From: Jill Caverly
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Date: 11/5/2007 1:32:38 PM
Subject: Draft SAMA RAIs
cc: <IPNonPublicHearingFile@nrc.gov>

Dear Donna and Mike:
I have attached DRAFT SAMA Requests for Additional Information for your review. Please let me know when you will be available for a call to discuss the forthcoming RAIs.
Many thanks,
JILL

Jill S. Caverly, P.E.
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DRAFT Request for Additional Information
Regarding the Analysis of Severe Accident Mitigation Alternatives (SAMAs)
for INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3

<u>SAMA RAI 1</u>

1. The SAMA analyses for Indian Point Unit 2 (IP2) and Unit 3 (IP3) are based on the most recent versions of the plant-specific Probabilistic Safety Analysis (PSA), i.e., Revision 1, April 2007 for IP2, and Revision 2, April 2007 for IP3. Provide the following information regarding the PSA models (for both units unless otherwise specified).

   a. (IP2) Provide a listing of the major changes to the plant and PSA models incorporated in the 2003 PSA update for IP2.

   b. Describe major changes to the internal flood model in each of the PSA updates (the 2003, 2005, and 2007 updates for IP2, and the 2001 and 2007 updates for IP3).

   c. Characterize the WOG peer review findings related to the internal flood model (2002 review for IP2 and 2001 review for IP3). Identify any review comments not yet incorporated and discuss their impact on the SAMA analysis and results.

   d. Characterize the major findings of the focused self-assessment and external reviews of Revision 0 (2005 update) of the IP2 PSA, and the outside consultant reviews and focused self-assessment of Revision 1 (2001 update) of the IP3 PSA. Identify any review comments not yet incorporated and discuss their impact on the SAMA analysis and results.

   e. (IP2) Explain the plant features or models that result in the relatively low contributions to core damage frequency (CDF) from loss of 125 VDC bus and total loss of service water initiating events at IP2. Identify any plant features contributing to this result that are not in IP3.

   f. Identify and discuss the plant features or modeling assumptions that result in the relatively high internal flooding contribution in both units.

   g. For the SGTR initiating event (IE-T7), it is stated (e.g., in Table E.1-2 and E.3-2) that many Phase I SAMAs have been implemented to mitigate this event, including improving detection and isolation capabilities, improving makeup capabilities to the reactor pressure vessel, and improving primary side depressurization reliability. Identify the specific improvements made and the updates made to PSA associated with each of these improvements.

   h. Provide the truncation limit used for quantifying the PSA and its bases.

<u>SAMA RAI 2</u>

Provide the following information relative to the Level 2 Analysis:

   a. Provide a breakdown of the population dose (person- rem per year within 50 miles) by containment failure mode. Identify the contributions for SGTR, ISLOCA, and containment isolation failure.

   b. Characterize the WOG and other peer review findings related to the Level 2 PSA model (2002 and 2005 reviews for IP2, and 2001 and 2007 reviews for IP3).

Identify any review comments not yet incorporated and discuss their impact on the SAMA analysis and results.

c. Indicate the specific version of the MAAP4 code used in the Level 2 analysis.

SAMA RAI 3

Provide the following information regarding the treatment and inclusion of external events in the SAMA analysis:

a. Provide a listing of the dominant seismic scenarios and their CDFs for both the IPEEE and the latest update.

b. Section E.1.3.2 indicates that the dominant fire sequences were reevaluated as part of the IP2 SAMA analysis. Section E.3.3 indicates that the seismic and fire PSAs were updated as part of the IP3 SAMA. Describe the quality controls that were applied to these updates and any peer reviews that were performed.

c. (IP2) Section E.1.3.2 indicates that the fire reevaluation resulted in a revised fire CDF of 9.11E-6 per reactor year for IP2. However, Table E.1-11 indicates a total fire CDF of 6.45E-5 per year (for the fire zones listed). Address this discrepancy. Provide a more complete accounting of the dominant CDF contributors in the revised analysis. Confirm whether the CDF is per year or per reactor year.

d. (IP3) Discuss the impact of the current operational scheme with block valve open on the control room fire in panels FBF or FCF for IP3. Identify other external event scenarios including the seismic events that could have been affected by this change in the operation.

e. (IP3) State the features associated with the 480VAC Switchgear Room (Fire Zone 14) that contribute to its 1.3E-05 per year fire CDF for IP3. Include a description of the fire scenarios that are significant contributors to the calculated risk.

