Jonathan Rowley - Pg 2-38 info

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Date: 06/18/2007 12:02 PM
Subject: Pg 2-38 info

(PA-LR)

The PNP SER states:

"The staff examined the applicant's environmental report, Appendix E, Attachment E.1, "Evaluation of Probabilistic Safety Analysis Model," to verify that there is no risk significance system in the list. None of the 14 systems is a dominant contributor to the risk reduction worth rankings to core damage frequency nor are these systems involved in the dominant initiating events

<<Table RAI.1-3.doc>> <<ER Table E.1-3.doc>> <<Revised Table E.1-3.doc>>

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MESSAGE	482	06/18/2007 12:01:38 PM
TEXT.htm	1516	
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ER Table E.1-3.doc	698880	
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Table RAI.1-3 Summary of Major PSA Model Versions

Model	CDF[1]	LERF
IPE (transients & LOCAs)	4.3 E-06	9.4 E-07
VY118 (transients & LOCAs)	4.9 E-06	n/a
IPEEE (internal floods)	9.0 E-06	n/a
VY00R0	1.78E-05	9.33E-07
VY02R0	4.28E-06	1.05E-06
VY02R1	4.28E-06	1.12E-06
VY02R2	4.62E-06	n/a
VY02R3	4.89E-06	n/a
VY02R4	7.81E-06	n/a
VY02R5	7.81E-06	2.29E-06
VY02R6	7.77E-06	2.29E-06
VY02R7	7.63E-06	2.23E-06
VY02R8	8.73E-06	2.61E-06
VY04R0	4.91E-06	1.50E-06
VY04R1	5.03E-06	1.56E-06
VY05R0	7.98E-06	2.50 E-6

[1] With the exception of the original IPE, IPEEE, and version VY118 CDF and LERF values, subsequent VYNPS model version updated CDF and LERF values include the combine contributions from transients, LOCAs and internal floods initiators.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
HPCI	1.4966	This term represents random failure of the HPCI system. Phase I SAMAs to improve availability and reliability of the HPCI system that have already been implemented include raising backpressure trip setpoints and proceduralizing intermittent operation. Additional improvements were evaluated in Phase II SAMAs 049, 050, 051, 052, 053, and 054.
RCIC	1.4223	This term represents random failures of the RCIC system. Phase I SAMAs to improve availability and reliability of the RCIC system that have already been installed include raising backpressure trip setpoints and proceduralizing intermittent operation. Additional improvements were evaluated in Phase II SAMAs 049, 050, 051, 052, 053, and 054.
ECCS Low Pressure Interlock	1.3472	This term represents random failures of reactor low-pressure transmitters during transients with stuck open SRVs or LOCAs in which random failures prevent all low-pressure injection valves from opening. Phase II SAMAs 065 and 066 to reduce the risk due to failure of the ECCS low-pressure interlock were evaluated.
Depressurization (SRVs and ADS Logic)	1.2724	This term represents random failures of the SRVs to open for depressurization during transients and small LOCAs. Phase I SAMAs to enhance reliability of the SRVs that have already been implemented include adopting symptom based EOPs and SAGs, modifying ADS logic, and upgrading SRV pneumatic components. Additional improvements were evaluated in Phase II SAMAs 059 and 060.
Loss of Feedwater - initiating event	1.1796	This term represents the initiating event for loss of feedwater. Modifications to significantly reduce or eliminate the potential for loss of feedwater, such as installing a digital feedwater control system, providing a backup water supply and adding a third feedwater pump, have already been implemented. Many of the Phase II SAMAs (e.g., 035, 051, 052, 053, and 054) explored potential benefits for mitigation of this event.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Operator Action: Operator fails to open SRVs for vessel depressurization during transients and small LOCA	1.1110	This term represents operator failure to manually open the SRVs for depressurization during transients and small LOCAs. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Loss of Offsite Power - initiating event PC – Plant Centered GR – Grid Related	1.0951-PC 1.0605-GR	This term represents the loss of offsite power initiating event. Industry efforts over the last twenty years have led to a significant reduction in plant scrams from all causes. Improvements related to enhancing offsite power availability or reliability and coping with plant SBO events were already implemented and evaluated during preliminary SAMA screening. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Torus Vent via TVS-86 and Rupture Disk	1.0948	This term represents random failures of components in the containment vent path. A hardened pipe vent path was implemented as a result of the NRC Containment Performance Program to provide a redundant means for containment heat removal capability. Several Phase I SAMAs regarding the drywell spray system were already installed to provide containment decay heat removal capability by plant design. Therefore, no Phase II SAMAs were proposed to reduce random failure of containment vent path components. However, Phase II SAMA 063 to control containment venting within a narrow pressure band to prevent rapid depressurization during venting was evaluated.
