January 23, 2002

NOTE TO: File

FROM: Andrew J. Kugler, Sr. Environmental Project Manager **/s/AJKugler**
Environmental Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation.

SUBJECT: INFORMATION PROVIDED BY VIRGINIA ELECTRIC AND POWER COMPANY IN RELATION TO SEVERE ACCIDENT MITIGATION ALTERNATIVES IN ITS LICENSE RENEWAL APPLICATION FOR THE SURRY POWER STATION, UNITS 1 AND 2 (TAC NOS. MB1992 AND MB1993)

The Virginia Electric and Power Company (VEPCo, or the licensee) provided the attached information to the NRC staff via emails dated January 15 and January 22, 2002. Because the staff may rely on some of this information in its environmental review of VEPCo's application for renewal of the Surry Power Station, Units 1 and 2, licenses, this information is being docketed and made publicly available.

Docket Nos. 50-280 and 50-281

Attachment: As stated

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DATE	01/23/02

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INFORMATION PROVIDED BY VIRGINIA ELECTRIC AND POWER COMPANY IN RELATION TO SEVERE ACCIDENT MITIGATION ALTERNATIVES IN ITS LICENSE RENEWAL APPLICATION FOR THE SURRY POWER STATION, UNITS 1 AND 2 (TAC NOS. MB1992 AND MB1993)

The following questions were provided via phone on January 10, 2002 from Andy Kugler (NRC) to Tony Banks (Dominion):

1) Which version of MACCS was used in the SAMA analysis?

RESPONSE: Version 1.12

2) Was the latest version of the PRA model used for the SAMA analysis?

RESPONSE: The S7B version of the model was used for the SAMA analysis. This update was started in 1997 but the model was not actually released until 1998.

3) Please verify that 7200 seconds was the evacuation time used as input to the MACCS model.

RESPONSE: The Surry analysis used the following MACCS2 inputs for the base case:

Delay time to take shelter = 7200 seconds
Delay time to begin evacuation = 0.0 seconds

The sensitivity case used:

Delay time to take shelter = 5400 seconds
Delay time to begin evacuation = 0.0 seconds

The following questions were provided via email from Andy Kugler (NRC) to Tony Banks (Dominion) on January 7, 2002.

1) Did you (Dominion) or did you not do an importance analysis (either as part of the SAMA review or separately)?

RESPONSE: An importance analysis is routinely performed as part of the model update process. However, this importance list was not used to identify potential SAMAs.

2) Did you assess the results of the cutset-based SAMA screening against the results of the importance analysis?

RESPONSE: Review of the top 100 cut sets was chosen as the primary source for identifying potential plant specific SAMA candidates for the following reasons. The top 100 cut sets contain 61.5% of the core damage frequency, and 57% of the total plant risk. The top contributors to core damage, LERF and plant risk are all captured in these top 100 cut sets. The top contributors to LERF and plant risk are SGTR and ISLOCA events, both of which appear in the top 100 cut sets. Therefore, confidence is obtained that no important SAMAs were missed. Most of the quantifications for the SAMA analysis were performed as bounding calculations. In other words the maximum benefit was obtained by assuming that the SAMA completely eliminated rather than reduced the likelihood or consequence for which the SAMA was proposed. In these instances, the SAMA would take into account any cut set that resulted in the undesirable outcome regardless of its rank in the cut set list. Similarly, many of the SAMAs were calculated by eliminating an initiating event frequency or a reduction of an initiating event frequency. Since initiator basic events are included in all cut sets regardless of rank these SAMA evaluations also included more than the top 100 cut sets. So, while it is true that the potential SAMA list was developed by looking at the top 100 cut sets the SAMA evaluations were performed in a way that considered many more than the top 100 cut sets.

As indicated in the revised response to question 2b an importance analysis is typically performed as part of the model update process. In order to verify that the important events are contained in the top 100 cut sets the following review was completed. The importance list was sorted based on risk reduction worth (RRW) assuming that this is the logical measure to use for a SAMA evaluation. There were 131 basic events with a RRW greater than 1.005 which is the numerical value recommended in NUMRAC 93-01 as the break point between risk significant and low risk significant. These 131 basic events were spot checked at the bottom in the middle and at the top of the list. The spot check revealed that the risk significant basic events were contained in the top 100 cut sets. This review validates the use of the top 100 cut sets as the source for identifying plant specific SAMA candidates.

