DiabloCanyonNPEm Resource

From: Keegan, Elaine
Sent: Thursday, February 26, 2015 12:30 PM
To: Wentzel, Michael
Subject: FW: NRC Submittal, DCL-15-027, Update to LRA Amendment 49 and LRA Appendix E Part 7 of 8
Attachments: DCL-15-027 Part 7.pdf

fyi

From: Hartwig, Adriana [mailto:ADH6@pge.com]
Sent: Wednesday, February 25, 2015 6:53 PM
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Subject: NRC Submittal, DCL-15-027, Update to LRA Amendment 49 and LRA Appendix E Part 7 of 8

The electronic file of the following letter that was recently sent to the Nuclear Regulatory Commission is attached to this e-mail and is being routed for your information.

NRC Submittal DCL-15-027, “Update to the Diablo Canyon Power Plant License Renewal Application (LRA), Amendment 49 and LRA Appendix E, “Applicant’s Environmental Report – Operating License Renewal Stage,” Amendment 2”

Signed by: Barry S. Allen – Vice President, Nuclear Services

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Table F.5-1
DCPP Level 1 Importance List Review

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZPRIS2	1.50E-01	1.01E+00	Instrumentation degraded	This SF represents the failure to isolate a spuriously opened PORV with degraded instrumentation. There are several contributing fire areas and different combinations of injection/heat removal failure that lead to core damage; however, one of the larger contributors is the loss of RHR due to the failure to trip "deadheaded" RHR pumps. A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1). The current DCPP fire procedure already identifies actions to close spuriously operating PORVs from the hot shutdown panel and to trip the pressurizer heaters in the scenarios where they can be impacted, which would prevent the induced PORV LOCAs.
GXF	3.50E-02	1.01E+00	1/3 DIESELS UNAVAILABLE (BUS F)	This is an intermediate SF for GF1 related to the failure of DG 1-3 to start and run for 6 hours. Cross-tie from the opposite unit is available, but common cause failures would likely limit the credit associated with including the capability in the model. Installation of a self-contained, independent swing diesel, not dependent on external support systems, would provide increased defense in depth and should be considered for loss of onsite emergency AC power sources (SAMA 15). A potential alternate solution is to use a 480V AC generator to supply the battery chargers for long term AFW support in conjunction with a self cooled, 480V AC RCS high pressure injection pump that can be used to make up for normal seal leakage or boil off if SG makeup fails (SAMA 12).

Table F.5-1
DCPP Level 1 Importance List Review

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZHTRP3	6.50E-03	1.01E+00	Operator Action - Instrumentation OK	This event represents the failure to trip the RHR pumps before failure when they have been "deadheaded" without CCW flow to the RHR heat exchangers. A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1).
PR6AW1	9.66E-02	1.01E+00	PRESSURE RELIEF: Fire - 8000C, 456 available, 455C failed. This will overlap with PRM. Water Challenge. Block valve closure fails.	This SF is primarily associated with induced LOCAs for fires in fire area 6-A-1. The SF boundary conditions indicate that block valve 8000C and PORV-456 are available while PORV-455C is failed. The fire procedure indicates that for fires in this area, block valve 8000A and the PZR heaters may be impacted. These scenarios generally include spurious operation of the pressurizer heaters and induced LOCAs. Core damage results either because the action to swap to recirculation fails, or because an otherwise RHR pump has been damaged due to the failure to trip after prolonged "deadheaded" operation. A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1). To reduce the frequency of failures related to the action to transition to recirculation mode, the process could be automated (SAMA 7).

Table F.5-1
DCPP Level 1 Importance List Review

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
GG2	2.90E-02	1.01E+00	DG 1-2 (BUS G) : GF-F	Cross-tie from the opposite unit is available, but common cause failures would likely limit the credit associated with including the capability in the model. Installation of a self-contained, independent swing diesel, not dependent on external support systems, would provide increased defense in depth and should be considered for loss of onsite emergency AC power sources (SAMA 15). Alternatively, a smaller sized EDG could be used to power the AFW battery chargers for long term SBO operation and a new, self cooled, 480V AC PDP could be used for primary side makeup (SAMA 12).
BB1H	1.42E-02	1.01E+00	Train 2H fails with Recovery - TH=S	This SF is an intermediate SF for Unit 2 power failures. These failures show up in the importance list, but are non-minimal failures that do not directly impact the sequence of events. No SAMAs are required.
SACSS6	3.30E-01	1.01E+00	SEISMIC FAILURE OF AC TB STRUCT SUCCESSFULE: SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This SF represents the failure of all vital 4KV AC power given that the turbine building does not fail due to the seismic event. In most cases, the 230KV offsite supply is also failed and power is not available to the site at all. Given that this SF is associated with a large scale seismic events (>1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

Table F.5-1
DCPP Level 1 Importance List Review

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
GX	1.90E-04	1.01E+00	3/3 DIESELS UNAVAILABLE	This is an intermediate SF for failure of all three DGs. Cross-tie from the opposite unit is available, but common cause failures would likely limit the credit associated with including the capability in the model. Installation of a self-contained, independent swing diesel, not dependent on external support systems, would provide increased defense in depth and should be considered for loss of onsite emergency AC power sources (SAMA 15). A potential alternate solution is to use a 480V AC generator to supply the battery chargers for long term AFW support in conjunction with a self cooled, 480V AC RCS high pressure injection pump that can be used to make up for normal seal leakage or boil off if SG makeup fails (SAMA 12).
CD1FL	4.55E-02	1.01E+00	FLOOD-ALL SUPPRT AVAILABLE-MFW PUMPS AVAILABLE	This SF represents the failure of the Condensate system in flooding events when all support systems and MFW pumps are available. The top contributor is from a flood sequence in which a pipe from the RWST breaks in the fuel handling building. All AFW pumps and the RWST are lost, as well as RHR due to lack of inventory. Failure of condensate results in loss of all heat removal capability. In other cases, fire protection system breaks in the AFW pump rooms result in failure of AFW, which in combination with Feed and Bleed and Condensate system failure lead to core damage. For fire protection system ruptures, a potential means of mitigating the event would be to provide water level sensors in critical areas, such as those housing the charging pumps, AFW pumps, CCW pumps, and RHR pumps that could actuate on high level to shut down the fire protection pumps when there is not a coincident fire alarm (SAMA 17). These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).