SAMA RAI 4

Provide the following information regarding the MACCS2 analyses:

a. Provide the date of issuance and a brief description of the Westinghouse analyses cited as the basis for the reactor core radionuclide inventories used in the MACCS2 analyses (Reference E.1.22 for IP2 and Reference E3.23 for IP3).

b. Confirm whether there are any planned future changes to reactor power level or fuel management strategies that would impact the reactor core radionuclide inventory used in the MACCS2 analysis. If so, provide an assessment of their impact on the population dose and on the SAMA screening and evaluation.

c. The analysis assumes that the 2004 transient to permanent population ratio will be representative of the ratio in 2035. Discuss the uncertainty associated with this assumption and its impact on the SAMA evaluation.

d. The ER indicates that a “no evacuation scenario” was assumed to conservatively estimate the population dose. Confirm that this same scenario was used to estimate economic impacts. Clarify how other emergency response actions were modeled in this scenario (including sheltering, relocation, interdiction, and decontamination) and describe the associated assumptions and criteria (including

the distances over which these actions were assumed to be taken). The warning times provided for each release category (e.g., in Table E.1-10 for IP2) are used in the analysis.

e. Provide the technical basis for the value of non-farm wealth ($208,838 per person) used in sensitivity case 3 to show the economic impact of lost tourism and business. Explain why the impact of lost tourism and business was addressed as a sensitivity case rather than including these impacts in the base case analysis. Provide an assessment of the impact on the SAMA analysis results (base case and uncertainty case) if the higher value of non-farm wealth were used in the base case analysis.

f. Briefly describe other key MACCS2 input assumptions that contribute to the offsite economic cost risk (e.g., daily cost for relocated individuals, the costs to relocate an individual, daily cost for relocated individuals, cost of farm and non-farm decontamination, the value of farm and non-farm wealth, cost of decontamination labor, property depreciation rate, investment rate of return). Justify that the input values used for these parameters are reasonable for the Indian Point site/region.

g. Three problems related to use of the SECPOP2000 code have recently been identified, and publicized throughout the industry. These deal with: (1) a formatting error in the regional economic data block text file generated by SECPOP2000 for input to MACCS2 which results in MACCS2 mis-reading the data, (2) an error associated with the formatting of the COUNTY97.DAT economic database file used by SECPOP2000 which results in SECPOP2000 processing incorrect economic and land use data (i.e., missing entries in the “Notes” column result in data being output for the wrong county), and (3) gaps in the numbered entries in the COUNTY97.DAT economic database file which result in any county beyond county number 955 being handled incorrectly in SECPOP2000. Confirm whether the SECPOP2000 was used to derive MACCS2 input parameters, and if so, that the three identified were addressed in the SAMA analyses.

<u>SAMA RAI 5</u>

The following additional information is needed for the Analysis Cases identified below:

a. **Additional CCW Pump.** The analysis case sets the common cause failure probability for the CCW pumps to zero and indicates that this results in no change in the CDF. Describe the plant features or modeling assumptions that make the CCW pumps unimportant.

b. **Containment Sprays.** The analysis case indicates that eliminating containment spray system failures has no impact on CDF or offsite dose. Describe the plant features or modeling assumptions that make containment spray unimportant for both CDF and offsite dose. Discuss the impact of containment spray in terms of decontamination factors, containment failure modes involving core concrete interactions, containment heat removal.

c. **SGTR Fission Product Scrubbing.** The analysis case assumes the addition of a water spray would result in a factor of 2 reduction in source terms for SGTR sequences. Provide the basis of this reduction factor and an assessment of the impact of this assumption on the results of the SAMA evaluation.

d. **ISLOCA Valves.** The analysis case assumes a reduction of 50 percent in ISLOCA initiating events. Provide the basis of this reduction value.

e. **MSIV Design.** The analysis case indicates that eliminating MSIV failures to isolate a faulted steam generator has zero benefit. Describe the plant features or modeling assumptions that yield this result.

f. (IP2) **DC Power** and (IP3) **DC Power/AFW System Changes.** The analysis case for both units involves changing the time available to recover offsite power before local operation of the AFW steam-driven pump is required from 2 hours to 24 hours during SBO scenarios. For IP2, Table E.1-2 appears to indicate that basic event OAFWT (failure to manually control turbine-driven AFW Pump 22 after battery depletion) addresses the control of AFW following battery depletion. A similar action for IP3 was not identified in Table E.3-2. Describe the approach used by operators to control steam generator level during an SBO event, and the modeling of the turbine-driven pump and associated operator actions in the PRA for each unit. Describe any differences in plant design/operation and PRA modeling between IP2 and IP3, including the reasons why the analysis case is defined differently for the two units. Justify that the analysis case represents a bounding analysis for both units.

g. **Alternate Battery Charger Capability.** The analysis case for IP2 involves setting the failure to locally control the turbine-driven AFW pump to zero, whereas the analysis case for IP3 involves changing the time available to recover offsite power before local operation of AFW is required from 2 hours to 24 hours during SBO scenarios, and reducing internal switchgear room floods 5 percent to account for local operation of the turbine-driven AFW pump. Explain why the assumptions used to quantify the benefits for IP2 and IP3 are different. For IP2, verify that the operator action that is set to zero is basic event OAFWT. Also, justify the significant difference in the estimated benefits for the “Alternate Battery Charger Capability” and the “DC Power” analysis cases ($420K and $44K, respectively). For IP3, SAMA candidates 30 (Provide a portable diesel-driven battery charger) and 42 (Provide hookup for portable generators to power the turbine-driven AFW pump) appear to be related but the associated analysis cases and the benefit values are not comparable (i.e., Alternate Battery Charger Capability for SAMA 30 with a benefit of $509K, and DC Power/AFW System