The following questions were asked during a phone call on January 10, 2002 between NRC, NRC PRA consultants, and Dominion.

1) Please verify that a factor of two increase on both the bounding benefit and cost uncertainties was included.

RESPONSE: Yes, the Bounding Benefit value listed in the ER Table 4-6 has been doubled to account for external events. The doubling to account for uncertainties is included in the Estimated Cost column in Table 4-6.

2) Provide a 5 -10 word clarification as to the model inputs or modifications that were done to determine the bounding benefit of the potential improvement SAMAs listed in Table 4-6.

RESPONSE: The following tables (Table A for SPS and Table B for NAPS) provide the requested clarification wording. [The tables are at the end of this document.]

The following questions were provided via email from Andy Kugler (NRC) to Tony Banks (Dominion) on January 17, 2002.

Question 1: Several of the detailed cost estimates provided by Dominion appear very high. Three examples are SAMA 64 ($1.5-3M), SAMA 77 ($2-5M), and SAMA 86 ($1.5-3M). We request that Dominion provide additional justification, including a cost breakdown, for the costs of these three SAMAs. This information should already exist in the form of worksheets.

Response: The requested cost breakdowns are as follows:

SAMA 64: Alternate Battery Charging Capability

Scope: The total battery load of the DC emergency buses during a four hour SBO event would require a 50KW battery charger. A portable unit with appropriate disconnects on the batteries for hook up during full power operation could be installed. The hookup would need to be brought out to the alleyways where the diesel would be located when needed. Temporary cables would also be provided. The diesel would need to be placed into service within 4 hours (SBO coping duration). Therefore, a permanent plant modification is required to have the wiring and inverter in place at the start of the event with the capability to drive any of the batteries. Switchgear in Safety-Related (SR) areas is seismically installed. This includes the disconnects for each of the batteries. The diesel and the patch panels would be non-safety related (NS). Location of the diesel patch panels is based on the condition that the opposite unit's alleyway location is accessible to station personnel due to radiation.

Cost Summary:

Cost Basis	**Engr.**	**Material**	**Labor**	**Services**	**O/H, Cap X**	**Total**
Install	**$ 650 K**	**$ 230 K**	**$ 465K**	**$135K**	**$150K**	**$1630K**
O & M				**$100K**		**$ 100 K**
Total				**$235K**		**$1730 K**

Order of Magnitude Uncertainty for this estimate: +75%; -15%
Final Cost Range: **$1500K - $3000K**

Engineering: Costs are for 3 Design Change Packages (DCPs) plus field support. One DCP to install the patch panels and inverter; one DCP per unit to install the disconnects and make final terminations for that unit. Estimated $175K for preparation of each DCP plus $125K for field support and closeout activities.

Materials: Diesel-driven mobile 50 KW generator unit ($50K):Inverter ($15K); Switchgear (SR disconnects at each of 8 batteries ($120K total); NS main switchgear at the inverter ($10K); NS patch panels at the alleyways ($10K); 1000' of conduit, seismically installed (8 SR batteries x 100' per run; 100' from inverter station to each alleyway patch panel); conduit, fittings, support materials ($10K);2000' of power cable ($10K); internal wiring and miscellaneous materials ($5K).

Labor: Costs are estimated as follows: Place 12 panels (7 men x 90 hours x 12 panels = $225K); Install 2000' of seismically supported conduit (10 men x 400 hours = $120K); Pull and terminate cables (10 men x 400 hours = $120K)

Notes:
Costs are for the total station. Individual unit and facility costs are combined in these totals.
All dollars are present day.
Cable and conduit runs are order of magnitude and need to be confirmed with detailed routing plans.
Installation services equal 10% of engineering, material and labor.
Enduring O&M costs are associated with periodic testing and maintenance of the equipment.
Estimate an annual PT requiring 3 operators ½ a shift and an annual PM requiring 3 mechanics 1 shift and 2 electricians 1 shift. Estimate based on 30 year remaining life of the plant
Overhead equals 5% of direct costs; Capitalized Interest is 5%.
Incremental training costs are excluded.
Spare parts inventory is excluded.
No simulator modifications are identified.