Table F.5-1
DCPP Level 1 Importance List Review

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
GH3	1.87E-01	1.01E+00	DG 1-1 (BUS H) : GF-F,GG-F	This SF represents the failure of DG H given failure of the F and G DGs. Cross-tie from the opposite unit is available, but common cause failures would likely limit the credit associated with including the capability in the model. Installation of a self-contained, independent swing diesel, not dependent on external support systems, would provide increased defense in depth and should be considered for loss of onsite emergency AC power sources (SAMA 15). A potential alternate solution is to use a 480V AC generator to supply the battery chargers for long term AFW support in conjunction with a self cooled, 480V AC RCS high pressure injection pump that can be used to make up for normal seal leakage or boil off if SG makeup fails (SAMA 12).
ZPRSI1	2.80E-01	1.01E+00	Operator action to terminate spurious SI - Instrumentation OK	This SF represents the failure to terminate a fire induced spurious SI signal. In this case, the fire has not degraded the instrumentation used to perform the SI termination action. The DCPP fire procedure already includes guidance on addressing spurious actuation of SI and it is directed to be used for any fire scenario. A potential enhancement to consider would be to include a note identifying the spurious signal actuations that may occur in each fire area with a reference to the attachment that governs the mitigating steps for the associated spurious actuation (SAMA 16).
ZSGALL	9.97E-01	1.01E+00	PCV-19, -20, -21, and -22 spuriously open due to fire - fire impact PCV-19, PCV-20, PCV-21 and PCV-22	This SF represents the fire induced opening of PCVs-19, -20, -21, and -22 given that all of the AFW ADVs are impacted by the fire. This, combined with other failures (generally fire induced), leads to loss of SG makeup capability. The top contributors also all include fire induced small LOCAs such that SG makeup alone cannot mitigate the accident. For the diverse set of fire initiators that include this event, a comprehensive mitigation strategy is considered to be required. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
CPFIRE	1.00E-01	1.16E+00	Failure of Isolating the Containment Pen of greater than 2": Failure of Pen 45 valves due to fire	This SF represents the failure to manually isolate the RCP seal water return lines given a fire induced failure of the valves, which leads to an open pathway from containment that exists prior to core damage. A potential means of improving reliability of the isolation action would be to provide fire area specific guidance that addresses containment isolation valves. In some cases, reference to the SAMGs or additional guidance may be appropriate when isolation will result in the loss of a function that is required to prevent core damage (SAMA 21)
SPCET3	7.67E-01	1.15E+00	RCP SEAL COOLING UNAVAILABLE	There are numerous path that lead to core damage that include the unavailability of RCP seal cooling, but all of the top LERF contributors are the result of induced steam generator tube ruptures. These types of events can be prevented by maintaining level in the SGs after core damage to prevent overheating of the SG tubes. A portable, high pressure engine driven SG makeup source with diverse suction supplies can provide this capability (SAMA 2).
ISCET3	7.10E-02	1.15E+00	INDUCED-SGTR: Loss of seal cooling, smallest leak size, no CST resupply	This SF represents the probability that an induced steam generator tube rupture occurs. While SG makeup alone cannot necessarily prevent core damage for cases in which primary side inventory has been lost, providing the capability to inject water into the SGs will prevent tube failure. A portable, high pressure engine driven SG makeup source with diverse suction supplies can provide this capability (SAMA 2).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
OSZ1	5.30E-02	1.15E+00	MANUAL ACTUATION IN EVENT SSPS FAILS: Instrumentation degraded	Addressed in the Level 1 importance list.
ISCET1	5.80E-02	1.11E+00	INDUCED-SGTR: Loss of SG cooling at setpoint pressure	This SF represents the probability that an induced steam generator tube rupture occurs. While SG makeup alone cannot necessarily prevent core damage for cases in which primary side inventory has been lost, providing the capability to inject water into the SGs will prevent tube failure. A portable, high pressure engine driven SG makeup source with diverse suction supplies can provide this capability (SAMA 2).
OR1	2.30E-02	1.09E+00	OPERATOR COOLDOWN AND DEPRESSURIZE RCS	Addressed in the Level 1 importance list.
OX1	1.60E-02	1.07E+00	OPERATOR DECIDES TO ISOLATE RUPTURED SG	This SF represents the probability that the operators will fail to isolate a ruptured SG in a tube rupture scenario. It is generally coupled with the failure to cool down the RCS as part of the mitigation process. In these cases, the types of strategies that are available to reduce the LERF are limited, but providing primary side SG isolation valves is a potential means of simplifying the mitigation strategy and terminating the scenario (SAMA 19).
RECSR	6.50E-02	1.06E+00	Recovery actions for CSR Scenarios from HSP	Addressed in the Level 1 importance list.
SA1	3.26E-03	1.06E+00	SSPS TRAIN A: GENERAL TRANSIENT	This SF, which is a failure of the "A" train of the solid state protection system, is often paired with operator failure to trip the reactor that result in ATWS events, which are assumed to result in core damage for Seismic initiators. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
S12	4.82E-05	1.06E+00	SSPS TRAIN A&B FAIL (GENERAL TRANSIENT)	This is an intermediate SF for SB2, which represents failure of the "B" SSPS channel given failure of the "A" channel. There are limited options available to address the sequences where operators fail to manually actuate the safety systems after automatic actuation has failed. This SF is often paired with operator failure to trip the reactor that result in ATWS events, which are assumed to result in core damage for Seismic initiators. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).
SB2	1.48E-02	1.06E+00	SA-F (GENERAL TRANSIENT)	This is an intermediate SF for SB2, which represents failure of the "B" SSPS channel given failure of the "A" channel. The SB2 SF is often paired with operator failure to trip the reactor that result in ATWS events, which are assumed to result in core damage for Seismic initiators. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).
WLF0	1.00E-01	1.06E+00	Both SSPS Trains Not available, no fire	This SF, which is a failure of the "B" train of the solid state protection system, is often paired with operator failure to trip the reactor that result in ATWS events, which are assumed to result in core damage for Seismic initiators. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
SDC6	1.26E-01	1.04E+00	SEISMIC FAILURE OF DC DUE TO FRAGILITY: SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This SF represents the seismic failure of 125V DC power. This SF is typically combined with LOOP events, which result in SBO scenarios given that DC power is required for on-site power alignment. Given that this SF is associated with a large scale seismic events (>1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
PRB1A	1.76E-01	1.04E+00	PR Failed due to PORV 455C 8000B Failure - FOR FIRE AREA 1A and 9A	Addressed in the Level 1 importance list.
ZHTRP2	1.60E-01	1.04E+00	Operator Action - Degraded Instrumentation	Addressed in the Level 1 importance list.
ZSVHES	5.80E-03	1.04E+00	480V Switchgear Ventilation - Operator Action: No fire damage to flow switches	Addressed in the Level 1 importance list.

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
SDC5	3.82E-02	1.04E+00	SEIS5, Hazard Levels: 2.500E+00 to 3.00E+00	This SF represents the seismic failure of 125V DC power. This SF is typically combined with LOOP events, which result in SBO scenarios given that DC power is required for on-site power alignment. Given that this SF is associated with a large scale seismic events (>1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
PR6BWZ	9.66E-02	1.04E+00	Fire - 456 available, 8000C and 455C failed. Overlaps with PR9. Water Challenge.	Addressed in the Level 1 importance list.
SDC4	8.45E-03	1.03E+00	SEISMIC FAILURE OF DC DUE TO FRAGILITY: SEIS4, Hazard Levels: 2.00E+00 to 2.500E+00	Addressed in the Level 1 importance list.
AZAF3	2.70E-02	1.03E+00	UNIT 1 4.16 KV BUS F: HF13/HF14 impacted - Recovery successful	Addressed in the Level 1 importance list.
AF1SB	1.38E-04	1.03E+00	UNIT 1 4.16 KV BUS F: All support available (with recovery - Seismic Group B)	This SF represents the probability that 4KV bus F fails in a lower magnitude seismic event. It is typically combined with other failures of buses G and H along with a failure to trip the reactor due to unavailability of DC power to the shunt trip coils for manual trip (local breaker action not credited). This results in an ATWS. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				buses feeding the rod drive motor generator sets (SAMA 20).
AY3FGH	2.26E-05	1.03E+00	VITAL AC TRAINS F&G&H FAIL (SEISMISC GROUP B)	This is an intermediate SF for AH3SB, which represents the failure of 4 KV Bus H given failure of buses F and G in seismic events. The contributors that include this SF are generally combined with the failure to trip the reactor when DC power is not available to the shut trip coils to support a manual trip (local breaker action not credited). This results in an ATWS. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).
AH3SB	4.67E-01	1.03E+00	UNIT 1 4.16 KV BUS H: DF-S, DG-S, AF-F,AG-F (with recovery) - Seismic Group B	This SF represents the failure of 4 KV Bus H given failure of buses F and G in seismic events. The contributors that include this SF are generally combined with the failure to trip the reactor when DC power is not available to the shut trip coils to support a manual trip (local breaker action not credited). This results in an ATWS. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
AG2SB	3.50E-01	1.03E+00	UNIT 1 4.16 KV BUS G: DF-S, AF-F, with recovery (Seismic Group B)	This SF represents the failure of 4 KV Bus G given failure of bus F in seismic events. The contributors that include this SF are generally combined with the failure to trip the reactor when DC power is not available to the shut trip coils to support a manual trip (local breaker action not credited). This results in an ATWS. A potential means of reducing the contribution of this SF is to use an alternate signal, such as AMSAC, to automate the de-energization of the 480V buses feeding the rod drive motor generator sets (SAMA 20).
ZSGALL	9.97E-01	1.03E+00	fire impact PCV-19, PCV-20, PCV-21 and PCV-22	Addressed in the Level 1 importance list.
AZAG7	5.00E-01	1.03E+00	HG14 affected - Conditional recovery - Local action	Addressed in the Level 1 importance list.
WLF1	1.00E-01	1.02E+00	WATER LEVEL FOR SUMP RECIRCULATION: Both SSPS Trains Not available, fire with Recovery	This SF represents the failure to close the containment sump discharge valves given the unavailability of both SSPS trains in fire events. A potential improvement would be to include explicit guidance in the fire procedure to manually close either FCV-500 or FCV-501 for fires in zones that could fail SSPS (SAMA 21).
AWR1	2.93E-04	1.02E+00	Failure to supply water from FWST or RWR (non seismic)	Addressed in the Level 1 importance list.
ZPRSI2	2.80E-01	1.02E+00	Operator action to terminate spurious SI: Degraded instrumentation	Addressed in the Level 1 importance list.