Changes for SAMA 42 with a benefit of $35K). Clarify the differences between SAMA 30 and SAMA 42.

h. **Improve 118VAC System.** The analysis case is stated as being used to evaluate the change in plant risk from plant modifications to convert signals from 2-of-4 to 3-of-4 logic. Explain how setting the common cause failure of the 118VAC transformers to zero bounds the benefit.

i. **Main Feedwater System Upgrade.** The analysis case state that the bounding analysis for digital feedwater upgrade and installing a motor-driven feedwater pump achieved by setting the feedwater initiator to zero. Explain how this treatment addresses the improved post-trip operation of Main Feedwater for other initiating events.

j. **Independent Boron Injection System.** The analysis case states that setting common cause failure of the boric acid transfer pumps to zero is bounding for determining the benefit of installing an independent boron injection system. Explain how setting the common cause failure to zero bounds the benefit. Describe the plant features or modeling assumptions that cause this analysis to yield zero benefit for both units.

k. **Control Room ATWS Mitigation.** Explain the plant features that result in small benefit associated with the bounding analysis that sets failure to trip the control rods motor generator sets to zero. Describe the ATWS mitigation actions including the credited operator actions, their failure probabilities and bases.

l. **Pressurizer PORV Block Valves.** State the scope of the change necessary to change the PORV block valves from closed to open. Specifically provide the basis for the $800,000 improvement cost.

m. (IP3) **Appendix R Power to SI or RHR Pump.** Confirm that the baseline benefit of $11,274,888 provided for the analysis case is an error. Provide the correct value.

n. **CCW Heat Exchanger Alternate Cooling Supply.** The description of this analysis case suggests that the back up service water pumps could be used for both essential and non-essential service water rather than essential service water only. Explain all the contributions included in the benefit side in terms of reduced initiator frequency, increased support system reliability (e.g.CCW), and impact on RCP seal failure.

o. **Upgrade Alternate Safe Shutdown System for RCP Seal Cooling.** This analysis case states that a bounding analysis is obtained by setting the control building flooding initiators to zero. However, the benefit of the SAMAs addressed by this case could impact other external initiators. Identify all other external initiators that can benefit from implementation of this SAMA candidate. Explain in more detail the proposed modification. Discuss any impact that installing the Unit 2 Appendix R DG and potential decommissioning of the turbine generators will have on this SAMA candidate. Explain the relationships between setting flooding initiating events to zero and the loss of the 480VAC buses.

SAMA RAI 6

Explain why the assumptions used to quantify the benefits for IP2 and IP3 are different for the following analysis cases: (a) AC Power Cross-Tie with Alternate Unit, (b) Alternate Battery Charger Capability, and (c) Alternate Water Sources to Steam Generators.

SAMA RAI 7

Explain why the estimated benefits for IP2 and IP3 are significantly different for the following analysis cases: (a) Automatic Recirculation Cooling Swap-Over ($81K for IP2 and $340K for IP3), (b) MSLB Inside Containment ($73K for IP2 and $611K for IP3), (c) Pressurizer PORV DC Power ($40K for IP2 and $0 for IP3), (d) Alternate Water Sources to Steam Generators ($385K for IP2 and $183K for IP3).

SAMA RAI 8

Explain the plant features that resulted in the following cost-beneficial (or low cost) SAMAs not being included in the list of potential SAMAs for the opposite unit: (a) SAMAs 56, 60, and 61 for IP2, which have no corresponding SAMAs for IP3, and (b) SAMAs 42, 52, and 55 for IP3, which have no corresponding SAMAs for IP2.

SAMA RAI 9

For certain SAMAs considered in the ER, there may be lower-cost alternatives that could achieve much of the risk reduction at a lower cost. In this regard, discuss whether any lower-cost alternatives to those Phase II SAMAs considered in the ER would be viable and potentially cost-beneficial. Evaluate the following SAMAs (previously found to be potentially cost-beneficial at other plants), or indicate if the particular SAMA has already been considered. If the latter, indicate whether the SAMA has been implemented or has been determined to not be cost-beneficial at IP2 or IP3:

a. To aid in the mitigation of a SGTR, the implementation of improved instrumentation and procedures to help cool down and depressurize the RCS prior to RWST depletion.

b. To aid in the mitigation of a SGTR , the implementation of a procedure for recovery of steam dump to condenser from the unaffected SGs.

c. To aid in the mitigation of a SGTR, the implementation of a procedure for recovery of the MFW/condensate post SI actuation.

d. Reactivate the IP3 post-accident containment venting system (B5b information implies that this is still active on IP2 but was deactivated on IP3).