SAMA 77: **Provide a connection to alternate offsite power source (Gravel Neck).**

Scope: Assuming that the switchyard has been incapacitated, then a weather proof duct bank would need to be installed. The duct bank would extend nearly ¾ of a mile and traverse under the Intake Canal to the plant. Switchgear would need to be provided at each end to disconnect from the normal sources and align the alternate offsite power source to the Station buses. The Gravel Neck Combustion Turbines (CTs) do not have a black start capability. Operator action is required to get them on line. Estimate accounts for all four units to be connected to provide flexibility to get any one of them started.

Cost Summary:

Cost Basis	**Engr.**	**Material**	**Labor**	**Services**	**O/H, Cap X**	**Total**
Install	**$ 525K**	**$ 310K**	**$ 825K**	**$165K**	**$185K**	**$ 2010K**
O & M				**$ 80K**		**$ 80K**
Total				**$245K**		**$ 2090K**

Order of Magnitude Uncertainty for this estimate: +250%; -0% (See Note 5)
Final Cost Range: **$2000K - $5000K**

Engineering: Engineering costs are for 2 DCPs. The first DCP is for all materials from the CT end up to the transfer bus switchgear panels. The second DCP provides the tie-ins from that panel to each of the transfer buses. ($175K for the DCPs; $175K for field support and closeout.)

Materials: 8 Switchgear Panels (3 SR Panels for each transfer bus; 1 NS Panel for master switching and 4 NS panels for each CT at Gravel Neck) ($45K for SR panels; $10K for master panel; $20K for CT panels; total $75K); transformer installed at CTs ($75K); concrete placements and housings for equipment at CT end including transformer pad and enclosure for switchgear with ventilation and lighting. ($25K); 4000' prefabricated weather proof ductbank (similar to what is currently installed in the Surry switchyard) ($80K); 600' of seismically installed conduit ($6K conduit, fittings, support materials); 200' of conduit at the CTs ($2K conduit, fittings, support materials); 100' of ductbank buried under the intake canal ($12K); 200' of cable tray ($5K); 5000' 750MCM 3 conductor cable ($25K); internal wiring and miscellaneous materials ($5K).

Labor: Costs are estimated as follows: Erect transformer pad and enclosure at CT location ($50K); Install prefabricated duct bank (5 men x 400 hours for excavation; 10 men x 400 hours for placement; 5 men x 200 hours for final grading equals $210K); Install ductbank under the intake canal (10 men x 800 hours = $240K); placement of panels (7 men x 70 hours x 8 panels = $120K); installation of conduit and cable tray (10 men x 160 hours = $50K); install 5000' of large cable ((a)ductbank; 10 men x 200 hours = $60K; (b)under canal; 10 men x 150 hours = $45K; (c) in plant; 20 men x 60 hours = $35K); final terminations (5 men x 100 hours = $15K).

Notes:
Costs are for the total Station. Individual unit and facility costs are combined in these totals.
All dollars are present day.
Cable and conduit runs are order of magnitude and need to be confirmed with detailed routing plans.
Switchgear for the transfer buses is in the normal switchgear room or cable spreading room. Confirmation of space availability is required.
There is a great deal of uncertainty in the actual costs associated with the ductbank materials and installation. The estimate basis is that it does not need to be missile protected only weather proof. If missile protection is required then costs would increase dramatically.
Estimate is based on a transfer bus outage being performed one at a time while units are on-line. Confirmation is required.
Installation services equal 10% of engineering, material and labor.
Overhead equals 5% of direct costs; Capitalized Interest is 5%.
Enduring O&M costs are associated with periodic testing and maintenance of the equipment. Estimate an annual PT requiring 3 operators ½ a shift and an annual PM requiring 2 electricians 2 shifts. Estimate is based on a 30 year remaining life.
Incremental training costs are excluded.
Spare parts inventory is excluded
No simulator modifications are identified.