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZSETB7	9.87E-01	1.02E+00	Fire induced loss of thermal barrier cooling: 355, 356, 357, 750 impacted - 355 not recoverable	This SF represents the fire induced loss of thermal barrier cooling. The sequences including these events lead to LERF primarily due to hydrogen burns that fail containment and induced SGTR events. While SG makeup alone cannot necessarily prevent core damage for cases in which primary side inventory has been lost, providing the capability to inject water into the SGs will prevent tube failure. The scenarios including this SF also generally include fire induced LOCAs from pressurizer heater actuation or charging flow imbalance. Multiple other functions/components are also failed, such as the CCW heat exchangers and SG steam relief capability. The wide range of failures essentially requires a fire-safe train of equipment for success. SAMA 18 represents an independent primary and seconday side makeup capability, but for all but very small LOCAs, successful mitigation would require a permanently installed system with higher makeup flow capacity than the portable pumps envisioned for SAMA 18. This type of system would be more expensive than SAMA 18. For this analysis, SAMA 18 is assigned as a bounding case for these contributors. The frequency of containment failure due to hydrogen burns could be reduced by providing a means of eliminating hydrogen buildup in a diverse range of scenarios, such as with a hydrogen igniter system (SAMA 22).
SVI6	3.57E-02	1.02E+00	ALL FOUR VITAL INSTRUMENT CHANNELS: SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This SF represents the failure of all four vital instrument channels in large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
SVZ3R1	2.73E-02	1.02E+00	480V SWITCHGEAR VENTILATION: E-43, S-43 and HD43-SO impacted - run failure	Addressed in the Level 1 importance list.
SACSS4	3.91E-02	1.02E+00	SEISMIC FAILURE OF AC TB STRUCT SUCCESSFULE: SEIS4, Hazard Levels: 2.00E+00 to 2.500E+00	Addressed in the Level 1 importance list.
SSG6	3.19E-02	1.01E+00	SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This top event represents the seismic failure of the steam generator supports and postulated failure of the reactor coolant system and steam connecting piping. Failure of this top event is modeled as leading to core damage. The top event failure also is modeled as failing containment because it results in high containment internal pressure. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
ZPRL3C	4.37E-02	1.01E+00	Normal letdown LOCA due to fire induced/random failures: All components impacted - Recovery of 8149A,B,C impacted. (HEP=0.1)	This event represents a letdown path LOCA with failure of the recovery action to isolate the LOCA pathway by opening the DC supply breakers for the valves. DCPP currently has fire procedures that direct this action for fires in the relevant area and no additional changes to the procedures have been identified that would significantly improve action reliability. A potential enhancement would be to provide fire barriers to protect the cables related to the valves in the letdown path associated with LOCA (valves 8149A,B,C valves and LCV-459 and LCV-460).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				Ensuring that either LCV-459 or 460 is protected in area 5A1 could prevent or mitigate the fire induced LOCA (SAMA 14).
SEL6	2.99E-02	1.01E+00	EXCESSIVE LOCA: SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This top event represents a seismically induced excessive LOCA. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
ZPRS2F	9.98E-01	1.01E+00	Inadvertent pressurizer spray through aux or normal path: All components impacted	This SF represents the failure to terminate a fire induced spurious SI signal. In this case, the fire has failed the instrumentation used to diagnose the SI termination action. The DCPP fire procedure already includes guidance on addressing spurious actuation of SI and it is directed to be used for any fire scenario. A potential enhancement to consider would be to include a note identifying the spurious signal actuations that may occur in each fire area with a reference to the attachment that governs the mitigating steps for the associated spurious actuation (SAMA 16).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
SPR6	8.42E-02	1.01E+00	SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This top event represents a seismically induced pressure relief/small LOCA. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
RF3Z	1.60E-01	1.01E+00	FIRE: SWITCHOVER TO CONTAINMENT SUMP RECIRCULATION AFTER SLOCA DEGRADED INSTRUMENTATION	Addressed in the Level 1 importance list.
C2CT3	1.80E-02	1.01E+00	CONTAINMENT FAILURE AT VESSEL BREACH: No HPME caused DCH (low pressure, or HPME doesn't occur at higher pressure) without spray or CFCUs	This SF is assoicated with top event CSCET, which considers containment failure due to RCS blowdown or combustible gas detonation. The scenarios including this SF are all large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
L2CT3	3.30E-01	1.01E+00	LARGE CONTAINMENT FAILURE AT VESSEL BREACH: No HPME caused DCH (low pressure, or HPME doesn't occur at higher pressure) without spray, with CFCUs	This SF is assoicated with top event L2CET, which considers large containment failure due to RCS blowdown or combustible gas detonation. The scenarios including this SF are all large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
D2F1	2.48E-04	1.01E+00	125V DC BUS F (BATTERY) - ALL SUPPORT AVAILABLE	This SF represents the unavailability of the bus F 125 V battery. In most cases, it occurs in scenarios in which all 3 DC divisions have failed. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
SSG5	1.12E-02	1.01E+00	SEIS5, Hazard Levels: 2.500E+00 to 3.00E+00	This top event represents the seismic failure of the steam generator supports and postulated failure of the reactor coolant system and steam connecting piping. Failure of this top event is modeled as leading to core damage. The top event failure also is modeled as failing containment because it results in high containment internal pressure. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
PR6GWZ	9.66E-02	1.01E+00	Fire - 456 and 8000B failed. 8000C and 455C available. Overlaps with PR1E. Water Challenge.	Addressed in the Level 1 importance list.
ZTDPHD	1.00E-01	1.01E+00	Failure to control SG 2/3 Water Level: Partial Instruments are available	Addressed in the Level 1 importance list.
SVI5	1.08E-02	1.01E+00	SEIS5, Hazard Levels: 2.500E+00 to 3.00E+00	This SF represents the failure of all four vital instrument channels in large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
SSG4	3.00E-03	1.01E+00	SEIS4, Hazard Levels: 2.00E+00 to 2.500E+00	This top event represents the seismic failure of the steam generator supports and postulated failure of the reactor coolant system and steam connecting piping. Failure of this top event is modeled as leading to core damage. The top event failure also is modeled as failing containment because it results in high containment internal pressure. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				exchanger system (SAMA 4).
BB1G	1.97E-02	1.01E+00	UNIT 2 VITAL AC/DC SYSTEM: Train 2G fails with Recovery - TS=S	Addressed in the Level 1 importance list.
D2G2	1.94E-02	1.01E+00	125V DC BUS G (BATTERY) - GIVEN D2F=F	This SF represents the unavailability of the bus G 125 V battery given failure of the bus F battery. In most cases, it occurs in scenarios in which all 3 DC divisions have failed. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
DA3FGH	2.33E-06	1.01E+00	VITAL DC TRAINS F, G AND H (2 HOUR) UNAVAILABLE	This SF represents the unavailability of all 3 125V DC divisions. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.

