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Vogtle Electric Generating Plant - Units 1 and 2
Methods to be used in the Implementation of
Risk-Informed Technical Specifications Initiative 4b

Ladies and Gentlemen:

On March 29, 2011, the Nuclear Regulatory Commission (NRC) held a public meeting with Southern Nuclear Operating Company (SNC) regarding SNC's intent to submit license amendment applications on two risk-informed initiatives, 10 CFR 50.69 and Risk-Informed Technical Specifications (RITS) Initiative 4b. During this meeting, SNC agreed to supply the NRC with SNC's proposed process for addressing external hazards and the preliminary list of Vogtle Electric Generating Plant Technical Specification (TS) Limiting Conditions of Operation (LCO) that will be considered for RITS Initiative 4b implementation.

The two items listed above, which are provided in this letter as Enclosures 1 and 2, are in preliminary stages. They will likely vary from the versions that will be submitted with the RITS Initiative 4b license amendment application. It is expected that the aforementioned license amendment application will be submitted by the end of the year 2012. This submittal date supersedes the date of September 30, 2011, which was submitted by SNC on July 14, 2010 to the NRC (Accession Number ML101960013).

This letter contains no NRC commitments. If you have any questions, please contact Jack Stringfellow at (205) 992-7037.

Respectfully submitted,

Mark J Ajluni

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Nuclear Licensing Director

MJA/EGA/lac

Enclosures: 1. Process for Addressing External Hazards in Implementation of Risk-managed Tech Specs

2. Preliminary List of TS LCOs for NEI 06-09 Consideration

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Mr. S. E. Kuczynski, Chairman, President & CEO
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Vogtle Electric Generating Plant - Units 1 and 2
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Risk-Informed Technical Specifications Initiative 4b

Enclosure 1

Process for Addressing External Hazards in
Implementation of Risk-managed Tech Specs

Process for Addressing External Hazards in Implementation of Risk-managed Tech Specs

Draft B

Prepared for:

Southern Nuclear Company

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March 25, 2011

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Process for Addressing External Hazards in Implementation of Risk-managed Tech Specs

1.0 Background

Southern Nuclear Operating Company (SNC) has adopted a corporate initiative to implement Risk-managed Technical Specifications (RMTS) at all their sites. The Vogtle site has been selected as the pilot plant for this initiative, but SNC's intent is to adopt this risk-informed initiative across their fleet.

RMTS utilizes a risk-informed methodology to permit a licensee to extend completion times (CTs) associated with actions of technical specifications (TSs), provided risk is assessed and managed within a configuration risk management program (CRMP). NEI 06-09, Revision 0-A, *Risk-Managed Technical Specifications (RMTS) Guidelines Industry Guidance Document* [Ref. 1], provides guidance on development and implementation of a RMTS program.

One of the key issues to be addressed in the plant-specific implementation of an RMTS program is the scope of the risk analysis required. The NRC's Final Safety Evaluation (SE) is incorporated directly into the NEI guidance document. With regard to the required scope of the PRA, the SE states the following:

> ***Scope of the PRA***
>
> *TR NEI 06-09, Revision 0, requires a quantitative assessment of potential impact on risk due to impacts from internal events, including internal fires. Other sources of risk (i.e., seismic, other external events) must be quantitatively assessed if they contribute significantly to configuration-specific risk. Transition risk is conservatively not considered in establishing [Risk-informed Completion Times] RICTs, and as the RMTS are not applicable to cold shutdown and refueling modes, shutdown risk for these conditions need not be evaluated. Consideration is made of both CDF and LERF metrics. Bounding analyses or other conservative quantitative evaluations are permitted where realistic PRA models are unavailable. The guidance provided in TR NEI 06-09, Revision 0, is sufficient to ensure the scope of the risk analysis supporting the RMTS evaluations are adequate to assess configuration risk and is consistent with Section 2.3.2 of RG 1.177.*

In both NEI 06-09 and the NRC's Staff's SE, it is clear that the expectation is that internal hazards, including internal events, internal floods, and internal fires, must be addressed using a plant-specific PRA. It is also clear that other external hazards can be excluded from the scope of the PRA, if it can be shown that the incremental risk posed by the hazard caused by entry into the configuration is not significant. The degree to which external hazards must be quantitatively addressed, if at all, is a function of the technical specification being considered and the facility–specific design and geographic features that influence the relevance of a hazard for that site. Consequently, it is not possible to generically disposition the risk significance of external hazards for all potential tech specs.

2.0 Purpose

The purpose of this white paper is to outline the process to be used by SNC to identify, evaluate, and, as necessary, address external hazards in the implementation of RMTS across the fleet. Some examples are included, but the primary purpose is to illuminate the process, not to provide a final basis for dispositioning a particular hazard for a particular facility. Such a technical basis will be developed and documented separately.

3.0 Scope

The scope of facilities considered in this guidance includes all of the nuclear power stations within the SNC fleet:

Table 3-1
Scope of Stations

Site & Units	Reactor Type/Vendor	Year of Commercial Operation
Vogtle 1 & 2 (Pilot)	PWR – 4 Loop/Westinghouse	1987/1989
Hatch 1 & 2	BWR – 4, Mark I/General Electric	1975/1979
Farley 1 & 2	PWR – 3 Loop/Westinghouse	1977/1981

These facilities span a spectrum of reactor types and vintages. While the process described in this paper is for all plants, it is anticipated that the implementation approach to addressing specific external hazards may vary across the fleet, depending of the relevance of the hazard to facility risk and the tech specs included in the RMTS program.