Loss of 4.16KV Bus 3 - initiating event	1.0869(IE)	This term represents loss of 4.16KV bus 3. Phase I SAMAs to improve 4.16KV bus crosstie capability and procedures to repair or replace failed 4.16KV breakers have already been implemented. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Emergency Diesel Generators (A & B)	1.0810	This term represents random failures of the emergency diesel generators, leading to an SBO event. Phase I SAMAs to improve reliability of the emergency diesel generators by creating a crosstie of EDG fuel oil supplies and a backup source for diesel cooling have already been installed. In addition, Phase II SAMAs 002, 003 and 032 to improve reliability of the EDGs were evaluated.
Loss of 4.16KV Bus 4 - initiating event	1.0756	This term represents loss of 4.16KV bus 4. Phase I SAMAs to improve 4.16KV bus crosstie capability and procedures to repair or replace failed 4.16KV breakers have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Operator Action: Operator fails to initiate HPCI/RCIC during transients, medium and small LOCAs	1.0685	This term represents operator failure to initiate HPCI/RCIC to perform the core cooling function during transients, medium LOCAs, and small LOCAs when automatic initiation fails. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Operator Action: Operator fails to align firewater system and John Deere Diesel for alternate injection	1.0660	This term represents operator failure to align the John Deere diesel generator to provide electric power to 480VAC bus 9 during a loss of offsite power event. With bus 9 energized and supplying MCC8B and 9B, battery charging is maintained as well as power to RHR valves necessary for aligning the diesel fire pump for alternate RPV vessel injection. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Containment N_2	1.0553	This term represents random failure of the containment nitrogen system for SRV operation during loss of offsite power. A Phase I SAMA, adding high-pressure nitrogen bottles as a backup to the normal nitrogen supply, has already been installed to improve reliability of the containment nitrogen system. Since failure of the SRVs has a larger risk reduction worth than failure of this support system, the benefit derived from Phase II SAMA 060, "Improve SRV design," is greater than the benefit possible from improving the nitrogen supply system. Also, the cost of adding another nitrogen supply is judged comparable to the cost of modifying the SRVs. Therefore, no Phase II SAMAs were evaluated to further improve reliability of nitrogen supply to the SRVs.
Diesel Fire Pump and John Deere Diesel for Alternate Injection	1.0584	This term represents random failure of diesel fire pump P40-1A and John Deere diesel generator during the alignment of John Deere diesel generator to provide alternate RPV vessel injection during a loss of offsite power event. Phase I SAMAs to use the fire protection system as a backup source for containment spray and reactor vessel injection during loss of offsite power have already been installed to provide redundant capability for RPV injection and heat removal. Phase II SAMA 064 to provide a crosstie for fire protection from RHRSW system to RHR loop B to further improve injection capability was evaluated.
Inadvertent Opening of Relief Valve—initiating event	1.0571	This term represents the initiating event of inadvertent opening of a relief valve. Improvement of the SRV design and SRV reseat reliability, to reduce the probability and consequences of this initiating event, were evaluated in Phase II SAMAs 055 and 060.
Loss of Bus DC-1 and associated battery—initiating event	1.0541(IE) 1.0264	These terms represent the initiating event of a complete loss of the 125VDC bus DC-1 and random failures of battery A-1. Phase I SAMAs to improve alternate battery charging capability, replace existing batteries with more reliable ones, and DC bus crosstie capability have already been installed. Phase II SAMAs 028, 029, 030, and 033 for enhancing DC system availability and reliability were evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Loss of Bus DC-2 and associated battery - initiating event	1.0517(IE) 1.0316	These terms represent the initiating event of a complete loss of 125VDC bus DC-2 and random failures of battery B-1. Phase I SAMAs to improve alternate battery charging capability, replace existing batteries with more reliable ones and DC bus crosstie capability have already been installed. Phase II SAMAs 028, 029, 030, and 033 for enhancing DC system availability and reliability were evaluated.
Torus Cooling Mode of RHR & RHRSW	1.0515	This term represents random failure of the torus cooling mode of the RHR and RHRSW systems. Containment spray mode of RHR and fire protection system crosstie has already been implemented to provide redundant containment heat removal capability. In addition, Phase II SAMAs 004, 010 and 017 to improve the reliability of containment decay heat removal were evaluated.
Operator Action: Operator fails to open SRVs for vessel depressurization during medium LOCA	1.0408	This term represents operator failure to manually open the SRVs to depressurize during a medium LOCA. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Loss of Service Water - initiating event	1.0102	These terms represent random passive failures of the service water system and the initiating event of a complete loss of the service water system. Enhancement of the service water system was evaluated in Phase II SAMA 001.