TABLE F.5-2A
DCPP LEVEL 2 (ST1 / ST5)[1] IE IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
SDC3	2.23E-03	1.01E+00	SEIS3, Hazard Levels: 1.75E+00 to 2.00E+00	This SF represents the seismic failure of 125V DC power. This SF is typically combined with LOOP events, which result in SBO scenarios given that DC power is required for on-site power alignment. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
D2H3	4.87E-01	1.01E+00	D2F-F, D2G-F	The probability of this event reflects the failure of multiple DC buses given the availability of 480V AC buses. As such, a backup independent DC power supply system capable of being connected to the affected bus in a timely manner may lower the importance of this event (SAMA 10).
ZPRL3A	4.37E-02	1.01E+00	All components impacted - Recovery of 8149A,B,C impacted. (HEP=1)	Addressed in the Level 1 importance list.

Table Note:

1. ST1 and ST5 refer to release categories Large Early and ISLOCA, respectively

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
CIA	1.03E-01	1.86E+00	FAILURE OF CONTAINMENT ISOLATION: Fire with Recovery	This SF rerpresents the failure of containment isolation in fire events. Because there are multiple valves associated with this function, there are a large set of fire initiating events and accident evolutions associated with this SF. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18). The existing DCPP fire procedures already include fire area specific actions to mitigate fire induced damage; however, the actions to address the containment isolation function are general. Another potential enhancement would be to explicitly identify the containment isolation valves that may be impacted for each fire area (SAMA 21).
ZOI5	1.90E-01	1.28E+00	Manual containment Isolation: INST. FOR OPERATOR CUE ARE PARTIALLY FAILED DUE TO FIRE	This SF is associated with the operator action to manually perform containment isolation when the instrumentation used for diagnosis is partially degraded. The existing DCPP fire procedures already include firea area specific actions to mitigate fire induced damage; however, the actions to address the containment isolation function are general. Another potential enhancement would be to explicitly identify the containment isolation valves that may be impacted for each fire area (SAMA 21).
ZHTRP2	1.60E-01	1.21E+00	Operator Action - Degraded Instrumentation	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZOI6	4.50E-02	1.17E+00	Manual containment Isolation: INSTRUMENTS FOR OPERATOR CUE ARE OK FROM FIRE	This SF is associated with the operator action to manually perform containment isolation when the instrumentation used for diagnosis is not impacted. Because there are multiple valves associated with this function, there are a large set of fire initiating events and accident evolutions associated with this SF. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
PR6BWZ	9.66E-02	1.11E+00	Fire - 456 available, 8000C and 455C failed. Overlaps with PR9. Water Challenge.	Addressed in the Level 1 importance list.
RF3Z	1.60E-01	1.10E+00	FIRE: SWITCHOVER TO RECIRCULATION AFTER SLOCA DEGRADED INSTRUMENTATION	Addressed in the Level 1 importance list.
PR6GWZ	9.66E-02	1.09E+00	Fire - 456 and 8000B failed. 8000C and 455C available. Overlaps with PR1E. Water Challenge.	Addressed in the Level 1 importance list.
PRB1A	1.76E-01	1.08E+00	PR Failed due to PORV 455C 8000B Failure - FOR FIRE AREA 1A and 9A	Addressed in the Level 1 importance list.
ZTDPHD	1.00E-01	1.08E+00	Failure to control SG 2/3 Water Level: Partial Instruments are available	Addressed in the Level 1 importance list.
RECSR	6.50E-02	1.07E+00	Recovery actions for CSR Scenarios from HSP	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
OSZ1	5.30E-02	1.07E+00	MANUAL ACTUATION IN EVENT SSPS FAILS: Instrumentation degraded	Addressed in the Level 1 importance list.
ZPRSI2	2.80E-01	1.05E+00	Operator action to terminate spurious SI: Degraded instrumentation	Addressed in the Level 1 importance list.
AW4	1.61E-02	1.04E+00	SUPPORT FOR BOTH MDP'S UNAVAILABLE	Addressed in the Level 1 importance list.
P2CET3	2.82E-01	1.04E+00	RCS PRESSURE AT VESSEL BREACH EXCEEDS 650 PSIA	This SF is linked to scenarios for which the RCS is at intermediate pressure at the time of vessel breach. They include primarily large magnitude seismic events and fire events in which 480V switchgear room cooling fails. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4). For the fire events, containment failure is linked to hydrogen burns. The frequency of containment failure due to hydrogen burns could be reduced by providing a means of eliminating hydrogen buildup in a diverse range of scenarios, such as with a hydrogen igniter system (SAMA 22).
GXH	3.50E-02	1.04E+00	1/3 DIESELS UNAVAILABLE	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
			(BUS H)	
AWFZ	5.24E-01	1.04E+00	No support for AFWP2, AFWP3 and fire impacts on AFWP1.	Addressed in the Level 1 importance list.
ZSGALL	9.97E-01	1.04E+00	fire impact PCV-19, PCV-20, PCV-21 and PCV-22	Addressed in the Level 1 importance list.
ZPRL3A	4.37E-02	1.04E+00	Normal letdown LOCA due to fire induced/random failures: All components impacted - Recovery of 8149A,B,C impacted. (HEP=1)	Addressed in the Level 1 importance list.
AZAF3	2.70E-02	1.04E+00	UNIT 1 4.16 KV BUS F: HF13/HF14 impacted - Recovery successful	Addressed in the Level 1 importance list.
ZTDPHS	5.00E-02	1.03E+00	Failure to control SG 2/3 Water Level: All Instruments are available	Addressed in the Level 1 importance list.
PRC1A	1.73E-01	1.03E+00	PR Failed due to PORV 456C 8000C Failure - FOR FIRE AREA 1A and 9A	Addressed in the Level 1 importance list.
RF1Z	8.68E-03	1.03E+00	FIRE: SWITCHOVER AFTER SLOCA OR B/F WITH CS FAILED	Addressed in the Level 1 importance list.
HRF23A	6.00E-01	1.03E+00	Fire - HR Fails due to ZHR23A fails: NO FLOW PATH FROM RHR TO HIGH PRESSURE PUMPS:	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
PR6AW1	9.66E-02	1.03E+00	PRESSURE RELIEF: Fire - 8000C, 456 available, 455C failed. This will overlap with PRM. Water Challenge. Block valve closure fails.	Addressed in the Level 1 importance list.
OB1Z2	1.34E-01	1.03E+00	Fire - Loss of Instrument Air (HEP successful) and Instrumentation Degraded	Addressed in the Level 1 importance list.
SIZCR6	8.41E-01	1.03E+00	8974A, and All ZSI1componnts impacted	Addressed in the Level 1 importance list.
ZPRIS2	1.50E-01	1.03E+00	Instrumentation degraded	Addressed in the Level 1 importance list.
LSCET1	5.00E-01	1.03E+00	INDUCED PORV (OR PRESSURIZER SAFETY) FAILURE	This SF represents the probability that a PORV has failed in the open position after repeated cycling at elevated temperatures, which leads to a low pressure RCS at vessel breach and containment typically fails due to long term overpressurization. The sequences that include PORV failures are diverse and include internal events initiators, fire scenarios, and seismic events. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
ZSETB7	9.87E-01	1.03E+00	355, 356, 357, 750 impacted - 355 not recoverable	This SF represents the fire induced loss of thermal barrier cooling. The sequences including these events are represented by a wide range of fire events that lead to long term containment overpressurization failures. The scenarios including this SF also generally include fire induced LOCAs from pressurizer heater actuation or charging flow imbalance. Multiple other