NEI 06-09 and the associated PWROG guidance [Ref. 2] do not provide a specific list of hazards to be considered in an RMTS program. However, NUREG-1855 [Ref. 3] provides regulatory guidance on risk-informed decision-making relative to hazards that are not considered in the PRA model. Specifically, Section 6 of NUREG-1855 provides the following list of external hazards that should be addressed either via a bounding analysis or included in a PRA calculation:

Table 3-2
Minimum Scope of External Hazards to be Considered

- Seismic Events
- Accidental Aircraft Impacts
- External Flooding
- Extreme Winds and Tornados (including generated missiles)
- Turbine-Generated Missiles
- External Fires
- Accidents From Nearby Facilities
- Release of Chemicals Stored at the Site
- Transportation Accidents
- Pipeline Accidents (e.g., natural gas)

Consistent with NEI 06-09, it is assumed that any plant adopting RMTS will have a PRA that addresses internal events, internal floods, and internal fires. The scope of this paper is the process for consideration of the above hazards for the entire SNC fleet of nuclear power plants.

4.0 Technical Approach

The guidance contained in NEI 06-09 states that all hazards that contribute significantly to incremental risk of a configuration must be quantitatively addressed in the implementation of RMTS. The following approach focuses on the risk implications of specific external hazards in the determination of the RICT for the selected RMTS.

Consistent with NUREG-1885, the process includes the ability to address external hazards by

- Screening the hazard based on low risk,
- Bounding the potential impact and including it in the decision-making, or
- Developing a PRA model to be used in the RMAT/RICT calculation.

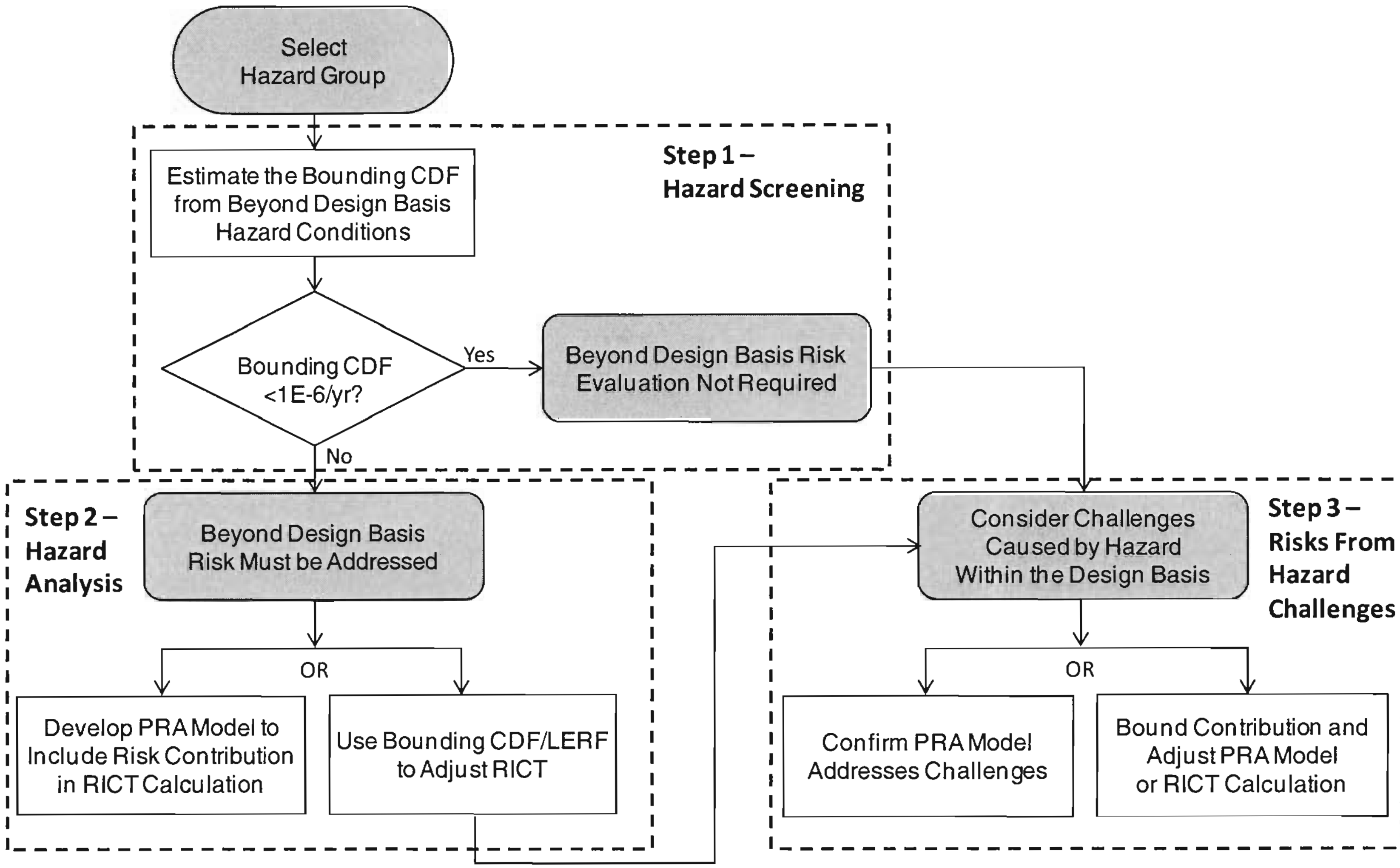
The overall process for addressing external hazards is shown in Figure 4-1. Each hazard identified in Table 3-2 is addressed individually.