SAMA 86: **Improved SGTR Coping Abilities**

Scope: The installation would involve the installation of numerous control circuits within the instrument racks. Existing radiation alarms could be used to generate the high radiation signal. Close signals would be sent to the affected Steam Generator (SG) Power Operated Relief Valve (PORV), Main Steam Trip Valve (MSTV) and Main Steam Bypass valve, SG Blowdown Trip Valves and to the auxiliary feedwater (AFW) Terry Turbine steam supply valves (currently a manual valve but the valve would be changed to an AOV or MOV). Auto close to the AFW pumps would not be included to allow the operator time to assure that the SG had at least an 11% level before securing AFW. The modification would include the changeout of the Terry Turbine steam supply valves with control circuits to the instrument racks and control room, instrumentation feeds from an existing radiation monitors to the instrument racks, appropriate annunciation in the control room to indicate the automatic action (including an automatic reactor trip) and wiring modifications in the instrument racks to the aforementioned components. Currently the Surry plant uses the air ejector radiation monitors (AERMs) to detect the onset of a SG Tube Rupture (SGTR) event. A project has been recently approved to install an N-16 system as a diverse real time means of detecting SGTR events. This will bring Surry into compliance with EPRI guidelines. (Note: North Anna already had both AERMs and an N-16 system.) Extensive operating procedures and training are already provided for the SGTR event. The basis for this estimate is that additional measures are required to further mitigate the consequences of this event by installing automatic actuation equipment. CAUTION: Reliance on an automatic system to correctly identify the affected Steam Generator depends on a clear and unambiguous signal from the N-16 system.

Cost Summary:

Cost Basis	**Engr.**	**Material**	**Labor**	**Services**	**O/H, Cap X**	**Total**
Install	**$ 800K**	**$ 350K**	**$ 415K**	**$ 155K**	**$ 90K**	**$ 1810K**
O & M				**$ 145K**		**$ 145K**
Total				**$ 300K**		**$ 1955 K**

Order of Magnitude Uncertainty for this estimate: +50%; -25%
Final Cost Range: **$1500K - $3000K**

Engineering: Costs are for 2 DCPs (one for each unit). This mod will impact many drawings and other design basis documentation. ($400K per DCP including field support and closeout activities)

Materials: 6 MOVs (3 per unit) to replace existing manual AFW steam supply valves (SR valves @ $25K each = $150K); 1200’ of conduit for the MOVs ($12K for conduit, fittings and support materials); 400’ of conduit as an allowance for instrument rack and control room wiring ($4K for conduit, fittings and support materials); 600’ of conduit from the N-16 system to the racks ($6K for conduit, fittings and support materials); SGTR actuation panels (one per unit mounted in the ESGR) ($100K); 6 SR breakers for the MOVs ($60K); 2000’ of power and control cable ($10K); 800’ as an allowance for wiring ($3K); Miscellaneous indication equipment ($5K).

Labor: Cost are estimated as follows: Placement of the 2 actuation panels in the ESGR (7 men x 90 hours x 2 panels = $38K); installation of 6 MOVs (4 men x 90 hours x 6 valves = $65K); installation of 2200’ of conduit (10 men x 440 hours = $132K); pull and termination of 2800’ cable and wire (10 men x 500 hours = $150K); allowance for simulator modifications ($30K).

Notes:
Costs are for the Station. Individual unit and facility costs are combined in these totals.
All dollars are present day.
Cable and conduit runs are order of magnitude and need to be confirmed with detailed routing plans.
Installation services equal 10% of engineering, material and labor.
Overhead equals 5% of direct costs; Capitalized Interest is 5%.
Estimate based on availability of space in the Emergency Switchgear Room for the actuation cabinets.
Enduring O&M costs are associated with periodic testing and maintenance of the equipment. Estimate a quarterly PT requires 3 operators and 2 instrument technicians a total of ½ shift per unit and an annual PM requires 2 instrument technicians one shift per unit.
Incremental training costs are excluded.
Spare parts inventory is excluded.