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				functions/components are also failed, such as the CCW heat exchangers and SG steam relief capability. The wide range of failures essentially requires a fire-safe train of equipment for success. SAMA 18 represents an independent primary and seconday side makeup capability, but for all but very small LOCAs, successful mitigation would require a permanently installed system with higher makeup flow capacity than the portable pumps envisioned for SAMA 18. This type of system would be more expensive than SAMA 18. For this analysis, SAMA 18 is assigned as a bounding case for these contributors.
ZAH7	5.00E-01	1.02E+00	4.16 kV Bus H fails due to fire: HH14 affected - Conditional recovery - Local action	Addressed in the Level 1 importance list.
SDS1	2.17E-02	1.02E+00	RCP Shutdown seals Fail to Actuate	Addressed in the Level 1 importance list.
ZHTRP3	6.50E-03	1.02E+00	Operator Action - Instrumentation OK	Addressed in the Level 1 importance list.
C2CT3	1.80E-02	1.02E+00	CONTAINMENT FAILURE AT VESSEL BREACH: No HPME caused DCH (low pressure, or HPME doesn't occur at higher pressure) without spray or CFCUs	This SF is assoicated with top event CSCET, which considers containment failure due to RCS blowdown or combustible gas detonation. The scenarios including this SF are all large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
AZAH7	5.00E-01	1.02E+00	HH14 affected - Conditional Recovery - Local action	Addressed in the Level 1 importance list.
OG2305	6.04E-01	1.02E+00	AVAILABILITY OF POWER FROM 230 KV OFFSITE GRID: 52HG15 impacted	The offsite power failures are generally combined with a failure of an EDG, a 4 KV Bus/supply failure, and a 480V AC bus/supply failure, or some combination of similar events. Typically, the G 480V AC bus is not available to support TD AFW and an alternate means of SG makeup is required. Because there are often induced LOCAs, primary side makeup is also necessary. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
AWR1	2.93E-04	1.02E+00	Failure to supply water from FWST or RWR (non seismic)	Addressed in the Level 1 importance list.
GF1	3.50E-02	1.02E+00	DG 1-3 (BUS F) STARTS & RUNS FOR 6 HR	Addressed in the Level 1 importance list.
AZAG7	5.00E-01	1.02E+00	HG14 affected - Conditional recovery - Local action	Addressed in the Level 1 importance list.
BB1G	1.97E-02	1.02E+00	UNIT 2 VITAL AC/DC SYSTEM:	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
			Train 2G fails with Recovery - TS=S	
GH4G	3.52E-02	1.02E+00	UNIT 1 BUS H DIESEL GENERATOR: DG 1-1 (BUS H) : GF-S, GG-B	This SF is associated with a failure of DG 1-1, primarily for fires in the 4-A-1 area (Chemical Lab Area, G Bus Compartment). The scenario including this SF are typically associated with fires in the 4-A-1 area (Chemical Lab Area, G Bus Compartment). In these cases, the fire impacts RHR pump 1-1 and 480V bus G in combination with the random failue of DG 1-1 and fire induced failue of 4KV bus G. The result is a failure of power to the DG fuel oil system, which leads to an SBO as it is also combined with a failure to align the backup power supply to the fuel oil system. DCPP has a viable recovery option for this typs of event, but the action to perform the task is impacted by degraded instrumentation and it has failed. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
GXF	3.50E-02	1.02E+00	1/3 DIESELS UNAVAILABLE (BUS F)	Addressed in the Level 1 importance list.
SCT6	4.51E-01	1.02E+00	RELAY CHATTER: SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This SF represents the failure of the emergency AC power system due to seismically induced relay chatter. Without relay reset, onsite AC sources cannot be aligned to required loads. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
SCT5	2.72E-01	1.02E+00	RELAY CHATTER: SEIS5, Hazard Levels: 2.500E+00 to 3.00E+00	This SF represents the failure of the emergency AC power system due to seismically induced relay chatter. Without relay reset, onsite AC sources cannot be aligned to required loads. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZFO32	1.90E-01	1.01E+00	Failure to Align Backup Power Supply: Partial Instruments are available	This SF represents the failure to align a diesel fuel oil pump to its backup power supply when the instrumentation required for diagnosis of the action has been degraded by a fire event. The scenarios including this SF are typically associated with fires in the 4-A-1 area (Chemical Lab Area, G Bus Compartment). DCPP already has a portable diesel fuel oil transfer pump. If the model accounted for the use of this pump, the importance of this split fraction would fall below the review threshold. No SAMAs are required to address this contributor.
C2CT11	7.20E-03	1.01E+00	CONTAINMENT FAILURE AT VESSEL BREACH: High or setpoint pressure, w/o sprays or CFCUs, HPME cause DCH	This SF is related to the failure of containment at the time of vessel breach. The contributors including this SF are primarily large magnitude seismic events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
ZPRS2F	9.98E-01	1.01E+00	Inadvertent pressurizer spray through aux or normal path: All components impacted	For scenarios that include fire induced pressurizer spray actuation induced LOCAs, many of the contributors initially have an RHR pump available for mitigation. Failure to trip the deadheaded pump before it is damaged leads to loss of heat removal capability and subsequent containment overpressurization. A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1).
DB4F	5.64E-03	1.01E+00	125V DC BUS F - LONG TERM (TRAIN 11): 125V DC VITAL POWER BUSES: Train DF - (BTC11=S, BTC121=F)	This is an intermediate SF for DF4, which represents the unavailability of DC bus F. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
IPCET2	1.20E-01	1.01E+00	INDUCED RCS HOT LEG OR SURGE LINE FAILURE: RCS at setpoint pressure, Seal LOCA, smallest leak size, no CST resupply, no RCS failures	They include primarily large magnitude seismic events and fire events in which 480V switchgear room cooling fails. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4). For the fire