Internal Flooding Initiator, SW pipe break in torus room, at El. 213' of the reactor building	1.0397	This term represents the initiating event of SW pipe break in torus room, at El. 213' of the reactor building. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Operator Action: Operator fails to recognize the need to vent the torus for pressure reduction	1.0367	This term represents operator failure to recognize the need to vent the torus for pressure reduction during loss of containment heat removal accident sequences. Phase II SAMA 063 to control containment venting within a narrow pressure band to prevent rapid containment depressurization during venting was evaluated.
Internal Flooding Initiator, SW pipe break in NE ECCS corner room of the reactor building	1.0357	This term represents the initiating event of SW pipe break in NE ECCS corner room of the reactor building. A Phase I SAMA to increase berm height to prevent flooding of the ECCS corner room has already been installed. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Internal Flooding Initiator, SW pipe break in SE ECCS corner room of the reactor building	1.0343	This term represents the initiating event of SW pipe break in SE ECCS corner room of the reactor building. A Phase I SAMA modifying and sealing the hatch lift points and hatch edges has already been installed to ensure hatches are watertight. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Internal Flooding Initiator, SW pipe break at El. 303' of the reactor building	1.0324	This term represents the initiating event of SW pipe break at El. 303' of the reactor building. A Phase I SAMA, adding chase berms at elevation 303', has already been installed. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Bus 2 (supplied by SU XFMR) – 4.16KV	1.0318	This term represents the initiating event of a complete loss of offsite power from the 345 KV switchyard and 115 KV line. Phase I SAMAs to improve 4.16KV bus crosstie capability, procedures to repair or replace failed 4.16KV breakers and provide connection to an alternate source of offsite power have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
RPS	1.0316	This term represents random failure of the reactor protection system. Several Phase I SAMAs to minimize the risks associated with ATWS scenarios have already been installed. No Phase II SAMAs were evaluated to further improve reliability of RPS. However, Phase II SAMAs 057 and 058 to enhance the reliability of the standby liquid control system and improve ATWS capability to mitigate the consequences of this event were evaluated.
Transient with PCS available - initiating event	1.0287	This term represents the initiating event of a transient with PCS available. Industry efforts over the last twenty years have led to a significant reduction of plant scrams from all causes. Phase II SAMA 046 to improve MSIV design and mitigate the consequences of this event was evaluated.
Operator Action: Operator fails to align a condensate transfer pump to inject via LPCI or core spray lines for alternate injection	1.0282	This term represents operator failure to align condensate transfer pump to inject via LPCI or core spray lines for alternate injection. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Operator Action: Operator fails to initiate alternate cooling mode from the cooling tower deep basin	1.0257	This term represents operator failure to align water from the west cooling tower deep basin to the suction of the RHRSW pumps to cool a number of loads normally cooled by the service water system. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Feedwater/Condensate	1.0237	This term represents random failure of the feedwater and condensate injection path. Phase I SAMAs creating connections of existing or alternate water sources to feedwater and condensate, and installing motor driven feed water pumps, have already been installed to increase the availability of injection subsequent to MSIV closure. Many of the Phase II SAMAs (e.g. 050, 051, 052, 053, and 054) explored potential benefits of enhancing the reliability of high pressure injection systems.
Internal Flooding Initiator, SW pipe break (north) affecting MCCs and ECCS in NE corner room of the reactor building	1.0218	This term represents the initiating event of SW pipe break in NE ECCS corner room of the reactor building. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Bus 1 (supplied by SU XFMR) – 4.16KV	1.0200	This term represents the initiating event of a complete loss of offsite power from the 345 KV switchyard and 115 KV line. Phase I SAMAs to improve 4.16KV bus crosstie capability, procedures to repair or replace failed 4.16KV breakers and provide connection to an alternate source of offsite power have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Vernon Tie	1.0153	This term represents random failure of Vernon tie line circuit breakers to close and operator failure to close two breakers from the control room. Phase I SAMAs to provide an alternate source of offsite power, proceduralize steps in recovery of offsite power after SBO, and protect control cable of Vernon tiebreakers have already been installed. No Phase II SAMAs were evaluated to further improve reliability of the Vernon tie. However, Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system availability or reliability to cope with the loss of offsite power and SBO events were evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, fire protection pipe break in upper RCIC room at El. 232'	1.0177	This term represents the initiating event of fire protection pipe break in torus room, at El. 232' of the reactor building. A Phase I SAMA, to provide a relief path to relieve water accumulation in the upper RCIC to lower RCIC area before floor failure, has already been implemented. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
ATWS with MSIV Closed - initiating event	1.0155	This term represents the ATWS initiating event. Several Phase I SAMAs to create a boron injection path through CRD, increase boron concentration, and provide RPT, ARI, and FW trip to minimize the risks associated with ATWS scenarios have already been installed. In addition, Phase II SAMAs 057 and 058 to enhance reliability of the standby liquid control system and improve ATWS capability to mitigate the consequences of this event were evaluated.