The process considers two aspects of the external hazard contribution to risk. The first is the contribution from the occurrence of beyond design basis conditions, e.g., winds greater than design, seismic events greater than DBE, etc. These beyond design basis conditions challenge the capability of the systems, structures, and components (SSCs) to maintain functionality and support safe shutdown of the plant. The second aspect addressed are the challenges caused by external conditions that are within the design basis, but still require some plant response to assure safe shutdown, e.g., high winds or seismic events causing loss of offsite power, etc. While the plant design basis assures that the safety related equipment necessary to respond to these challenges are protected, the occurrence of these conditions nevertheless cause a demand on these systems that in and of itself presents a risk.

Step 1 – Hazard Screening

The first step in the evaluation of the external hazard is screening based on an estimation of a bounding core damage frequency (CDF) for beyond design basis hazard conditions. An example of this type of screening is reliance on the NRC's 1975 Standard Review Plan (SRP) [Ref. 4] which is acknowledged in both the ASME/ANS PRA Standard [Ref. 5] and in the NRC's IPEEE procedural guidance [Ref. 6] as assuring a bounding core damage frequency of less than 1E-6/yr for each hazard. The bounding CDF estimate is often characterized by the likelihood of the site being exposed to conditions that are beyond the design basis limits and an estimate of the bounding conditional core damage probability (CCDP) for those conditions. Sometimes, the bounding CCDP is conservatively assumed to be 1.0. In these cases, removal of equipment from service has no impact on the CDF from the hazard. In cases where a bounding CCDP is assumed to be less than unity, it is necessary to assure that removal of equipment from service under the RMTS does not invalidate the assumed bounding CCDP. It is expected that this will often be straightforward, as the bounding CCDPs are often on the order of 0.1, based on bounding assumptions of human response, and are therefore generally less dependent on the availability of redundant equipment.

Figure 4-1
Process for Addressing External Hazards in RMTS



If the bounding CDF for the hazard can be shown to be less than 1E-6/yr, then beyond design basis challenges from the hazard can be screened and do not need to be addressed quantitatively in the RMTS program. The basis for this is as follows:

- The overall calculation of the RICT is limited to an incremental core damage probability (ICDP) of 1E-5.
- The backstop (maximum) time interval allowed for this RICT is 30 days.
- If the maximum CDF contribution from a hazard is <1E-6/yr, then the maximum ICDP from the hazard is <1E-7 (1E-6/yr * 30 days/365 days/yr).
- Thus, the bounding ICDP contribution from the hazard is shown to be less than 1% of the permissible ICDP in the bounding time for the condition. Such a minimal contribution is not significant to the decision in computing a RICT.

While the direct CDF contribution from beyond design basis hazard conditions can be shown to be non-significant using this approach, some external hazards can cause a plant challenge even for hazard severities that are less than the design basis limit. These considerations are addressed in Step 3 of the process.

Some external hazards may not present a particular challenge to plant systems and need not be further evaluated, e.g., toxic chemical releases for which the plant response is for the operators to don breathing apparatus.

Each hazard group should be reviewed to determine the nature of such challenges presented, if any.

There is one other important consideration for screened hazards that must be addressed within the RMTS program. This relates to maintaining the boundary conditions of the base risk analysis. The screening process described above assumes that the capability of the plant to withstand the hazard is consistent with the design assumptions. In some cases, plant activities can change this. For example:

- Removal of a toxic gas monitor from service on the control room HVAC system can impact the ability of the plant systems and operators to respond to a toxic gas release.
- Removal of a tornado missile or flood barrier from service in order to support a maintenance activity can degrade the capability of the plant to respond to such hazards, if the removal of the barrier reduces the protection of equipment that is expected to be available. That is, if the barrier only protects equipment that is considered out of service under the RMTS, then there is no need to address this further, but if other equipment that is intended to be available could be impacted, then the basis for the screening of the hazard becomes invalid.

Step 2 - Hazard Analysis

There are two options in cases where the bounding CDF for the external hazard cannot be shown to be less than 1E-6/yr. Such hazards are generally those with relatively larger frequencies of beyond design basis conditions, such as seismic events. The first option is to develop a PRA model that explicitly models the challenges created by the hazard and the role of the systems included in the RMTS in mitigating those challenges. This need not be a completely comprehensive PRA, but it must characterize the risk related to these systems and would be used in the evaluation of RICTs under RMTS.

The second option for addressing an external hazard is to compute a bounding CDF contribution from the hazard to utilize the RICT calculation. The basic approach is as follows:

1. Estimate Bounding CDF

   This approach is similar to the approach taken in Step 1, but can be refined as necessary to provide additional insights.

2. Evaluate Potential Risk Increases Due to Out of Service Equipment

   In many cases, the risk associated with the equipment out of service is bounded by the CDF estimate either because the risk calculation assumes failure of redundant components, or because the CCDP is dominated by human response, not equipment response. If this is not the case for a hazard addressed using this approach, then some estimate must be made of the increase in CDF resulting from the out of service equipment.