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				events, the action to align portable switchgear ventilation is credited, (instrumentation required for diagnosis is not degraded) and it fails. Loss of all AC power is considered to be an adequate cue to credit the alignment of an additional mitigation strategy, such as the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
ZPRSI1	2.80E-01	1.01E+00	Operator action to terminate spurious SI: Instrumentation OK	Addressed in the Level 1 importance list.
DB2H	5.64E-03	1.01E+00	125V DC VITAL POWER BUSES: Train DH - BTC132=S, BTC131=F	This is an intermediate SF for DH10, which represents the unavailability of DC bus H. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
DF4	5.64E-03	1.01E+00	125V DC BUS F - LONG TERM (TRAIN 11): BTC11=S, BTC121=F	This SF represents the unavailability of DC bus F. An alternate DC generator could be used to either power critical DC buses or to directly power critical DC equipment (SAMA 10). The generator would have to be stored in a seismically qualified area.
ZSVHES	5.80E-03	1.01E+00	480V Switchgear Ventilation - Operator Action: No fire damage to flow switches	Addressed in the Level 1 importance list.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
OG230S	6.63E-01	1.01E+00	AVAILABILITY OF POWER FROM 230 KV OFFSITE GRID: 52HG15 impacted - for scenario ZTRY22F1	This SF represents the failure of offsite power from the 230KV source in a fire event. The scenario including this SF are typically associated with fires in the 4-A-1 area (Chemical Lab Area, G Bus Compartment). In these cases, the fire impacts RHR pump 1-1 and 480V bus G in combination with the random failue of DG 1-1 and fire induced failue of 4KV bus G. The result is a failure of power to the DG fuel oil system, which leads to an SBO as it is also combined with a failure to align the backup power supply to the fuel oil system. DCPP has a viable recovery option for this typs of event, but the action to perform the task is impacted by degraded instrumentation and it has failed. These types of events could also potentially be mitigated through the use of portable, engine driven, high pressure RCS and SG injection pumps (SAMA 18).
AWBB	6.23E-03	1.01E+00	SUPPORT FOR THE TDP AND MDP 1-2 UNAVAILABLE	This SF represents the failure of MD AFW pump 13 given the unavailability of the other two pumps. A potential approach to restoring SG makeup would be to provide an engine driven SG makeup pump that can be aligned in time to mitigate loss of SG makeup scenarios (SAMA 2).

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
GYG	5.65E-02	1.01E+00	1/3 DIESELS UNAVAILABLE (BUS G)	This is an intermediate SF for TG1 and similar SFs, which represent the unavailability of DG 2-1. The SF appears in the importance list, but it is related to non-minimal failures that do not directly impact the sequence of events. No SAMAs are required.
SIZCR4	8.73E-01	1.01E+00	TOP EVENT SI: 8976, 8974B, and all ZSI2 components impacted	This SF represents the failure of the SI top event given fire impact on the RWST suction and recirculation valves. The sequences that include this SF often include RHR pump failure due to the failure to trip the pumps when operating in the "deadhead" condition. A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1).
CI4	1.03E-01	1.01E+00	SSPS Trains A and B Not Avail but Manual Recovery Avail	This represents failure of containment isolation when both SSPS trains are unavailable. The primary contributors to these scenarios are flooding events that lead to failure of all three DC batteries/buses. Credit is already taken for manual isolation of the flooding event. A portable DC generator could be used to directly power critical loads in the event that batteries have failed (SAMA10).

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
PRA1A	1.96E-01	1.01E+00	PRESSURE RELIEF: PR Failed due to PORV 474 8000A faiure - for fire area 9A	This SF represents the fire related failures of PORV 474 block valve 8000A. The scenarios generally include either a failure to swap recirculation mode or failure to trip deadheaded RHR pumps to prevent pump damage. Automating the swap to recirculation mode could improve the reliability of the function (SAMA 7). A potential means of precluding the need to trip the RHR pumps would be to install a normally open CCW flow bypass line around the RHR Hx outlet valve. This would ensure that minimum cooling flow would be available to prevent damage to the RHR pumps when they are running with the RCS at high pressure (SAMA 1).
GH4F	3.52E-02	1.01E+00	UNIT 1 BUS H DIESEL GENERATOR: DG 1-1 (BUS H) : GF-B,GG-S	This SF represents the failure of DG 1-1 given success of DG 1-2 (and bypass of DG 1-3). In top contributors, the failure of DG 1-1 is combined with fire induced failure of SI pump 1-2, leaving no adequate high pressure injection supply to mitigate the fire induced LOCA. Cross-tie from the opposite unit is available, but common cause failures would likely limit the credit associated with including the capability in the model. Installation of a self-contained, independent swing diesel, not dependent on external support systems, would provide increased defense in depth and should be considered for loss of onsite emergency AC power sources (SAMA 15).

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
AWS4	1.61E-02	1.01E+00	SUPPORT FOR BOTH MDP'S UNAVAILABLE	This is an intermediate SF for AW4S. The primary contributors containing this SF are LOOP and SBO seismic events in which MD AFW is failed due to power dependencies. Subsequent to the TD AFW failure, feed and bleed is unavailable due to loss of power to one PORV and loss of instrument air for the other. Providing a backup air supply to PORV PCV 474 could reduce the feed and bleed failures associated with loss of instrument air (SAMA 5). Also, a more robust seismically-resistant 4kV power source (SAMA 4 or SAMA 15) can provide some benefit.
ZSG234	9.83E-01	1.01E+00	PCV-19 spuriously opens due to fire: fire impact PCV-20, PCV-21 and PCV-22	This SF represents the failure of PCV-19 to open for steam relief given fire impact on the other 3 ADVs. Many of the scenarios that include this SF also include failure of the charging pumps due to loss of cooling to the pumps, which impacts mitigation of a fire induced LOCA. In these cases, instrumentation for diagnosis is degraded and there is limited time for the 30 minute alternate cooling alignment from fire water. A potential imporovement would be to provide a hard pipe connection between the fire water system and the charging pump cooling lines to simplify the alignment and reduce the time required for the action (SAMA 23).
IPCET1	7.20E-01	1.01E+00	INDUCED RCS HOT LEG OR SURGE LINE FAILURE	This SF represents the probability of failure of the RCS hot leg or surge line after core damage, which occurs for a diverse range of events. A potential means of preventing these failures would be to provide an independent means of adding water to the RCS at high pressure. These types of events could also potentially be mitigated through the use of portable, engine driven, high

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
				pressure RCS and SG injection pumps (SAMA 18).
TD1	1.61E-02	1.01E+00	SEISMIC TD AFW PUMP - SCT=F	This SF represents the failure of the turbine driven AFW pump in seismic events. Most of the contributors are related to large magnitude events. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).
BB1H	1.42E-02	1.01E+00	Train 2H fails with Recovery - TH=S	Addressed in the Level 1 importance list.
GYF	5.65E-02	1.01E+00	DEG 2-3 GENERATOR FAILURE (1/3): 1/3 DIESELS UNAVAILABLE (BUS F)	This is an intermediate SF for TF1 and similar SFs, which represent the unavailability of DG 2-3. The SF appears in the importance list, but it is related to non-minimal failures that do not directly impact the sequence of events. No SAMAs are required.

TABLE F.5-2B
DCPP LEVEL 2 (ST2)[1] IMPORTANCE LIST REVIEW

EVENT NAME	PROBABILITY	RISK REDUCTION WORTH	DESCRIPTION	POTENTIAL SAMAS
FO2AZ	4.34E-03	1.01E+00	FUEL OIL TRANSFER SYSTEM: SUPPORT FOR TRAIN 0-1 AVAIL; FIRE INDUCED FAILURE OF TRAIN 0-2	A portable diesel fuel oil transfer pump is already available. The risk importance of this split fraction would fall below the review threshold if its use were credited in the model. No SAMA is required.
SOP6	9.97E-01	1.01E+00	SEIS6, Hazard Levels: 3.00E+00 to 3.99E+00	This SF represents the loss of all offsite power and is based on the 230kV switchyard seismic fragility, which is significantly stronger than the 500kV switchyard seismic fragility. Given that this SF is associated with a large scale seismic event (greater than 1.75g), a new mitigating system capable of responding after seismic events (potentially up to 4g) is considered to be required. Such a system would include a 4KV power source, a core spray type injection system (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system (SAMA 4).