Question 2: Regarding SAMA 25, we request that Dominion confirm whether existing procedures direct operator actions to open doors and use fans to achieve ESGR cooling (i.e., a low cost procedure-based improvement). If not, Dominion should evaluate this as a lower cost alternative to SAMA 25 (a hardware fix estimated at $15-25M), and justify why it should not be implemented.

Response: A procedure currently exists to direct contingency actions following the loss of ESGR cooling. This procedure includes the possible use of fans and opening doors to limit temperature increases. The Surry procedure is titled "Loss of ESGR Cooling" and the entry conditions include loss of the operating air handling unit or the control room chillers. The abnormal procedures "Service Water System Abnormal Conditions and Turbine Building or MER 3 Flooding have a transition into the "Loss of ESGR Cooling" procedure. North Anna has a similar procedure titled "Loss of Control Room/Emergency Switchgear Room Air Conditioning" with entry condition for loss of either the chillers or the air handling units.

The lower cost procedure-based alternative was provided and evaluated as SAMA 26. SAMA 26 is listed in Appendix G, Table G.2-1 and is identified as "Screened Out" on the basis that the SAMA has been implemented at SPS (Criterion B).

Question 3: Regarding SAMA 70, the justification provided for not enhancing training is weak. Furthermore, this same SAMA has twice the benefit for North Anna making it even more cost beneficial there. We request further justification in two areas:

a) Dominion indicates that the 25% reduction assumed in the analysis is too optimistic. We request that they provide us a more realistic risk reduction value, given enhanced training, and provide a revised estimate of the total benefit based on this value.

Response: Training resources are allocated based on needs assessments. Electrical failures have a proportionally high percentage of training time currently. A large part of this is due to the increased focus on electrical loss procedures due to procedure enhancements, the frequency at which failures are occurring, the conflicts that may exist with deregulation, and the increased focus mandated by SOER 99-1, Loss of Grid. As a result, the improvement in human performance in this area appears to be at the point of diminishing returns. That is, the trend has been toward increasing operator training in this area. This increased licensed operator training relating to the potential loss of offsite power is part of the reason that the 25% reduction in probability of failing to recover offsite power is optimistic. The other major factor is that the primary emphasis of the operator training discussed above is not to repair failed equipment causing the loss of offsite power but to restore power to the emergency busses by any one of several available means.

The operator training discussed in SAMA 70 is not intended to be diagnostic in nature. Diagnosis and repair of the faulted condition is likely to be governed by one of two conditions. A relatively quick restoration of offsite power as would occur if the wrong fuse were pulled and power was restored simply by replacing the fuse. Roughly 70% of the historical events have been of this nature (i.e., restored within two hours). Longer term outages tend to be the result of either severe weather or significant equipment failures. Operator training has no impact on these types of failures.

An optimistic reduction was intentionally chosen for this SAMA and many others. The use of an input that would increase the benefit is conservative for a SAMA analysis in that it would make the SAMA more likely to be cost beneficial. This approach also alleviates the need to precisely determine the parameter of interest. However, Dominion training personnel believe the benefit in this area is quite small and would be 1% or 2% at best as opposed to the 25% assumption presented in the SAMA analysis. Based on this assessment, the total benefit would be at least an order of magnitude less than that provided in Table 4-6 of the SPS and NAPS ERs. Doubling this revised benefit value yields <$7K for Surry and <$15K for North Anna. Implementation cost for additional training over the remainder of plant operating life would easily exceed this benefit value.

b) Dominion indicates that operator training curriculum is heavily loaded and the only way to implement this SAMA would be to add additional training time. We request that Dominion provide an estimate of the additional time and costs associated with incrementing the current training schedule (one time and recurring). We also request that they provide additional explanation of the downsides to re-focussing the current training within the current schedule (i.e., what topics might need to be displaced/de-emphasized in order to accommodate additional training on SBO, and why this wouldn't be prudent).