3. Include Bounding CDF in ΔCDF Calculation

   The bounding risk increase from the hazard can be added to the increase computed from the PRA model as a means to bound the incremental risk and reflect the bounding total the computation of the ΔCDF. If multiple hazards are addressed by bounding analysis, then the sum of the ΔCDF values for individual hazards are added to the ΔCDF computed using the PRA model. Thus, the ΔCDF for a condition can be computed as:

   $$\Delta CDF_{Total} = \Delta CDF_{PRA\ Model} + \Sigma \Delta CDF_{Bounded\ Hazard(i)}$$

4. Evaluate Bounding LERF Contribution

   The RMTS program requires addressing both core damage and large early release risk. When a comprehensive PRA does not exist, the LERF considerations can be estimated based on the relevant parts of the internal events LERF analysis. This can be done by considering the nature of the challenges induced by the hazard and relating those to the challenges considered in the internal events PRA. This can be done in a realistic manner or a conservative manner. The goal is to provide a representative or bounding conditional probability of large early release (CPLER) that aligns with the ΔCDF computed in the bounding CDF evaluation. If multiple hazards are addressed by bounding, then the sum of the individual hazards are added to the ΔLERF computed using the PRA model. The change in large early release frequency (ΔLERF) for each hazard is then computed as:

$$\Delta LERF_{Bounded\ Hazard} = \Delta CDF_{Bounded\ Hazard} * CPLER_{Bounded\ Hazard}$$

These bounding increases in ΔLERF can be added, if multiple hazards are unscreened to compute an overall ΔLERF:

$$\Delta LERF_{Overall} = \Delta LERF_{PRA\ Model} + \Sigma(\Delta CDF_{Bounded\ Hazard(i)} * CPLER_{Bounded\ Hazard(i)})$$

or

$$\Delta LERF_{Overall} = \Delta LERF_{PRA\ Model} + \Sigma\Delta LERF_{Bounded\ Hazard(i)}$$

5. Compute RICT Accounting for Bounding Risk Estimates

   The potential risk contribution from any external hazard is addressed in the RMTS program by including the overall ΔCDF and overall ΔLERF estimates in the calculation of the RICT:

$$RICT_{CDF} = 1E\text{-}5/(\ \Delta CDF_{PRA\ Model} + \Sigma\Delta CDF_{Bounded\ Hazard(i)})$$

$$RICT_{LERF} = 1E\text{-}6/(\ \Delta LERF_{PRA\ Model} + \Sigma\Delta LERF_{Bounded\ Hazard(i)})$$

   The RMAT is not adjusted because of the bounding nature of the hazard risks and the fact that the risk management actions to be taken are not materially different.

These estimates of the bounding CDF focus on the hazard-induced failures. As in the case of using the bounding CDF estimates for the screening of other external hazards, the risk from the challenges not involving failures beyond the design basis also need to be addressed in Step 3.

Appendix A provides an example of this approach for Vogtle Units 1 and 2 with respect to the seismic hazard.

Step 3 - Risks from Hazard Challenges

Steps 1 and 2 address the direct risks from damage to the facility from external hazards. While the direct CDF contribution from beyond design basis hazard conditions can be shown to be non-significant using this approach, without a full PRA there are risks that may be unaccounted for. These risks are related to the fact that some external hazards can cause a plant challenge even for hazard severities that are less than the design basis limit. For example:

- High winds, tornadoes, and seismic events can cause extended loss of offsite power conditions below design basis levels.
- Depending on the site, external floods can challenge the availability of normal plant heat removal mechanisms.

The approach to be taken in this step is to identify the plant challenges caused by the occurrence of the hazard within the design basis and evaluate whether the risks associated with these events are either already considered in the existing PRA model or they are not significant to the risk. Appendix B provides an example of the consideration of some representative external hazards for Vogtle Units 1 and 2.

5.0 Summary

The RMTS program must account for all hazards that can contribute significantly to the calculation of the associated RICT. The process described in this paper includes the ability to address external hazards by either

- Screening the hazard based on low risk,
- Bounding the potential impact and including it in the decision-making, or
- Developing a PRA model to be used in the RMAT/RICT calculation.

In cases where a full PRA is not available, the risk from these external hazards must either be determined to be not significant to the RICT calculation or they must be quantitatively accounted for in the computation of the RICT. In cases where hazards are excluded, it is also necessary to address the risk that results from the site challenges caused by the hazard.

6.0 References

1. NEI 06-09, "Risk-Managed Technical Specifications (RMTS) Guidelines Industry Guidance Document", Rev. 0-A, November 2006.

2. WCAP-16952-NP, "Supplemental Implementation Guidance for the Calculation of Risk Informed Completion Time and Risk Managed Action Time for RITSTF Initiative 4B", August 2010.

3. NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making", Volume 1, March 2009.

4. NUREG-75/087, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition", 1975.

5. American Society of Mechanical Engineers and American Nuclear Society, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications", ASME/ANS RA-Sa-2009, New York (NY), February 2009.

6. NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities", June 1991.

Appendix A
Example: Analysis of Seismic Risk for Vogtle Units 1 & 2

The purpose of this Appendix is to provide an example of the approach that could be taken in Step 2, when a seismic PRA is not available. As described in Section 4, the process for analyzing an unscreened external hazard without the use of a full PRA involves the following five steps:

1. Estimate Bounding CDF
2. Evaluate Potential Risk Increases Due to Out of Service Equipment
3. Include Bounding CDF in ΔCDF Calculation
4. Evaluate Bounding LERF Contribution
5. Compute RICT Accounting for Bounding Risk Estimates

This example will be based on Vogtle Units 1 and 2 so that the process is fully exercised, but the process could be applied to any of the SNC facilities.

A.1 Estimate Bounding CDF

The NRC recently published information on the estimates of the seismic risk levels for all plants in the Central and Eastern United States (CEUS) as part of Generic Issue 199 [Ref. A-1]. Seismic hazards are a subject of considerable uncertainty. In order to address the changing state of knowledge on seismic hazards, the NRC Staff developed a technical analysis that computed conservative estimates of seismic risk for all plants in the CEUS [Ref. A-2]. The NRC Staff analysis used a variety of calculational approaches to compute a conservative estimate of the seismic core damage frequency (SCDF) using three different seismic hazard sources. The results of these analyses for the Vogtle site are presented in Table A-1.