[1] ST2 refers to the Small Early release category.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
1	Install a Minimum CCW Cooling Flow Line Around the RHR Heat Exchanger Outlet Valve	For scenarios in which an SI signal is generated while the RCS pressure remains above the RHR low pressure interlock for extended times, it is necessary for the operators to check the status of the RHR pumps at some point after initiation and to shut them down to prevent pump damage. If CCW is flowing to the RHR heat exchangers, however, the action to trip the RHR pumps is not required to prevent pump failure. A means of preventing RHR pump failure without adding a large, early demand on the CCW system is to add a small, normally open bypass line around the RHR heat exchanger outlet valves in the CCW flowpath.	PRA Importance List Review	$3,020,424	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.1.
2	Provide an Engine Driven SG Makeup Pump	For cases in which the AFW pumps have failed and/or the support systems are failed, such as the 480V AC switchgear, providing an independent means of injecting water to the steam generators could provide the secondary side heat removal function. Ensuring that the makeup pump can be aligned in time to mitigate early loss of AFW scenarios and that diverse pump suction supplies are available (e.g., Fire Water, Raw Water) is required to mitigate the top DCPP risks. (This SAMA is addressed by elements of the DCPP FLEX strategy.)	PRA Importance List Review	$17,492,616	Implementation cost is greater than the MACR. Screened from further analysis.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
3	Change Procedures to Explicitly Address Vulnerability of Auto SI	The DCPP fire procedure already identifies equipment that may be damaged for each fire area and provides guidance to mitigate failed equipment. A potential enhancement would be explicitly identify that fire damage may impact auto SI actuation and direct the operators to monitor valid instruments to ensure it functions when it is required.	PRA Importance List Review	$376,342	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.2.
4	Seismically Qualified Response System	For large scale seismic events, many of the plant's mitigating systems may be damaged to an extent that only an independent, seismically durable system would be capable of preventing core damage. Such a system would include a 4KV power source, a core spray type injection header (with a qualified PORV) capable of spraying the core for cooling until the reactor cavity is flooded to a level above TAF, a connection to a large seismically qualified source of water (wells or seawater), and a heat exchanger system. (A significant portion of this SAMA's design is addressed by elements of the DCPP FLEX strategy. One exception is that this SAMA includes a core spray-like injection for reactor cavity flooding.)	PRA Importance List Review	$160,001,440	Implementation cost is greater than the MACR. Screened from further analysis.
5	Backup Air System for PORV PCV 474	Currently, loss of offsite power results in the loss of the IA system. Changing the air supply to PCV 474 (Pressurizer PORV) to a class I backup air supply would prevent this and reduce the loss of IA contributions to	PRA Importance List Review	$3,133,404	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.13

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
		core damage.			
6	Install an Additional Train of 480V Switchgear Room HVAC	Alternate Switchgear Room cooling procedures already exist for DCPP, but the loss of room cooling is still an important issue. While costly, a potential means of reducing the HVAC failure contribution would be to install an independent train of HVAC.	PRA Importance List Review	$9,993,910	Implementation cost is greater than the MACR. Screened from further analysis.
7	Automate Swap to Recirculation	The operators are well trained on the action to transition the RCS injection systems to recirculation mode, but automating the process will further improve reliability and reduce the contribution of this action to core damage scenarios.	PRA Importance List Review	$10,616,468	Implementation cost is greater than the MACR. Screened from further analysis.
8	Protect RHR Cables in Fire Areas 6-A-2 and 6-A-3	For fires in areas 6-A-2 and 6-A-3, fire induced failure of the 8700A/B and the FCV-641A/B valves lead to loss of the RHR system, which is critical for mitigating the fire scenarios. Providing additional protection for the cables associated with these components in these areas could help improve the likelihood that RHR would remain available.	PRA Importance List Review	$1,072,493	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.4.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
9	Install Spray Barriers to Protect the TD AFW Pump and Install a Waterproof MD AFW Pump	For some flooding scenarios, including those in fire areas 14-A and 3-Q-2, the AFW system is damaged by flood water from fire protection system breaks. Providing barriers to protect the TD AFW pump can reduce the likelihood that the pump will be damaged. The MD AFW pumps are susceptible to flood water incursion via ventilation ducts that must remain open to provide adequate room cooling. To protect the MD AFW pumps from these flooding events, it would be necessary to replace the existing equipment with a waterproof pump.	PRA Importance List Review	$25,520,160	Implementation cost is greater than the MACR. Screened from further analysis.
10	Alternate DC Generator	In order to mitigate DC system failures, an alternate DC generator could be used to directly power a bus (bypasses charger faults) or directly power critical loads (bypasses distribution failures). The generator should be stored in a seismically qualified area so that it would potentially be available to respond in seismic scenarios.	PRA Importance List Review	$22,572,878	Implementation cost is greater than the MACR. Screened from further analysis.
11	Install a Swing RHR Pump	For LOCA events in which the RHR pumps have failed, but cooling flow is available to the RHR heat exchangers, the availability of an additional RHR pump that can be powered from any AC division would provide a means of containment heat removal.	PRA Importance List Review	$75,042,192	Implementation cost is greater than the MACR. Screened from further analysis.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
12	Use an Alternate EDG to Support Long Term AFW Operation and a 480V AC Self-Cooled PDP for Primary Side Makeup	A low cost SBO mitigation strategy is to use a small, alternate EDG to power a station battery charger for steam generator level instrumentation and AFW control. In addition, if power can be supplied to a 480V AC self-cooled, high pressure positive displacement pump, primary side makeup could be maintained to make up for normal seal leakage and potentially for boil off in longer timeframes. (This SAMA is addressed by elements of the DCPP FLEX strategy.)	PRA Importance List Review	$13,560,218	Implementation cost is greater than the MACR. Screened from further analysis.
13	Not Used.				
14	Protect the Letdown Isolation Capability in Fire Area 5-A-1	In some cases, fires in area 5-A-1 can lead to uncontrolled letdown flow that opens a system relief valves and results in a LOCA path. The DCPP fire procedure already directs actions to isolate the letdown path by depowering the 8149A/B/C valves. To further reduce the risk associated with a letdown LOCA for fires in these areas, a potential enhancement would be to protect the cables associated with either LCV-459 or LCV-460 such that they could function normally and terminate/control flow through the line.	PRA Importance List Review	$5,620,896	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.6.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
15	Install a Self-Contained Swing EDG	One of the most effective means of reducing SBO scenarios is to provide a diverse emergency power supply that can support all of the equipment normally supplied by an existing EDG. (Some of the capabilities represented by this SAMA are addressed by elements of the DCPP FLEX strategy. One difference is that the FLEX strategy uses a portable 4 kV power supply delivered from the regional response center that would not be immediatley available.)	PRA Importance List Review	$146,105,155	Implementation cost is greater than the MACR. Screened from further analysis.
16	Change Procedures to Caution About Spurious SI Signals in Specific Fire Areas	The DCPP fire procedure already include guidance that addresses spurious actuation of equipment, but its use is not currently tied to specific fire areas. A potential enhancement would be to include cautions in the procedures to identify fire areas where damage could cause specific spurious actuations and identify the attachment with the mitigating steps.	PRA Importance List Review	$372,788	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.7.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
17	Install Flood Sensors to Mitigate Fire Protection System Pipe Breaks	There are multiple scenarios related to Fire Protection system pipe breaks that, if un-isolated, lead to significant equipment damage. In order to improve the likelihood of flood termination, water sensors could be installed in areas containing critical equipment that can be impacted by fire protection system floods, such as those containing the AFW, CCW, and RHR pumps. The water level sensor could be linked to logic that would trip the fire protection pumps and/or isolate a critical valve for scenarios where there is not a coincident fire alarm.	PRA Importance List Review	$9,610,440	Implementation cost is greater than the MACR. Screened from further analysis.
18	Portable Engine Driven Primary and Secondary Side Pumps	For events such as internal floods or fires that can result in the loss of multiple, critical plant functions, recovery may be easier via the use of portable equipment that bypasses the permanently installed equipment. The use of portable engine driven pumps for primary and secondary side makeup can provide a means of maintaining RCS inventory and decay heat removal. Ensuring the equipment can be aligned in time to respond to loss of AFW cases, have diverse suction sources, and injection points will improve the flexibility of the enhancement. (This SAMA is addressed by elements of the DCPP FLEX strategy; however, the FLEX strategy uses a 480V AC pump powered by a portable generator for RCS makeup.)	PRA Importance List Review	$49,473,576	Implementation cost is greater than the MACR. Screened from further analysis.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
19	Primary Side Isolation Valves	The availability of primary side steam generator isolation vales would provide a simple means of isolating ruptured SGs. While secondary side isolation capability exists, these valves would help avoid challenges to secondary side integrity due to failure to rapidly cool down the primary side.	PRA Importance List Review	$137,797,270	Implementation cost is greater than the MACR. Screened from further analysis.
20	Use Alternate Signal (such as AMSAC) to De-energize the 480V AC Buses that Supply the Rod Drive Motor Generator Sets	In the event that the MG set breakers do not trip in an ATWS, an alternate signal, such as an AMSAC signal, could be used to depower the 480V AC supply that powers the MG sets to ensure the control rod drive units are shut down. The 480V trip could be delayed so that it is only performed after 30 seconds with a valid ATWS signal.	PRA Importance List Review	$11,173,059	Implementation cost is greater than the MACR. Screened from further analysis.
21	Change Fire Procedures to Include Fire Area Specific Guidance on Containment Isolation Valves	The DCPP fire procedure already identifies equipment that may be damaged for each fire area and provides guidance to mitigate failed equipment. A potential enhancement would be to explicitly identify the containment isolation valves that may be impacted for each fire area. Where possible, the fire procedures could direct manual actions to close the valves. In cases where manual isolation would not be desirable until after loss of equipment or core damage, a reference to other procedures, such as the Severe Accident Mitigation Guidelines could be provided.	PRA Importance List Review	$256,817	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.8.