Internal flooding Initiator, SW pipe break in affecting instrument panels and 480V MCC, at El. 280' of the reactor building	1.0144	This term represents the initiating event of SW pipe break at El. 280' of the reactor building. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Alternate Cooling	1.0143	This term represents random failure of alternate cooling from the west cooling tower deep basin to the suction of the RHRSW pumps. Phase II SAMA 064 to improve alternate cooling capability was evaluated.
Stuck Open SRVs – initiating event	1.0139	This term represents the initiating event of stuck open SRVs. Improvement of SRV reseat reliability and SRV design were evaluated in Phase II SAMAs 055 and 060.
Operator Action: Operator fails to start a TBCCW pump	1.0133	This term represents operator failure to start TBCCW pump locally from the motor control panel and establish cooling to BOP components for RPV makeup and heat removal. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, circulating water pipe break in turbine building	1.0130	This term represents the initiating event of circulating water pipe break in the turbine building. Phase I SAMAs to improve inspection of expansion joints on the main condenser and to change procedures to reduce the probability of a circulating water piping break have already been implemented. No Phase II SAMA was evaluated to further reduce this initiator. However, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Operator Action: Operator fails to initiate SLC during an ATWS without main condenser	1.0130	This term represents operator failure to initiate SLC during an ATWS without main condenser. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject
Internal Flooding Initiator, SW pipe break in intake structure	1.0119	This term represents the initiating event of SW pipe break in the intake structure. Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Loss of PCS - initiating event	1.0111	This term represents the initiating event of a loss of PCS. Industry efforts over the last twenty years have led to a significant reduction of plant scrams from all causes. Phase II SAMA 046 to improve MSIV design and mitigate the consequences of this event was evaluated.
Operator Action: Operator fails to initiate and control feedwater and condensate during transients and small LOCA and medium LOCAs	1.0079	This term represents operator failure to align feedwater and condensate injection to perform the core cooling function during transients, medium LOCAs and small LOCAs. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject
24 VDC ECCS Bus B	1.0079	This term represents random failures of the 24VDC ECCS Bus B system. A Phase I SAMA, replacing the 24VDC batteries with 125VDC to 24VDC converters, has already been implemented. Phase II SAMA 047 to protect the power cabinet from internal flooding to further improve reliability of 24VDC ECCS buses was evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, fire protection pipe break (northeast) cascading to torus room at El. 252' reactor building	1.0078	This term represents the initiating event of fire protection pipe break (northeast) cascading to torus room at El. 252' reactor building. Phase I SAMAs, fire protection system standpipe, was enhanced to reduce internal flooding risk contribution. No Phase II SAMA was evaluated to further reduce this initiator. However, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Internal Flooding Initiator, SW pipe break affecting EDG-1A, EDG-1B, diesel room A, turbine building	1.0073	This term represents the initiating event of SW pipe break in diesel room A, turbine building. Phase II SAMA 047 to reduce the contribution of internal flooding was evaluated.
Internal flooding Initiator, auxiliary steam break affecting EDG-1A, turbine building	1.0071	This term represents the initiating event of auxiliary steam break in diesel room A, turbine building. Phase I SAMAs to improve doors in the turbine building have already been installed. No Phase II SAMA was evaluated to further reduce this initiator. However, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
Internal Flooding Initiator, auxiliary steam break affecting EDG-1B, turbine building	1.0067	This term represents the initiating event of auxiliary steam break in diesel room B, turbine building. Phase I SAMAs to improve doors in the turbine building have already been installed. No Phase II SAMA was evaluated to further reduce this initiator. However, Phase II SAMA 047 to reduce the CDF contribution of internal flooding was evaluated.
24 VDC ECCS Bus A	1.0065	This term represents random failures of the 24VDC ECCS Bus A system. A Phase I SAMA, replacing the 24VDC batteries with 125VDC to 24VDC converters has already been installed. Phase II SAMA 047 to protect the power cabinet from internal flooding to further improve the reliability of 24VDC ECCS buses was evaluated.
Internal Flooding Initiator, SW pipe break in general areas of turbine building	1.0059	This term represents the initiating event of SW pipe break in general areas of the turbine building. Phase II SAMA 047 to reduce the contribution of internal flooding was evaluated.