Table A-1
Estimates of Total Seismic Core Damage Frequency from Appendix D of Ref. A-2

	Calculational Approach				
Hazard Source	**Maximum Spectral Result**	**Simple Average**	**IPEEE Weighted Average**	**Weakest Link Model**	**Highest Estimate**
1989 EPRI [Ref. A-3]	2.2E-06	2.0E-06	1.9E-06	2.6E-06	2.6E-06
1994 LLNL [Ref. A-4]	2.0E-05	1.5E-05	1.4E-05	2.0E-05	2.0E-05
2008 USGS [Ref. A-5]	6.6E-06	5.0E-06	4.8E-06	7.1E-06	7.1E-06

These estimates span a fairly wide range, with the maximum value generated using the 1994 Lawrence Livermore National Lab (LLNL) hazard curve along with conservative estimates of the seismic fragility. Using these conservative analyses, the maximum total SCDF is computed to be 2E-5/yr. This represents the convolution of the 1994 LLNL Vogtle seismic hazard curve with an assumed limiting plant fragility based on the high confidence of low probability of failure (HCLPF) of 0.3g, as reported in the Vogtle IPEEE [Ref. A-6]. Such methods have been shown to provide a conservative estimate of SCDF. By adopting the maximum estimate generated by various methods, this provides a bounding estimate of the SCDF for use in this RMTS example.

A.2 Evaluate Potential Risk Increases Due to Out of Service Equipment

The approach taken to the computation of SCDF in Ref. A-2, assumes that the SCDF can be based on the likelihood of a single seismic-induced failure leads to core damage. This approach is bounding and implicitly relies on the assumption that seismic-induced failures of equipment show a high degree of correlation, i.e., if one SSC fails, all similar SSCs will also fail. This simplifying assumption is conservative, but direct use of this assumption in evaluating the risk increase from out of service equipment could lead to an underestimation of the change in risk.

On the other hand, if one were to assume no correlation at all in the seismic failures, then the base seismic risk would be lower, but the computed risk with a redundant piece of irnportant equipment out of service would be back up to the original bounding level.

Thus, the risk increase due to out of service equipment must be between 0 and the total SCDF estimated by the bounding method used in Ref. A-2. That is, for the Vogtle site, the delta SCDF from equipment out of service cannot be greater than 2E-5/yr.

A.3 Include Bounding CDF in ΔCDF Calculation

The total change in core damage frequency can be bounded by adding the delta SCDF to the ΔCDF from the PRA model for that condition can be computed as:

$$\Delta CDF_{Total} = \Delta CDF_{PRA\ Model} + \Delta CDF_{Seismic} = \Delta CDF_{PRA\ Model} + 2E\text{-}5/yr$$

A.4 Evaluate Bounding LERF Contribution

The current Vogtle internal events PRA [Ref. A-7] includes a comprehensive treatment of LERF due to internally initiated events. Table A-2 provides a summary of the results of the internal events analysis. These results show that the Vogtle containment is robust with respect to LERF contributors, except when the scenario is initiated by a bypass event (i.e., SGTR or ISLOCA). All other scenarios, including Station Blackout (%SBO) show a conditional probability of LERF of less than 0.01.

Seismic events would not be expected to induce containment bypass scenarios. Therefore, a bounding conditional probability of large early release for seismic events ($CPLER_{Seismic}$) is assumed to be 0.01. The incremental large early release probability from seismic events ($\Delta LERF_{Seismic}$) is then computed as:

$$\Delta LERF_{Seismic} = \Delta CDF_{Seismic} * CPLER_{Seismic} = 2E\text{-}5/yr * 0.01 = 2E\text{-}7$$

Table A-2
Conditional Large Early Release Probability from Internal Event PRA

Initiating Event	Description	CDF (/yr)	LERF(/yr)	CPLER
%ISLOCA	INTERFACING SYSTEMS LOCA IDENTIFIER	1.03E-09	1.04E-09	101.0%
%SGTR	SGTR IE IDENTIFIER	1.12E-07	3.94E-08	35.2%
%SSBI	SECONDARY SIDE BREAK UPSTREAM OF MSIVs INITIATING EVENT IDENTIFIER	2.15E-07	1.43E-09	0.7%
%LO120VAB	LOSS OF 120VAC PANELS A AND B SPECIAL IE IDENTIFIER	5.81E-09	1.53E-11	0.3%
%MLOCA	MEDIUM LOCA IE IDENTIFIER	1.48E-06	3.60E-09	0.2%
%LODCB	LOSS OF DC BUS 1B SPECIAL INITIATOR IDENTIFIER	2.44E-07	4.64E-10	0.2%
%SSBO	SECONDARY SIDE BREAK DOWNSTREAM OF MSIVs INTIATING EVENT IDENTIFIER	1.67E-07	3.04E-10	0.2%
%LODCA	LOSS OF DC BUS 1A SPECIAL INTIATOR IDENTIFIER	2.13E-07	3.15E-10	0.1%
%LLOCA	LARGE LOCA IE IDENTIFIER	1.13E-08	1.63E-11	0.1%
%SBO	Station Blackout IE IDENTIFIER	6.27E-06	8.75E-09	0.1%
%LONSCW	LOSS OF NSCW IDENTIFIER	2.24E-06	3.09E-09	0.1%
%RVR	REACTOR VESSEL RUPTURE IE IDENTIFIER	9.10E-08	1.25E-10	0.1%
%ISINJ	INADVERTENT SI INJECTION IE IDENTIFIER	2.52E-06	3.46E-09	0.1%

