changes to reduce the risk of LOSP.	LOSPP	2	2	80K (168K)	188K (395K)	>7M	Not cost beneficial. LOSPP initiating event is covered by existing SAMAs. The LOSPP case conservatively maximizes the benefit by assuming that all plant-centered (hardware) LOSP events are completely eliminated. Cost of physical plant modifications and analysis, is judged comparable in scope and complexity to SAMA #156 for installation of alternate offsite power source that bypasses the switchyard. It is noted that Seabrook Station has recently completed a multi-phase, multi-million dollar, comprehensive project to improve the reliability of the electrical switchyard.
F2PSWA	Large flood due to rupture of SW Train A piping in PAB	Refer to F1PSWA	SWPI	--	--	--	--	--	Not cost beneficial. Evaluated under SAMA F1PSWA.
F1PSWB	Major flood due to rupture of SW Train B piping in PAB	Refer to F1PSWA	SWPI	--	--	--	--	--	Not cost beneficial. Evaluated under SAMA F1PSWA.

TABLE RAI-3-3
Seabrook SAMA – Phase II Evaluation of New CDF Initiating Event SAMA Candidates

Initiating Event (IE)	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
F2PSWB	Large flood due to rupture of SW Train B piping in PAB	Refer to F1PSWA	SWPI	--	--	--	--	--	Not cost beneficial. Evaluated under SAMA F1PSWA.
F4TFPB	Major flood due to rupture of Fire Protection piping in TB impacting offsite power.	Provide flood and spray protection of non-safety bus duct	F4TFPB	1	0	14K (30K)	33K (70K)	>100K	Not cost beneficial. Cost to engineer and implement hardware changes exceed estimated benefit.
FCRAC	Fire in Control Room – AC Power Loss	Provide fire protection features to eliminate or reduce the potential for major fire on MCR Panel	FCRAC	1	0	15K (31K)	35K (73K)	>100K	Not cost beneficial. Cost to engineer and implement hardware changes exceed estimated benefit
LACPB	Loss of Train B Essential AC Power (4kV Bus E6	Related SAMA IE #14 (LACPA). Improve Bus E6 reliability and eliminate or reduce the potential for bus faults contributing to initiating events.	LACPA	3	1	44K (92K)	103K (216K)	>3M	Not cost beneficial. Same as IE #14 (LACPA) in Reference 3 Table 2.

TABLE RAI-3-3
Seabrook SAMA – Phase II Evaluation of New CDF Initiating Event SAMA Candidates

Initiating Event (IE)	Event Description	Related SAMA #'s and Proposed SAMA(s)	PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
F2PSWC	Large flood due to rupture of SW common return piping in PAB	Refer to F1PSWA	SWPI	--	--	--	--	--	Not cost beneficial. Evaluated under SAMA F1PSWA.
LOC1LG	Large LOCA	Hardware changes to eliminate or reduce the potential for large LOCA event	LOC1LG	1	0	4K (9K)	10K (21K)	>100K	Not cost beneficial. Cost to engineer and implement hardware changes exceed estimated benefit.

TABLE RAI-4-1

Seabrook SAMA – Phase II Sensitivity Evaluation of SAMA Candidates #91, #94, #99, #102 and #107

SBK SAMA Number	Potential Improvement	Description	Sensitivity PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
91	Install a passive containment spray system	Improved containment spray capability	CBSP	0	58	1.7M (3.5M)	4.0M (8.3M)	>10M	Not cost beneficial. Sensitivity PRA case CBSP assumes the addition of a passive containment spray and cooling system. This case assumes that all three functions: spray injection, containment recirculation and heat removal can be performed passively, independent of plant support systems consisting of initiation signals, AC & DC power, PCCW cooling and RWST suction. The PRA case also assumes that the passive system is independent of common-cause-failures among similar components. The independent failure probability of the passive system is assumed to be 1E-03. This failure probability is consistent with the failure probability of passive components (tank and valve) and assumes actuation is manual or automatic requiring instrumentation and control components. Based on this case, the benefit of a passive containment spray system could be higher compared to the previous evaluation, but significantly less than the expected cost Cost to engineer and implement a passive containment heat removal system same as that reported previously in the SAMA Supplement, Reference 3.
94	Install a filtered containment vent to remove decay heat. Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Increased decay heat removal capability for non-ATWS events, with scrubbing of released fission products	FVENT	0	69	2M (4.1M)	4.6M (9.7M)	~~>7.8M~~ >20M	Not cost beneficial. This SAMA is to install a filtered containment vent large enough for decay heat removal while providing filtration of fission products. Sensitivity PRA case FVENT is used to represent the benefit of this candidate SAMA. This PRA case assumes that the filtered vent is able to prevent the entire release frequency of LL3 (containment vent) and 80% of the release frequency LL5 (basemat melt-through). Thus, 100% of LL3 and 80% of LL5 are assigned to containment INTACT. Based on this case, the benefit of the filtered vent could be higher compared to the previous evaluation. Cost to engineer and implement a filtered containment vent has been re-assessed in this RAI to ensure that the cost estimate of a filtered containment vent system is realistic. The expected cost of a filtered vent system is in the range of $20M. This is based on a cost estimate of a filtered containment venting system for a two unit international plant, estimated at $48M.