Table E.1-3
Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs
(Continued)

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, SW pipe break in HVAC room of turbine building	1.0059	This term represents the initiating event of SW pipe break in the HVAC room of the turbine building. Phase II SAMA 047 to reduce the contribution of internal flooding was evaluated.
Internal Flooding Initiator, unisolable SW pipe break in torus room, at El. 213' reactor building	1.0054	This term represents the initiating event of unisolable SW pipe break in torus room, at El. 213' of the reactor building. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMA 047 to reduce the contribution of internal flooding was evaluated.
Internal Flooding Initiator, SW pipe break affecting EDG-1A, EDG-1B, diesel room B, turbine building	1.0053	This term represents the initiating event of SW pipe break in diesel room B, turbine building. Phase II SAMA 047 to reduce the contribution of internal flooding was evaluated.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
Emergency Diesel Generators (A & B)	1.4267	This term represents random failures of the emergency diesel generators, leading to an SBO event. Phase I SAMAs to improve reliability of the emergency diesel generators by creating a crosstie of EDG fuel oil supplies and a backup source for diesel cooling have already been installed. In addition, Phase II SAMAs 002, 003 and 032 to improve reliability of the EDGs were evaluated.
Loss of Offsite Power - Initiating event PC Plant Centered GR Grid Related WR Weather Related	1.0951-PC 1.0605-GR 1.2985-WR	This term represents the loss of offsite power initiating event. Industry efforts over the last twenty years have led to a significant reduction in plant scrams from all causes. Improvements related to enhancing offsite power availability or reliability and coping with plant SBO events were already implemented and evaluated during preliminary SAMA screening. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
HPCI	1.3931	This term represents random failure of the HPCI system. Phase I SAMAs to improve availability and reliability of the HPCI system that have already been implemented include raising backpressure trip setpoints and proceduralizing intermittent operation. Additional improvements were evaluated in Phase II SAMAs 049, 050, 051, 052, 053, and 054.
RCIC	1.3530	This term represents random failures of the RCIC system. Phase I SAMAs to improve availability and reliability of the RCIC system that have already been installed include raising backpressure trip setpoints and proceduralizing intermittent operation. Additional improvements were evaluated in Phase II SAMAs 049, 050, 051, 052, 053, and 054.
Operator Action: Operator fails to align firewater system and John Deere Diesel for alternate injection	1.2371	This term represents operator failure to align the John Deere diesel generator to provide electric power to 480VAC bus 9 during a loss of offsite power event. With bus 9 energized and supplying MCC8B and 9B, battery charging is maintained as well as power to RHR valves necessary for aligning the diesel fire pump for alternate RPV vessel injection. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
ECCS Low Pressure Interlock	1.1962	This term represents random failures of reactor low-pressure transmitters during transients with stuck open SRVs or LOCAs in which random failures prevent all low-pressure injection valves

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
		from opening. Phase II SAMAs 065 and 066 to reduce the risk due to failure of the ECCS low-pressure interlock were evaluated.
Depressurization (SRVs and ADS Logic)	1.1582	This term represents random failures of the SRVs to open for depressurization during transients and small LOCAs. Phase I SAMAs to enhance reliability of the SRVs that have already been implemented include adopting symptom based EOPs and SAGs, modifying ADS logic, and upgrading SRV pneumatic components. Additional improvements were evaluated in Phase II SAMAs 059 and 060.
Feedwater/Condensate	1.1150	This term represents random failure of the feedwater and condensate injection path. Phase I SAMAs creating connections of existing or alternate water sources to feedwater and condensate, and installing motor driven feed water pumps, have already been installed to increase the availability of injection subsequent to MSIV closure. Many of the Phase II SAMAs (e.g. 050, 051, 052, 053, and 054) explored potential benefits of enhancing the reliability of high pressure injection systems.
Torus Vent via TVS-86 and Rupture Disk	1.1149	This term represents random failures of components in the containment vent path. A hardened pipe vent path was implemented as a result of the NRC Containment Performance Program to provide a redundant means for containment heat removal capability. Several Phase I SAMAs regarding the drywell spray system were already installed to provide containment decay heat removal capability by plant design. Therefore, no Phase II SAMAs were proposed to reduce random failure of containment vent path components. However, Phase II SAMA 063 to control containment venting within a narrow pressure band to prevent rapid depressurization during venting was evaluated.