%LO4160VA	LOSS OF 4.16KV BUS A SPECIAL IE IDENTIFIER	1.14E-06	1.56E-09	0.1%
%LO4160VB	LOSS OF 4.16KV BUS B SPECIAL IE IDENTIFIER	5.19E-07	7.00E-10	0.1%
%LOSP	LOSS OF OFFSITE POWER IE IDENTIFIER	4.72E-06	6.18E-09	0.1%
%OTRAN	OTHER TRANSIENTS IE IDENTIFIER	7.00E-07	9.13E-10	0.1%
%SLOCA	SMALL LOCA IE IDENTIFIER	3.10E-07	3.98E-10	0.1%
%TTRIP	TURBINE TRIP IE IDENTIFIER	4.79E-07	6.14E-10	0.1%
%RTRIP	REACTOR TRIP IE IDENTIFIER	4.25E-07	5.43E-10	0.1%
%LOC	LOSS OF CONDENSER IE IDENTIFIER	2.68E-07	3.22E-10	0.1%
%ATWT	ATWT IDENTIFIER	1.87E-07	2.24E-10	0.1%
%LOFW	LOSS OF FEED WATER IE IDENTIFIER	1.71E-07	1.98E-10	0.1%
%LOSINJ	LOSS OF SEAL INECTION IDENTIFIER	3.61E-08	3.70E-11	0.1%
%LOIA	LOSS OF INSTRUMENT AIR SPECIAL INTIATOR IDENTIFIER	8.53E-09	3.79E-12	0.0%
Total	**Total CDF/LERF**	2.25E-05	7.37E-08	0.3%

A.5 Compute RICT Accounting for Bounding Risk Estimates

The potential risk contribution from seismic is addressed in the RMTS program by including the bounding ΔCDF and ΔLERF estimates in the calculation of the RICT:

$RICT_{CDF} = 1E\text{-}5/(\ \Delta CDF_{PRA\ Model} + \Delta CDF_{Seismic}) = 1E\text{-}5/(\ \Delta CDF_{PRA\ Model} + 2E\text{-}5/yr)$

$RICT_{LERF} = 1E\text{-}6/(\ \Delta LERF_{PRA\ Model} + \Delta LERF_{Seismic}) = 1E\text{-}6/(\ \Delta LERF_{PRA\ Model} + 2E\text{-}7/yr)$

A.6 Conclusions

The above example provides the technical basis for addressing the seismic-induced core damage risk for the Vogtle station by adding a bounding estimate of the ΔCDF and ΔLERF from seismic events to the computation of the ICDP/ILERP.

A.7 References

A-1. Generic Issue 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants", IN2001-18, September 2, 2010.

A-2. Staff Report, "Implications of Updated Probabilistic Seismic Hazard Estimates In Central And Eastern United States On Existing Plants, Safety/Risk Assessment", ML100270639, August 2010.

A-3. EPRI NP-6395-D, 1989, "Probabilistic Seismic Hazard Evaluation at Nuclear Plant Sites in the Central and Eastern United States: Resolution of the Charleston Issue," Electric Power Research Institute, Palo Alto, CA.

A-4. NUREG-1488, 1994, "Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains", U.S. Nuclear Regulatory Commission, Washington, D.C.

A-5. Petersen, M.D, and 14 others, 2008, "Documentation for the 2008 Update of the United States National Seismic Hazard Maps by the National Seismic Hazard Mapping Project," United States Geological Survey Open-file Report 2008-1128.

A-6. Georgia Power Company, "Vogtle Electric Generating Plant, Units 1 and 2, Individual Plant Examination of External Events," November 1, 1995.

A-7. Southern Nuclear Co., "VEGP Level 1 and 2 PRA Model Revision 4 - at power, internal events", Calculation No. PRA-BC-V-07-003, Rev. 0, December 15, 2010.

Appendix B
Example: Evaluation of External Event Challenges at Vogtle Units 1 & 2

The purpose of this Appendix is to provide an example of the approach that could be taken in Step 3, when external hazards have either been screened or they have been bounded in the RICT calculation. As described in Section 4, in these cases, the incremental risk associated with challenges to the facility that do not exceed the design capacity must be accounted for.

In accordance with NUREG-1855 [Ref. B-1], the following external hazards are considered:

- Seismic Events
- Accidental Aircraft Impacts
- External Flooding
- Extreme Winds and Tornados (including generated missiles)
- Turbine-Generated Missiles
- External Fires
- Accidents From Nearby Facilities
- Release of Chemicals Stored at the Site
- Transportation Accidents
- Pipeline Accidents (e.g., natural gas)

The Vogtle IPEEE for Units 1 and 2 [Ref. B-2] provides an assessment of the vulnerability of the site to these hazards. In general, the Vogtle site screened these external hazards based on meeting the Standard Review Plan (SRP) or other regulatory guidance. This screening assures that safety related equipment is not affected, but it does not necessarily consider the other challenges. Table B-1 reviews the bases for the evaluation of these hazards, identifies any challenges posed, and identifies any additional treatment of these challenges, if required.

B. 1 Seismic-induced LOOP

Based on Table B-1 for Vogtle Units 1 and 2, the only challenge that is not addressed is seismically induced loss of offsite power. The methodology for computing the seismically-induced LOOP frequency is simply a convolution of the mean seismic hazard curve and the offsite power fragility. Consistent with the analysis discussed in Appendix A, the hazard curve with the most conservative result will be applied. In this case, this is the 1994 LLNL hazard curves documented in NUREG-1488 [Ref. B-4]. This is also the hazard curve utilized by the NRC is the RASP Handbook on external events [Ref. B-5].

