AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

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U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

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Ameren UE

Subject: AmerenUE, Callaway Plant Unit 2 (NRC Docket No. 52-037) Supplemental Response to RAI No. 1 (eRAI 1839), Revision 0, Section 19.1, Probabilistic Risk Assessment and Severe Accident Evaluation

Reference:

1.) Surinder Arora (NRC) to David E. Shafer (AmerenUE), "RAI No. 1 (eRAI No. 1839) - Public" email dated 2/4/09.

2.) Letter from S. M. Bond (AmerenUE) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information for the Callaway Plant Unit 2 RAI No. 1, Revision 0, Section 19.1, Probabilistic Risk Assessment and Severe Accident Evaluation, dated March 2, 2009 (ALNRC 00012).

The purpose of this letter is to complete the response to the request for additional information (RAI) identified in Reference 1. Reference 2 provided responses to questions 19-1 through 19-6 of the subject RAI. This letter provides the response to question 19-7 of this RAI. This RAI addresses the Probabilistic Risk Assessment and Severe Accident Evaluation as discussed in Section 19.1 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Callaway Plant Unit 2 Combined License Application (COLA).

The response to NRC RAI No. 1 (eRAI No. 1839) question 19-7 is provided in Enclosure 1. This response does not include any new regulatory commitments. There are no COLA impacts associated with the response to this RAI question.

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NRO

If there are any questions regarding this transmittal, please contact Scott Bond at (573) 676-8519, SBond2@ameren.com or Dave Shafer at (573) 676-4722 DShafer@ameren.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on April 2, 2009:

Scott Bond

Scott M. Bond
Manager,
Nuclear Generation Development

SMB/RCW/slk

Enclosure:

Supplemental Response to NRC Request for Additional Information, RAI No. 1 (eRAI No. 1839) – Public, Revision 0, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation Application Section: 19.1

cc:

Mr. Elmo E. Collins, Jr.
Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
612 E. Lamar Blvd, Suite 400
Arlington, TX. 76011-4125

Bruce Olson, P.E.
Environmental Project Manager
U.S. EPR Projects Branch
Division of New Reactor Licensing
Office of New Reactors
Bruce.Olson@nrc.gov

Joseph Colaccino, Chief
U.S. EPR Projects Branch
Division of New Reactor Licensing
Office of New Reactors
Joseph.Colaccino@nrc.gov

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Surinder Arora, P.E.
Project Manager
U.S. EPR Projects Branch
Division of New Reactor Licensing
Office of New Reactors
Surinder.Arora@nrc.gov

Michael Miernicki
Senior Project Manager
U.S. EPR Projects Branch
Division of New Reactor Licensing
Office of New Reactors
Michael.Miernicki@nrc.gov

Project Team contacts:

Tim E. Herrmann
Scott Bond
Pat Cryderman
Dave Shafer
Roger Wink
John Tynan
Melissa Dubinsky
Rick Williamson
Rocky Sgarro
Doug Hibbard

RACC Members contacts:

George Wrobel
Jim Freels
Robert Poche
Steve Strout
Thomas Demitrack
Wayne Massie

File code: A160.5761

Enclosure 1

Supplemental Response to NRC Request for Additional Information
RAI No. 1 (eRAI No. 1839) - Public, Revision 0;

SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19.1

Question 19-7

Clarify whether the risk metrics resulting from the quantitative screening of external events described in Section 19.1.5 of the Callaway Plant Unit 2 FSAR are outputs of the at-power PRA or the PRA considering all modes of operation. If the at-power PRA was used, provide a similar discussion for external events that occur during shutdown so that the staff can conclude that the impact of external events on total core damage frequency (CDF) and large release frequency (LRF) is not significant.

Response:

The risk metrics resulting from the quantitative screening of external hazards are based on the at-power PRA, and are judged to be bounding for all modes of operation, because:

- External hazards generally affect non-safety structures which are not designed to withstand the same challenges as safety structures. Non-safety systems modeled in the PRA are mostly related to balance of plant systems, which are more important for power operation than during shutdown.
- The U.S. EPR™ at-power PRA model conservatively assumes a full year (365 days) of operation.

As requested, an evaluation of the risk impact of external hazards occurring during shutdown is provided to demonstrate that the risk metrics shown in Section 19.1.5 of the Callaway Plant Unit 2 FSAR are indeed bounding for all modes of operation.

In the Callaway Plant Unit 2 FSAR a detailed quantitative modeling has been performed for two external hazards: tornadoes (bounds high winds), and aircraft hazard. These were screening calculations and were based on the U.S. EPR™ at-power PRA model which conservatively assumes a full year (365 days) of operation. A detailed quantitative analysis based on the U.S. EPR™ shutdown PRA model is provided below to show that the core damage frequency (CDF) obtained from the at-power screening calculations bounds the CDF from all modes of operation.