Loss of Feedwater - initiating event	1.1072	This term represents the initiating event for loss of feedwater. Modifications to significantly reduce or eliminate the potential for loss of feedwater, such as installing a digital feedwater control system, providing a backup water supply and adding a third feedwater pump, have already been implemented. Many of the Phase II SAMAs (e.g., 035, 051, 052, 053, and 054) explored potential benefits for mitigation of this event.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	*RRW*	*Disposition*
Loss of 4.16KV Bus 3 - initiating event	1.1105(IE)	This term represents loss of 4.16KV bus 3. Phase I SAMAs to improve 4.16KV bus crosstie capability and procedures to repair or replace failed 4.16KV breakers have already been implemented. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Loss of 4.16KV Bus 4 - initiating event	1.1006	This term represents loss of 4.16KV bus 4. Phase I SAMAs to improve 4.16KV bus crosstie capability and procedures to repair or replace failed 4.16KV breakers have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Torus Cooling Mode of RHR & RHRSW	1.0735	This term represents random failure of the torus cooling mode of the RHR and RHRSW systems. Containment spray mode of RHR and fire protection system crosstie has already been implemented to provide redundant containment heat removal capability. In addition, Phase II SAMAs 004, 010 and 017 to improve the reliability of containment decay heat removal were evaluated.
Operator Action: Operator fails to open SRVs for vessel depressurization during transients and small LOCA	1.0684	This term represents operator failure to manually open the SRVs for depressurization during transients and small LOCAs. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Operator Action: Operator fails to initiate HPCI/RCIC during transients, medium and small LOCAs	1.0589	This term represents operator failure to initiate HPCI/RCIC to perform the core cooling function during transients, medium LOCAs, and small LOCAs when automatic initiation fails. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Operator Action: Operator fails to recognize the need to vent the torus for pressure reduction	1.0441	This term represents operator failure to recognize the need to vent the torus for pressure reduction during loss of containment heat removal accident sequences. Phase II SAMA 063 to control containment venting within a narrow pressure band to prevent rapid containment depressurization during venting was evaluated.
Containment N_2	1.0373	This term represents random failure of the containment nitrogen system for SRV operation

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
		during loss of offsite power. A Phase I SAMA, adding high-pressure nitrogen bottles as a backup to the normal nitrogen supply, has already been installed to improve reliability of the containment nitrogen system. Since failure of the SRVs has a larger risk reduction worth than failure of this support system, the benefit derived from Phase II SAMA 060, "improve SRV design," is greater than the benefit possible from improving the nitrogen supply system. Also, the cost of adding another nitrogen supply is judged comparable to the cost of modifying the SRVs. Therefore, no Phase II SAMAs were evaluated to further improve reliability of nitrogen supply to the SRVs.
Alternate Cooling	1.0373	This term represents random failure of alternate cooling from the west cooling tower deep basin to the suction of the RHRSW pumps. Phase II SAMA 064 to improve alternate cooling capability was evaluated.
Loss of Bus DC-2 and associated battery - initiating event	1.0367(IE) 1.0268	These terms represent the initiating event of a complete loss of 125VDC bus DC-2 and random failures of battery B-1. Phase I SAMAs to improve alternate battery charging capability, replace existing batteries with more reliable ones and DC bus crosstie capability have already been installed. Phase II SAMAs 028, 029, 030, and 033 for enhancing DC system availability and reliability were evaluated.
Loss of Bus DC-1 and associated battery - initiating event	1.0360(IE) 1.0226	These terms represent the initiating event of a complete loss of the 125VDC bus DC-1 and random failures of battery A-1. Phase I SAMAs to improve alternate battery charging capability, replace existing batteries with more reliable ones, and DC bus crosstie capability have already been installed. Phase II SAMAs 028, 029, 030, and 033 for enhancing DC system availability and reliability were evaluated.
Inadvertent Opening of Relief Valve - initiating event	1.0352	This term represents the initiating event of inadvertent opening of a relief valve. Improvement of the SRV design and SRV reseat reliability, to reduce the probability and consequences of this initiating event, were evaluated in Phase II SAMAs 055 and 060.
Operator Action: Operator fails to open SRVs for vessel depressurization during medium LOCA	1.0251	This term represents operator failure to manually open the SRVs to depressurize during a medium LOCA. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, SW pipe break in torus room, at El. 213' of the reactor building	1.0247	This term represents the initiating event of SW pipe break in torus room, at El. 213' of the reactor building. Both RCIC and HPCI are assumed to fail due to this flooding initiator. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure system to reduce the CDF contribution of this internal flooding initiator, were evaluated.
Internal Flooding Initiator, SW pipe break in NE ECCS corner room of the reactor building	1.0222	This term represents the initiating event of SW pipe break in NE ECCS corner room of the reactor building. RHR loop A and core spray loop A, and both RCIC and HPCI are assumed to fail due to this flooding initiator. A Phase I SAMA to increase berm height to prevent flooding of the ECCS corner room has already been installed. In addition, Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure system toreduce the CDF contribution of this internal flooding initiator, were evaluated.