Table B-2 provides the mean seismic hazard data and the loss of offsite power failure probability for each seismic interval based on the fragility of offsite power. The hazard data is taken from Table 4A-1 of the RASP Handbook. The failure probabilities are based on the fragility data from Table 4B-1 of the RASP Handbook:

$$\text{Median Offsite Power Capacity} = 0.3g,\ \beta_R = 0.3,\ \beta_U = 0.45$$

Table B-1
Evaluation of Plant Challenges Posed by External Hazards at Vogtle Units 1 and 2

External Hazard	Current Risk Basis	Challenge(s) Posed	Disposition for RMTS
Seismic Events	Seismic events treated using a bounding approach in the computation of the RICT (see Appendix A). Other challenges must be considered.	Seismically induced loss of offsite power (LOOP) – assume unrecoverable within 24 hours.	Address as part of internal events treatment of LOOP.
Accidental Aircraft Impacts	No airports or landing strips within 10 miles of site. Do not pose a threat to VEGP. [Ref. B-2]	n/a	Excluded from RMTS evaluation
External Flooding	Safety related structures meet SRP. [Ref. B-2]	TBD	TBD
Extreme Winds and Tornados (including generated missiles)	Minimal risk to safety related SSCs based on meeting SRP, however offsite power is susceptible to damage. [Ref. B-2]	Loss of offsite power	Weather related LOOP and recovery included in data used for internal events PRA [Ref. B-3]. No further analysis required.
Turbine-Generated Missiles	Do not have a basis. [Ref. B-2]	TBD	TBD
External Fires	Toxic gases and thermal effects found to not pose a threat to VEGP. [Ref. B-2]	n/a	Excluded from RMTS evaluation
Accidents From Nearby Facilities	Evaluated fires, explosions, missiles, and chemical releases from nearby facilities. Do not pose a threat to VEGP. [Ref. B-2]	n/a	Excluded from RMTS evaluation
Release of Chemicals Stored at the Site	Only threat to control room is ammonia and hydrazine. No toxic gas monitors, only rely on operator response to don	n/a	Excluded from RMTS evaluation

	respirators. [Ref. B-2]		
Transportation Accidents	Evaluated fires, explosions, missiles, and chemical releases from truck and rail transportation. Do not pose a threat to VEGP. [Ref. B-2]	n/a	Excluded from RMTS evaluation
Pipeline Accidents (e.g., natural gas)	Evaluated fires, explosions, missiles, and chemical releases from pipelines. Do not pose a threat to VEGP. [Ref. B-2]	n/a	Excluded from RMTS evaluation

Given the mean frequency and failure probability for each seismic interval, it is straightforward to compute the estimated frequency of seismically induced loss of offsite power for the Vogtle site by taking the product of the interval frequency and the offsite power failure probability. As shown in Table B-2, the total seismic LOOP frequency is the sum of interval frequencies.

Table B-2
Seismic LOOP Frequency Based on RASP Handbook [Ref. B-5]

Acceleration (g)	Mean Exceedence Frequency (/yr)	Seismic Interval (g)	Interval Frequency (/yr)	Offsite Power Failure Prob.	Weighted Average LOOP freq
0.05	2.50E-03	0.05-0.08	1.14E-03	1.84E-04	2.1E-07
0.08	1.36E-03	0.08-0.15	9.41E-04	2.46E-03	2.3E-06
0.15	4.15E-04	0.15-0.26	2.61E-04	6.29E-02	1.6E-05
0.26	1.55E-04	0.26-0.31	4.86E-05	2.79E-01	1.4E-05
0.31	1.06E-04	0.31-0.41	4.92E-05	4.02E-01	2.0E-05
0.41	5.68E-05	0.41-0.51	2.26E-05	6.11E-01	1.4E-05
0.51	3.42E-05	0.51-0.66	1.59E-05	7.57E-01	1.2E-05
0.66	1.83E-05	0.66-0.82	7.36E-06	8.81E-01	6.5E-06
0.82	1.09E-05	0.82-1.02	4.76E-06	9.41E-01	4.5E-06
1.02	6.18E-06	>1	6.18E-06	9.76E-01	6.0E-06
		Total Seismic LOOP Frequency =			**9.5E-05/yr**

The internal events PRA relies upon the loss of offsite power data in NUREG/CR-6890 [Ref. B-3]. Based on Appendix 10-C of the Vogtle internal events PRA [Ref. B-6], the total LOOP frequency is 3.26E-2/yr and the overall non-recovery probability at 24 hours is 6.5E-2. Thus, the internal events frequency already includes a frequency of unrecovered loss of offsite power that is 2.12E-3/yr (= 3.26E-2/yr * 6.5E-2).

The seismically-induced (unrecoverable) loss of offsite power frequency is less than 5% of the total unrecovered LOOP frequency. This is judged to be a sufficiently small fraction that it will not significantly impact the RICT calculations and it can be omitted.

B.2 Conclusions

Based on this review of external hazards for Vogtle Units 1 and 2, no additional external hazards need to be added to the existing PRA model, beyond the treatment of seismic risk described in Appendix A.

B.3 References

B-1. NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making", Volume 1, March 2009.

B-2. Georgia Power Company, "Vogtle Electric Generating Plant, Units 1 and 2, Individual Plant Examination of External Events," November 1, 1995.

B-3. NUREG/CR-6890, "Reevaluation of Station Blackout Risk at Nuclear Power Plants", December 2005.

B-4. NUREG-1488, 1994, "Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains", U.S. Nuclear Regulatory Commission, Washington, D.C.

B-5. "Risk Assessment of Operational Events Handbook, Volume 2 – External Events", Revision 1.01, January 2008.