Response: As per the response given to question 3A above, the maximum benefit would be for North Anna and would be <$15K. Past experience regarding procedure related changes to the operator training curriculum indicate that neither additional training or an analysis to evaluate re-focussing the existing training program could be performed for <$15K. Therefore, as stated in the conclusion of Table 4-6 for SAMA 70, this alternative is “Not cost beneficial; cost is estimated to exceed twice the true obtainable benefit.”

TABLE A

Summary of SPS Model Changes Used to Determine
Benefit of Potential Improvement SAMAs

SAMA No. 9
Added logic for the new pump to fault trees CW1 and CW2.

SAMA No. 10
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 11
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 14
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 15
Added logic for the new pump to the fault tree CC1.

SAMA No. 21
Added logic for the new pump to the fault tree CC1.

SAMA No. 23
SWN0IC1 fault tree is revised at four gates to provide a redundant 480V power supply.

SAMA No. 25
Change the initiating events frequency of the loss of HVAC to zero and eliminate conditional ESGR failure by setting unavailability equal to zero.

SAMA No. 27
Operator error for failure to recover HVAC is reduced by a factor of 10.

SAMA No. 30
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 32
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 33
Event tree functional equations related to Containment and Recirculation sprays replaced with an event that has an unavailability of zero.

SAMA No. 34
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 35
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 36
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 37
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 38
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 39
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 40
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 42
Set the Source Term Category frequencies to zero for STCs 1 through 16, 19 and 20.

SAMA No. 43
Modify the CET failure probabilities for debris cooling.

SAMA No. 44
Modify the CET failure probabilities for debris cooling.

SAMA No. 46
This failure mode was zero in Surry Level 2 analysis, so no further calculation was required.

SAMA No. 47
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 48
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 49
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 50
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 54
Set the Source Term Category frequencies to zero for STCs 1 through 16, 19 and 20.

SAMA No. 55
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 61
Battery failure basic events set to zero.

SAMA No. 64
Battery failure basic events set to zero.

SAMA No. 69
Basic events for all 4kV breaker failures are reduced by a factor or 4.

SAMA No. 70
Offsite power recovery basic events reduced by 25% (multiplied by 3/4)

SAMA No. 77
Loss of offsite power frequency reduced by a factor of 5.

SAMA No. 81
Replace the motor-operated isolation valve basic events with air-operated valve basic events. Also removed the power dependencies for each of the motor-operated valves.

SAMA No. 82
Since this SAMA relates to fires, estimate maximum possible benefit by placing the entire fire CDF (1.9E-6) in STC 19 (SBO) to see the benefit it has.

SAMA No. 83
Reduce transient initiating event frequency by 25%.

SAMA No. 86
Human error probabilities for isolating the faulted Steam Generator were changed to zero.

SAMA No. 88
Set the Plant Damage State 25 frequency to zero.

SAMA No. 89
Set the Plant Damage State 25 frequency to zero.

SAMA No. 101
CET endstates are modified by placing the entire frequency of CET endstate 23 (unscrubbed ISLOCA) in the CET endstate 22 (scrubbed ISLOCA).

SAMA No. 103
ISLOCA frequency is reduced to zero.

SAMA No. 111
Modify event tree functional equations related to AFW in an SBO to use a basic event whose unavailability is zero.

SAMA No. 115
Modify event tree functional equations related to AFW in an SBO to use a basic event whose unavailability is zero.

SAMA No. 122
Modify event tree functional equations related to MFW or AFW to use a basic event whose unavailability is zero.

SAMA No. 123
Basic event REC-INAIR-LOCAL is set to zero.

SAMA No. 124
House event XHOS-NO-CND-DUMP is removed from five fault trees and gates.

SAMA No. 125
Used unavailability of zero for all “late” low head SI and recirculation events in the event trees and modeled the FP connection to low head safety injection and recirculation fault trees

SAMA No. 126/127
New pump logic was added to all charging and high head safety injection fault trees.

SAMA No. 145/146
Set the frequency of the ATWS initiating events and to zero.

SAMA No. 154
Modify the CET failure probabilities for debris cooling.