Quantitative screening was also performed for the external flooding hazard. The external flooding risk comes from a potential loss of balance of plant initiating event. This initiating event does not apply outside of at-power operations, therefore the assumption of a full year of operation bounds the CDF from all modes of operation.

The remaining external hazards are screened based on not having an adverse impact on the plant, or based on the frequency of the hazard alone. Therefore, their screening is applicable to all modes of operation.

An evaluation of the bounding tornado and aircraft crash scenarios is performed with the Low Power and Shutdown (LPSD) U.S. EPR™ PRA model to confirm that the existing screening calculations are bounding for all modes of operation. The following three scenarios are examined:

1. Tornado strike disabling all structures, systems and components (SSC) not designed to withstand tornadoes. This would result in an unrecoverable loss of offsite power (LOOP), as well as the loss of all electrical equipment located in the switchgear building (SWGRB): SBO diesel generators, non safety 2-hour and 12-hour batteries.

2. Aircraft crash into the turbine building and the switchyard. The consequences of this scenario are similar to those of the tornado, with LOOP and failure of SWGRB SSC.

3. Aircraft crash into Safeguard Building (SB) 1 or 4. This is assumed to result in a pipe break in the running residual heat removal (RHR) train. All SSC located in the affected SB are assumed to be disabled.

The first two scenarios described above would not result directly in an initiating event (that is defined in shutdown as a departure from heat balance conditions). However, the loss of offsite power increases the likelihood of a loss of RHR, because RHR pump operation then requires support by the emergency diesel generators (EDG). Therefore these two scenarios are analyzed for a possible consequential loss of RHR, in which case they are transferred to the loss of RHR event tree.

The third scenario, modeled as an aircraft crash into SB1, results in an interfacing system LOCA (ISLOCA). Since all SSC located inside the affected SB (e.g., SB1) are inoperable, the ISLOCA must be isolated by one of the two RHR isolation valves in series located inside containment. One of the two valves is powered from Division 1 which is also assumed inoperable due to the loss of SB1. Therefore the other isolation valve (powered from Division 2) must close to isolate the ISLOCA. Only automatic isolation is credited. Failure to isolate is assumed to result in core damage. Successful isolation results in a safe state.

The three scenarios defined above are quantified using the LPSD PRA model. The quantification results are shown below in Table 19-7-1. The LPSD tornado CDF is 4.4E-10/yr. The LPSD aircraft crash CDF for both scenarios is 4.2E-10/yr.

Table 19-7-1 compares the LPSD CDF for these scenarios with the at-power CDF obtained from the quantitative analyses described in Callaway Plant Unit 2 FSAR (Section 19.1.5.4.1 for tornado and 19.1.5.4.4 for aircraft crash), and with the LPSD CDF for internal events (5.8E-8/yr, U.S. EPR™ FSAR, Section 19.1.6.2.1). This comparison shows that the CDF resulting from external hazards at shutdown is negligible (0.4%) compared with the current CDF for these same external hazards. It is also negligible compared with the current LPSD internal event CDF (0.7% for aircraft crash, 0.8% for tornado).

For each external hazard, the calculated LPSD risk is less than 0.5 % of the at-power risk. The assumed total duration of shutdown in the U.S. EPR PRA is 21 days, which is approximately 6% of the year. This shows that the average daily risk in shutdown due to these external events is much lower than the at-power risk. Therefore, the existing analysis, which assumes 365 days of at-power operation, is bounding.

Based on the presented results, two conclusions can be drawn:

- For both analyzed external hazards, the CDF obtained by explicitly modeling external hazards occurring during shutdown is negligible compared to the CDF presented in FSAR Section 19.
- The current risk metrics resulting from the quantitative screening of external events described in Section 19.1.5 bound the risk metrics from all modes of operation.

Table 19-7-1: Calculation of Tornado and Aircraft Crash CDF for Callaway Plant Unit 2 for LPSD operation

External Hazard Scenario	**Scenario Frequency (1/year)**	**Scenario at-power CDF (from Callaway Plant Unit 2 FSAR) (1/year)**	**Scenario LPSD CDF (calculated in this sensitivity run) (1/year)**	**Ratio of Scenario LPSD CDF to Total Scenario CDF**	**Ratio of Scenario LPSD CDF to LPSD CDF**
Tornado	1.3E-04	1.1E-07	4.4E-10	0.40%	0.76%
Aircraft Crash into SB1 or 4	1.6E-06	9.4E-08	4.0E-10	0.43%	0.69%
Aircraft Crash into TB	6.2E-06	5.4E-09	2.1E-11	0.39%	0.04%
Total Aircraft Crash		9.9E-08	4.2E-10	0.43%	0.73%

COLA Impact:

The Callaway Plant Unit 2 COLA will not be changed as a result of this question.