B-6. Southern Nuclear Co., "VEGP Level 1 and 2 PRA Model Revision 4 - at power, internal events", Calculation No. PRA-BC-V-07-003, Rev. 0, December 15, 2010.

Vogtle Electric Generating Plant - Units 1 and 2
Methods to be used in the Implementation of
Risk-Informed Technical Specifications Initiative 4b

Enclosure 2

Preliminary List of Technical Specification Limiting Conditions of Operation for NEI 06-09 Consideration

Preliminary List of Technical Specification Limiting Conditions of Operation for NEI 06-09 Consideration

Condition	Associated System	Exclusively Modeled *
3.4.9.B	Pressurizer	No
3.4.10.A	Pressurizer Safety Valves	Yes
3.4.11.B	Pressurizer Power Operated Relief Valves	Yes
3.4.11.C	Pressurizer Power Operated Relief Valves	Yes
3.4.11.F	Pressurizer Power Operated Relief Valves	Yes
3.4.15†	RCS Leakage Detection Instrumentation	No
3.5.1.A	Accumulators	No
3.5.1.B	Accumulators	No
3.5.2.A	ECCS – Operating	Yes
3.5.4.A	Refueling Water Storage Tank (RWTS)	No
3.5.4.B	Refueling Water Storage Tank (RWTS)	Yes
3.5.4.D	Refueling Water Storage Tank (RWTS)	No
3.5.5.A	Seal Injection Flow	Yes
3.5.6.A	Recirculation Fluid pH Control System	No
3.6.2.C	Containment Air Locks	No
3.6.3.A	Containment Isolation Valves	No
3.6.3.B	Containment Isolation Valves	No
3.6.3.C	Containment Isolation Valves	No
3.6.4.A	Containment Pressure	No
3.6.5.A	Containment Air Temperature	No
3.6.6.A	Containment Spray and Cooling Systems	No
3.6.6.B	Containment Spray and Cooling Systems	No
3.7.1.A	Main Steam Safety Valves	Yes
3.7.2.A	Main Steam Isolation valves	Yes
3.7.2.B	Main Steam Isolation valves	Yes
3.7.2.D	Main Steam Isolation valves	Yes
3.7.2.E	Main Steam Isolation valves	Yes
3.7.3.A	Main Feedwater Isolation Valves and Main Feedwater Regulation Valves and Associated Bypass Valves	Yes
3.7.3.B	Main Feedwater Isolation Valves and Main Feedwater Regulation Valves and Associated Bypass Valves	Yes
3.7.3.C	Main Feedwater Isolation Valves and Main Feedwater Regulation Valves and Associated Bypass Valves	Yes
3.7.3.D	Main Feedwater Isolation Valves and Main Feedwater Regulation Valves and Associated Bypass Valves	Yes
3.7.4.B	Atmospheric Relief Valves	Yes
3.7.5.A	Auxiliary Feedwater System	Yes
3.7.5.B	Auxiliary Feedwater System	Yes
3.7.6†	Condensate Storage Tank – (Redundant CSTs)	Yes
3.7.6a†	Condensate Storage Tank – (Non-redundant CSTs)	Yes
3.7.7.A	Component Cooling Water System	Yes
3.7.8.A	Nuclear Service Cooling Water System	Yes
3.7.9.A	Ultimate Heat Sink	No
3.7.9.B	Ultimate Heat Sink	Yes
3.7.9.C	Ultimate Heat Sink	No
3.7.10.A*	Control Room Emergency Filtration System – Both Units Operating	No

Preliminary List of Technical Specification Limiting Conditions of Operation for NEI 06-09 Consideration

Condition	Associated System	Exclusively Modeled *
3.7.10.B*	Control Room Emergency Filtration System – Both Units Operating	No
3.7.10.E*	Control Room Emergency Filtration System – Both Units Operating	No
3.7.11.G*	Control Room Emergency Filtration System – One Unit Operating	No
3.7.13.A*	Piping Penetration Area Filtration and Exhaust System	No
3.7.13.B*	Piping Penetration Area Filtration and Exhaust System	No
3.7.14.A	Engineered Safety Features Room Cooler and Safety Related Chiller System	No
3.8.1.A	AC Sources – Operating	Yes
3.8.1.B	AC Sources – Operating	Yes
3.8.1.C	AC Sources – Operating	Yes
3.8.1.D	AC Sources – Operating	Yes
3.8.1.E	AC Sources – Operating	Yes
3.8.1.F	AC Sources – Operating	Yes
3.8.1.G	AC Sources – Operating	Yes
3.8.4.A	DC Sources – Operating	Yes
3.8.4.B	DC Sources – Operating	Yes
3.8.4.C	DC Sources – Operating	Yes
3.8.7.A	Inverters – Operating	Yes
3.8.9.A	Distribution Systems – Operating	Yes
3.8.9.B	Distribution Systems – Operating	Yes
3.8.9.C	Distribution Systems – Operating	Yes

* Structures Systems and Components (SSCs) marked as not being exclusively modeled may have some functions that are modeled in the PRA; however, the entire scope of their functions may not be modeled. The treatment of all SSCs that are not exclusively modeled will be described in the license amendment request.

† These Limiting Conditions of Operation currently have no condition to which Initiative 4b may be applied; however, a loss of function condition will be added, and that new condition will be part of the Configuration Risk Management Program (CRMP).

* These SSCs do not contribute to the mitigation of Core Damage Frequency (CDF) or Large Early Release Frequency (LERF); however, as the pilot plant for implementation of Risk-Informed Technical Specifications Initiative 4b, Southern Nuclear Operating Company would like to explore the inclusion of these systems into the CRMP.