Transient with PCS available - initiating event	1.0221	This term represents the initiating event of a transient with PCS available. Industry efforts over the last twenty years have led to a significant reduction of plant scrams from all causes. Phase II SAMA 046 to improve MSIV design and mitigate the consequences of this event was evaluated.
Diesel Fire Pump for Alternate Injection	1.0218	This term represents random failure of diesel fire pump P40-1A to provide alternate RPV vessel injection during a loss of offsite power event. Phase I SAMAs to use the fire protection system as a backup source for containment spray and reactor vessel injection during loss of offsite power have already been installed to provide redundant capability for RPV injection and heat removal. Phase II SAMA 064 to provide a crosstie for fire protection from RHRSW system to RHR loop B to further improve injection capability was evaluated.
Internal Flooding Initiator, SW pipe break in SE ECCS corner room of the reactor building	1.0214	This term represents the initiating event of SW pipe break in SE ECCS corner room of the reactor building. RHR loop B and core spray loop B, and both RCIC and HPCI are assumed to fail due to this flooding initiator. A Phase I SAMA modifying and sealing the hatch lift points and hatch edges has already been installed to ensure hatches are watertight. In addition, Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
		high pressure system toreduce the CDF contribution of this internal flooding initiator, were evaluated.
RPS	1.0189	This term represents random failure of the reactor protection system. Several Phase I SAMAs to minimize the risks associated with ATWS scenarios have already been installed. No Phase II SAMAs were evaluated to further improve reliability of RPS. However, Phase II SAMAs 057 and 058 to enhance the reliability of the standby liquid control system and improve ATWS capability to mitigate the consequences of this event were evaluated.
Internal Flooding Initiator, SW pipe break at El. 303' of the reactor building	1.0171	This term represents the initiating event of SW pipe break at El. 303' of the reactor building. Spray from this flooding initiator is assumed to affect the ECCS 24V DC distribution panel. A Phase I SAMA, adding chase berms at elevation 303', has already been installed. In addition, Phase II SAMA 047, to shield the ECCS power cabinet to reduce the CDF contribution of this internal flooding initiator was evaluated.
Bus 2 (supplied by SU XFMR) 4.16KV	1.0164	This term represents the initiating event of a complete loss of offsite power from the 345 KV switchyard and 115 KV line. Phase I SAMAs to improve 4.16KV bus crosstie capability, procedures to repair or replace failed 4.16KV breakers and provide connection to an alternate source of offsite power have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Operator Action: Operator fails to align a condensate transfer pump to inject via LPCI or core spray lines for alternate injection	1.0166	This term represents operator failure to align condensate transfer pump to inject via LPCI or core spray lines for alternate injection. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.
Operator Action: Operator fails to initiate alternate cooling mode from the cooling tower deep basin	1.0144	This term represents operator failure to align water from the west cooling tower deep basin to the suction of the RHRSW pumps to cool a number of loads normally cooled by the service water system. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, SW pipe break (north) affecting MCCs and ECCS in NE corner room of the reactor building	1.0137	This term represents the initiating event of SW pipe break in NE ECCS corner room of the reactor building. Spray from this flooding initiator can affect the RCIC alternate shutdown transfer switch panel and local starter panel for V13-16. RCIC is also subject to flooding within 12 to 15 minutes. In addition, the spray event can affect HPCI local starter panel for V23-16. HPCI is also subject to flooding within 30 minutes. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure system to reduce the CDF contribution of this internal flooding initiator, were evaluated.
Bus 1 (supplied by SU XFMR) 4.16KV	1.0096	This term represents the initiating event of a complete loss of offsite power from the 345 KV switchyard and 115 KV line. Phase I SAMAs to improve 4.16KV bus crosstie capability, procedures to repair or replace failed 4.16KV breakers and provide connection to an alternate source of offsite power have already been installed. Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system reliability or to cope with loss of offsite power and SBO events were evaluated.
Vernon Tie	1.0129	This term represents random failure of Vernon tie line circuit breakers to close and operator failure to close two breakers from the control room. Phase I SAMAs to provide an alternate source of offsite power, proceduralize steps in recovery of offsite power after SBO, and protect control cable of Vernon tiebreakers have already been installed. No Phase II SAMAs were evaluated to further improve reliability of the Vernon tie. However, Phase II SAMAs 028, 029, 030, 031, 033 and 036 for enhancing AC or DC system availability or reliability to cope with the loss of offsite power and SBO events were evaluated.
Internal Flooding Initiator, fire protection pipe break in upper RCIC room at El. 232'	1.0111	This term represents the initiating event of fire protection pipe break in torus room, at El. 232' of the reactor building. This flooding initiator fails RCIC since flood water and spray is delivered to the lower RCIC area. A Phase I SAMA, to provide a relief path to relieve water accumulation in the upper RCIC to lower RCIC area before floor failure, has already been implemented. Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
		system to reduce the CDF contribution of this internal flooding initiator, were evaluated.