TABLE RAI-4-1
Seabrook SAMA – Phase II Sensitivity Evaluation of SAMA Candidates #91, #94, #99, #102 and #107

SBK SAMA Number	Potential Improvement	Description	Sensitivity PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
99	Strengthen primary/secondary containment (e.g., add ribbing to containment shell)	Reduced probability of containment over-pressurization	CONST	0	4	117K (245K)	273K (574K)	11.5M	Not cost beneficial. The context of this SAMA is to reduce the probability of containment overpressure failure by strengthen containment by adding ribbing (reinforcement) to the containment shell. Adding reinforcement steel would increase the containment ultimate pressure strength thus extending the time to recover offsite power (late) and the containment cooling function before failure occurs. This sensitivity case assumes a factor of 10 reduction in the non-recovery probability of offsite power as a result of additional time that could be available for recovery (late) before containment pressure failure occurs. Based on this case, the benefit of adding ribbing to strengthen containment could be much lower compared to the previous evaluation and significantly less than the expected implementation cost. It is noted that the installation of structural support members sufficient enough to gain further design pressure margin to the containment building is judged not practical at Seabrook Station. Cost to engineer and implement installation of reinforcing steel to strengthen containment same as that reported previously in the SAMA Supplement, Reference 3.

TABLE RAI-4-1

Seabrook SAMA – Phase II Sensitivity Evaluation of SAMA Candidates #91, #94, #99, #102 and #107

SBK SAMA Number	Potential Improvement	Description	Sensitivity PRA Case	% Risk Reduction		Total Benefit ($) Baseline (with 2.1 multiplier)		Expected SAMA Cost ($)	Evaluation
				CDF	Pop. Dose	Internal & External	With Uncert.		
102	Construct a building to be connected to primary/sec. containment and maintained at a vacuum	Reduced probability of containment over-pressurization	CBSP	0	58	1.7M (3.5M)	4.0M (8.3M)	56.7M	Not cost beneficial. The context of this SAMA is to eliminate or reduce containment release events by adding a system to maintain evacuation (negative pressure) in the containment. It is noted that Seabrook Station already has an enclosure building around the primary containment building, which is maintained in a negative pressure condition. PRA case CSBP is used to represent the possible benefit of this candidate SAMA. This case is representative because the passive decay heat removal system in case CBSP would prevent containment overpressure failure. The failure probability of 1E-03, assumed for the passive spray and heat removal function in case CBSP, is a conservative failure probability for an active or passive large air handling and evacuation system with sufficient capacity to maintain low containment accident pressure and prevent overpressure failure. This represents the postulated reduction in the release challenge that might be realized by constructing an evacuation building to capture releases while preventing containment overpressure failure. Based on this case, the benefit of constructing an evacuation building could be higher compared to the previous evaluation but significantly less than the expected cost. Cost to engineer and construct a new building adjacent to containment with ventilation systems capable of maintaining a negative pressure is the same as reported previously in the SAMA Supplement, Reference 3.
107	Install a redundant containment spray system	Increased containment heat removal ability	CBSR	0	1	29K (62K)	69K (144K)	>10M	Not cost beneficial. The context of this SAMA is to reduce containment overpressure failure events by adding a redundant containment spray system. Seabrook currently has two trains of CBS. PRA case CBSR (containment building spray - redundant) assumes that an additional CBS system is installed and can provide all of the CBS functions of spray injection (I), spray recirculation (R) and spray heat removal (X). The support systems for the additional CBS train are the same as the existing CBS support systems. Based on this case, the benefit of adding a redundant containment spray train could be lower compared to the previous evaluation and significantly less than the expected cost. Cost to engineer and implement a redundant spray system is the same as reported previously in the SAMA Supplement, Reference 3.