SAMA No. 158
Set the MSLB initiating event frequencies to zero.

SAMA No. 159
Reduce the large LOCA initiating event frequency by 25%.

TABLE B

Summary of NAPS Model Changes to Implement
Potential Improvement SAMAs

SAMA No. 10
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 11
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 14
Changed event tree functional equations to eliminate the seal LOCA contribution

SAMA No. 21
Utilized results from SPS analysis that proved negligible benefit for SPS/NAPS plant design.

SAMA No. 23
Set Service Water header test and maintenance basic events to zero

SAMA No. 25
Change the initiating events frequency of the loss of HVAC to zero and eliminate conditional ESGR failure by setting unavailability equal to zero.

SAMA No. 27
Operator error for failure to recover HVAC is reduced by a factor of 10.

SAMA No. 30
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 32
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 33
Event tree functional equations related to Containment and Recirculation sprays replaced with an event that has an unavailability of zero.

SAMA No. 34
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 35
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 36
Event tree functional equations related to containment heat removal replaced with an event that has an unavailability of zero.

SAMA No. 37
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 38
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 39
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 40
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 42
Set the Source Term Category frequencies to zero for STCs 1 through 16, 19 and 20.

SAMA No. 43
Modify the CET failure probabilities for debris cooling.

SAMA No. 44
Modify the CET failure probabilities for debris cooling.

SAMA No. 46
This failure mode was zero in Surry Level 2 analysis, so no further calculation was required.

SAMA No. 47
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 48
Modify Containment Event Tree to set probability of late failure due hydrogen burn to zero.

SAMA No. 49
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 50
Event tree functional equations related to Containment and Recirculation sprays with an event that has an unavailability of zero.

SAMA No. 54
Set the Source Term Category frequencies to zero for STCs 1 through 16, 19 and 20.

SAMA No. 55
Use baseline analysis and assume all offsite release is eliminated.

SAMA No. 60
All battery failure events were set to zero.

SAMA No. 61
Battery failure events related to long-term SBO were set to zero.

SAMA No. 64
Battery failure events related to long-term SBO were set to zero.

SAMA No. 69
Basic events for all 4kV breaker failures are reduced by a factor or 4.

SAMA No. 70
Offsite power recovery basic events reduced by 25% (multiplied by 3/4)

SAMA No. 73
Reduce Loss of Offsite Power Initiating Event frequency by factor of 5.

SAMA No. 77
Reduce Loss of Offsite Power Initiating Event frequency by factor of 5.

SAMA No. 81
Reduce transient initiating event frequency by 25%.

SAMA No. 84
Human error probabilities for isolating the faulted Steam Generator were changed to zero.

SAMA No. 86
Set the Plant Damage State 25 frequency to zero.

SAMA No. 87
Set the Plant Damage State 25 frequency to zero.

SAMA No. 99
CET endstates are modified by placing the entire frequency of CET endstate 23 (unscrubbed ISLOCA) in the CET endstate 22 (scrubbed ISLOCA).

SAMA No. 101
ISLOCA frequency is reduced to zero.

SAMA No. 106
Transient and loss of MFW initiating event frequencies reduced by a factor of 3.

SAMA No. 113
Battery failure events related to long-term SBO were set to zero.

SAMA No. 120
Modify event tree functional equations related to MFW or AFW to use a basic event whose unavailability is zero.

SAMA No. 121
New recovery event, REC-INAIR-LOCAL, added with probability set to 0.1.

SAMA No. 122
House event XHOS-NO-CND-DUMP is removed from five fault trees and gates.

SAMA No. 123
Added logic to model the fire water connection to low head safety injection pumps.

SAMA No. 124/125
New pump logic was added to the high head safety injection fault trees.

SAMA No. 143/144
Set the frequency of the ATWS initiating events and to zero.

SAMA No. 152/153
Modify the CET failure probabilities for debris cooling.

SAMA No. 156
Screened out based on MSLBs being screened from the NAPS model.

SAMA No. 157
Reduce the large LOCA initiating event frequency by 25%.