ATWS with MSIV Closed - Initiating event	1.0100	This term represents the ATWS initiating event. Several Phase I SAMAs to create a boron injection path through CRD, increase boron concentration, and provide RPT, ARI, and FW trip to minimize the risks associated with ATWS scenarios have already been installed. In addition, Phase II SAMAs 057 and 058 to enhance reliability of the standby liquid control system and improve ATWS capability to mitigate the consequences of this event were evaluated.
Internal flooding initiator, SW pipe break in affecting instrument panels and 480V MCC, at El. 280' of the reactor building	1.0090	This term represents the initiating event of SW pipe break at El. 280' of the reactor building. A major break in the service water system 18" diameter supply piping on El. 280' (north) has the potential to fail ECCS instrument panel 6B (S2), channels A and C. Division S2 (channels A and C) of ECCS signal instruments are failed as a result of this flood event. A Phase I SAMA, enhancement of "Loss of Service Water" procedure to contain a mitigation strategy for each break location, has already been implemented. In addition, Phase II SAMA 047, to shield the ECCS power cabinet to reduce the CDF contribution of this internal flooding initiator was evaluated.
Operator Action: Operator fails to start a TBCCW pump	1.0083	This term represents operator failure to start TBCCW pump locally from the motor control panel and establish cooling to BOP components for RPV makeup and heat removal. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject
Operator Action: Operator fails to initiate SLC during an ATWS without main condenser	1.0083	This term represents operator failure to initiate SLC during an ATWS without main condenser. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject
Loss of PCS - initiating event	1.0083	This term represents the initiating event of a loss of PCS. Industry efforts over the last twenty years have led to a significant reduction of plant scrams from all causes. Phase II SAMA 046 to improve MSIV design and mitigate the consequences of this event was evaluated.
Stuck Open SRVs initiating event	1.0082	This term represents the initiating event of stuck open SRVs. Improvement of SRV reseat reliability and SRV design were evaluated in Phase II SAMAs 055 and 060.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
Internal Flooding Initiator, circulating water pipe break in turbine building	1.0081	This term represents the initiating event of circulating water pipe break in the turbine building. This break causes failure of turbine bypass and the main condenser. It results in degraded circulating water flow which leads to failure of feedwater and condensate. Phase I SAMAs to improve inspection of expansion joints on the main condenser and to change procedures to reduce the probability of a circulating water piping break have already been implemented. Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure system to reduce the CDF contribution of this internal flooding initiator, were evaluated.
Internal Flooding Initiator, SW pipe break in intake structure	1.0074	This term represents the initiating event of SW pipe break in the intake structure. This break causes significant flow diversion. The flow diversion causes circulating water, TBCCW, feedwater and condensate system failures. Phase II SAMAs 049, 50, and 53, to provide an additional high pressure injection pump with independent diesel, install independent AC high pressure injection system, and install an additional active high pressure system to reduce the CDF contribution of this internal flooding initiator, were evaluated.
Loss of Service Water - initiating event	1.0065	These terms represent random passive failures of the service water system and the initiating event of a complete loss of the service water system. Enhancement of the service water system was evaluated in Phase II SAMA 001.
24 VDC ECCS Bus B	1.0050	This term represents random failures of the 24VDC ECCS Bus B system. A Phase I SAMA, replacing the 24VDC batteries with 125VDC to 24VDC converters, has already been implemented. Phase II SAMA 047 to protect the power cabinet from internal flooding to further improve reliability of 24VDC ECCS buses was evaluated.
Operator Action: Operator fails to initiate and control feedwater and condensate during transients and small LOCA and medium LOCAs	1.0049	This term represents operator failure to align feedwater and condensate injection to perform the core cooling function during transients, medium LOCAs and small LOCAs. Phase I SAMAs including improvements to plant procedures, and installation of instrumentation to enhance the likelihood of success of operator action in response to accident conditions, have already been implemented. No additional Phase II SAMAs were recommended for this subject
24 VDC ECCS Bus A	1.0042	This term represents random failures of the 24VDC ECCS Bus A system. A Phase I SAMA, replacing the 24VDC batteries with 125VDC to 24VDC converters has already been installed.

Revised Table E.1-3 Correlation of Level 1 Risk Significant Terms to Evaluated SAMAs

Risk Significant Terms	RRW	Disposition
		Phase II SAMA 047 to protect the power cabinet from internal flooding to further improve the reliability of 24VDC ECCS buses was evaluated.