TABLE F.5-3
DCPP PHASE 1 SAMA LIST SUMMARY

SAMA NUMBER	SAMA TITLE	SAMA DESCRIPTION	SOURCE	COST ESTIMATE	PHASE 1 BASELINE DISPOSITION
22	Install Containment Combustible Gas Igniters	Early containment failure is a contributor to the LERF release category. Although inerting containment in accident conditions could help prevent burns of combustible gases, a better solution is to install battery-backed igniters throughout upper dome of containment.	PRA Importance List Review	$13,083,120	Implementation cost is greater than the MACR. Screened from further analysis.
23	Enhance the Firewater to Charging Pump Cooling Connection	For cases in which CCW is not available for charging pump cooling, it is possible to connect the Fire Protection system to the charging pump cooling line to provide alternate pump cooling. However, the current alignment requires the use of fire hoses and may not be viable in time stressed events, such as some fire scenarios. By providing a hard piped connection with manual isolation valves, the alignment could be performed rapidly and the reliability of the action could potentially be improved.	PRA Importance List Review	$491,021	Implementation cost is less than MACR. Retain for Phase II analysis. See Section F.6.9.

Notes:

(1) Cost estimates are on a per unit basis

Table F.6-1
DCPP Phase 2 SAMA List Summary

SAMA Number	SAMA Title	SAMA Description	Source	Phase 2 Baseline Disposition
1	Install a Minimum CCW Cooling Flow Line Around the RHR Heat Exchanger Outlet Valve	For scenarios in which an SI signal is generated while the RCS pressure remains above the RHR low pressure interlock for extended times, it is necessary for the operators to check the status of the RHR pumps at some point after initiation and to shut them down to prevent pump damage. If CCW is flowing to the RHR heat exchangers, however, the action to trip the RHR pumps is not required to prevent pump failure. A means of preventing RHR pump failure without adding a large, early demand on the CCW system is to add a small, normally open bypass line around the RHR heat exchanger outlet valves in the CCW flowpath.	PRA Importance List Review	This SAMA's net value is negative and is classified as not "cost beneficial".
3	Change Procedures to Explicitly Address Vulnerability of Auto SI	The DCPP fire procedure already identifies equipment that may be damaged for each fire area and provides guidance to mitigate failed equipment. A potential enhancement would be explicitly identify that fire damage may impact auto SI actuation and direct the operators to monitor valid instruments to ensure it functions when it is required.	PRA Importance List Review	This SAMA's net value is positive and is classified as potentially "cost beneficial".
5	Backup Air System for PORV PCV 474	Currently, loss of offsite power results in the loss of the IA system. Changing the air supply to PCV 474 (Pressurizer PORV) to a class I backup air supply would prevent this and reduce the loss of IA contributions to core damage.	PRA Importance List Review	This SAMA's net value is negative and is classified as not "cost beneficial".
8	Protect RHR Cables in Fire Areas 6-A-2 and 6-A-3	Fore fires in areas 6-A-2 and 6-A-3, fire induced failure of the 8700A/B and the FCV-641A/B valves lead to loss of the RHR system, which is critical for mitigating the fire scenarios. Providing additional protection for the cables associated with these components in these areas could help improve the likelihood that RHR would remain available.	PRA Importance List Review	This SAMA's net value is negative and is classified as not "cost beneficial".

Table F.6-1
DCPP Phase 2 SAMA List Summary

SAMA Number	SAMA Title	SAMA Description	Source	Phase 2 Baseline Disposition
14	Protect the Letdown Isolation Capability in Fire Area 5-A-1	In some cases, fires in area 5-A-1 can lead to uncontrolled letdown flow that opens a system relief valves and results in a LOCA path. The DCPP fire procedure already directs actions to isolate the letdown path by depowering the 8149A/B/C valves. To further reduce the risk associated with a letdown LOCA for fires in these areas, a potential enhancement would be to protect the cables associated with either LCV-459 or LCV-460 such that they could function normally and terminate/control flow through the line.	PRA Importance List Review	This SAMA's net value is negative and is classified as not "cost beneficial".
16	Change Procedures to Caution About Spurious SI Signals in Specific Fire Areas	The DCPP fire procedure already includes guidance that addresses spurious actuation of equipment, but its use is not currently tied to specific fire areas. A potential enhancement would be to include cautions in the procedures to identify fire areas where damage could cause specific spurious actuations and identify the attachment with the mitigating steps.	PRA Importance List Review	This SAMA's net value is negative and is classified as not "cost beneficial".
21	Change Fire Procedures to Include Fire Area Specific Guidance on Containment Isolation Valves	The DCPP fire procedure already identifies equipment that may be damaged for each fire area and provides guidance to mitigate failed equipment. A potential enhancement would be to explicitly identify the containment isolation valves that may be impacted for each fire area. Where possible, the fire procedures could direct manual actions to close the valves. In cases where manual isolation would not be desirable until after loss of equipment or core damage, a reference to other procedures, such as the Severe Accident Mitigation Guidelines could be provided.	PRA Importance List Review	This SAMA's net value is positive and is classified as potentially "cost beneficial".