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Vice President
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June 2, 2000

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Guy S. Vissing
Project Directorate I-1
Washington, D.C. 20555

Subject: Generic Letter 88-20, Internal Flooding Probabilistic Safety Assessment (PSA)
Final Report
Rochester Gas & Electric Corporation
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Reference: (a) Letter from R.C. Mecreddy, RG&E, to G.S. Vissing, NRC, Subject: *Generic Letter 88-20, Internal Flooding Probabilistic Safety Assessment (PSA)*, dated March 1, 1999.

Dear Mr. Vissing:

On May 11, 2000, a conference call was held between George Wrobel and Ray Gallucci of RG&E and Erasmia Lois and yourself. The purpose of this call was to discuss the Ginna Station Internal Flooding Probabilistic Safety Assessment submitted in response to Generic Letter 88-20 (Ref. (a)). At the conclusion of this conference call, three issues were still outstanding. The purpose of this letter is to provide the RG&E response to these three questions as shown below:

1. *When determining the probability of success of operator actions, how are times considered relative to detection of the need for action, as well as the time needed to perform the actions.*

Attachment I contains the summary of operator actions addressed within Revision 3 of the Ginna Station PSA. This includes those actions related to internal events, floods, fires, and shutdown. Attachment II contains a sample of the detailed operator action evaluations performed relative to the Internal Flooding PSA. As can be seen, this evaluation is performed consistent with NUREG/CR-4772 and NUREG/CR-1278.

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It should be noted that several of the operator error probabilities have changed since the submittal of the Internal Flooding PSA Final Report to the NRC. This is due to the issuance of Revision 3 of the Ginna Station PSA and updates to all supporting analyses and documentation. The overall impact of the new operator error rates is a decrease in overall core damage frequency.

2. *What are the anticipated completion dates for corrective actions relative to internal flooding vulnerabilities, particularly service water piping in the battery rooms?*

The only flooding vulnerability identified by RG&E in Ref. (a) that has not been completed is with respect to the service water piping in the battery rooms. This piping will be relocated from battery rooms by the completion of the spring 2002 refueling outage.

3. *How will internal flooding be addressed in EOOS?*

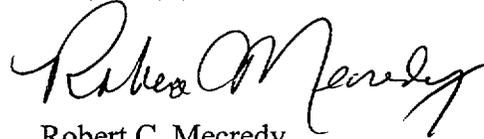
All licensed operators, STAs, and Work Week Schedulers received training on the PSA results, including the Flooding PSA findings, in November and December of 1999. The PSA Team is finalizing a new release to the EOOS package currently in use at Ginna Station that includes these updated findings. This will be fully tested by Scheduling with additional training to Operators to follow if necessary. The complete implementation of the new EOOS package will occur prior to the start of the refueling outage scheduled for September 2000. The new EOOS package includes the following changes:

- a. Upgrade to latest version of software
- b. Inclusion of cutsets from most recent PSA analyses (includes at-power, flooding, fire, and shutdown risk)
- c. Capability to solve model in "real-time"

As listed above, the new EOOS package will have the capability to use either cutsets or solution of the actual model in order to evaluate risk. In either instance, flooding risk will be considered since the flooding scenarios are included both in the cutsets and the model used for solution. The EOOS package works by assigning equipment designations to basic events within the model. When this equipment is removed from service, the affected basic events are then set to TRUE with a probability of one. If the cutset model is used, the probabilities associated with the affected basic events in the cutsets are increased to one and a new CDF is calculated. If the model is solved, the basic events are set to TRUE along with any basic events directly affected by the postulated flood,

and a CDF is calculated. While EOOS will not have tasks that increase the frequency of any flooding initiating event, if mitigation capability is significantly reduced, the calculated CDF would increase and appropriately focus attention on the related tasks. The use of EOOS by Operations and Scheduling is currently proceduralized.

Very truly yours,



Robert C. Mecredy

Attachments

xc: Mr. Guy S. Vissing (Mail Stop 8C2)
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Division of Licensing Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
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U.S. NRC Ginna Senior Resident Inspector

Attachment I

Summary of Operator Actions

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
ACHFDB1314	OPERATORS FAIL TO USE BUS 13-14 CROSS-TIE. This event represents the failure of operators to cross-tie electrical buses during shutdown conditions when one bus loses power. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
ACHFDB1416	OPERATORS FAIL TO USE BUS 14-16 CROSS-TIE. This event represents the failure of operators to cross-tie electrical buses during shutdown conditions when one bus loses power. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
ACHFDB1516	OPERATORS FAIL TO USE BUS 15-16 CROSS-TIE. This event represents the failure of operators to cross-tie electrical buses during shutdown conditions when one bus loses power. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
ACHFDB1718	OPERATORS FAIL TO USE BUS 17-18 CROSS-TIE. This event represents the failure of operators to cross-tie electrical buses during shutdown conditions when one bus loses power. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
ACHFDOFFXX	OPERATORS FAIL TO RECONNECT TO OFFSITE POWER FOLLOWING UV ON SISTER BUS. This event represents the failure of operators to manually close a 480V bus back onto offsite power if: (1) an UV on one 480V safeguards bus causes its sister bus to open under SI conditions with subsequent failure of the DG, or (2) the DG is originally supplying the bus under test conditions and then fails. In both cases offsite power is available. Timing for this event is based on equipment that is available (e.g., TDAFW pump) - worst case would be 1 hour. Procedure ECA-0.0, Step 7 has operators perform this action under SBO conditions; several other EOPs direct this activity for non-SBO conditions.	1.00E-01		Use same screening value.	1.00E-01
ACHFDRCOFF	FAILURE TO RECOVER SECOND OFFSITE POWER CIRCUIT AFTER FAILURE OF FIRST. This event represents the failure of operators to utilize an available offsite power circuit during shutdown operations after the first circuit has failed. This activity can be performed from the control room within approximately 10 minutes. Timing is based on the equipment that is available and the time available before boiloff within the reactor cavity. Assumed to be 1 hour or more.	1.00E-01		Use same screening value.	1.00E-01

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AFHFDALTTD	OPERATORS FAIL TO PROVIDE COOLING TO TDAFW LUBE OIL FROM DIESEL FIRE PUMP. This event represents to the failure of operators to align the diesel driven fire water pump to supply cooling water to the TDAFW pump lube oil cooler during a station blackout event. Actual testing of TDAFW pump has shown that it can run for 2 hours without cooling water to the lube oil coolers. Procedure ECA-0.0, Step 8, directs operators to align backup cooling water to the TDAFW pump using Attachment FIRE WATER COOLING TO TDAFW PUMP.	1.00E-01	FIDG1B10 FI0TB2-1 FI0TB2-3	If operators use EOPs, then same procedure steps apply and no change is necessary. All important fire scenarios involve successful suppression so assume no impact of fire on ex-control room actions. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	6.7E-03
AFHFDBLOWD	OPERATORS FAIL TO ISOLATE BLOWDOWN MANUALLY. This event represents the failure of operators to isolate the blowdown paths in the event automatic containment isolation failed. This isolation is required to prevent AFW from being diverted and failing to remove decay heat in the SGs. Assumed to be required within 45 minutes (see AFHFDSAFWX). Procedure E-0, Step 12 instructs operators to verify all containment isolation valves are closed. If not, they are directed to locally close alternate isolation valves per Attachment C/CVI.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to operators to manually isolate blowdown lines (e.g., ER-FIRE.1, Attach 3). No change required.	5.00E-03
AFHFDSTART	OPERATORS FAIL TO MANUALLY START AFW PUMP WITH NO AUTO START SIGNAL. This event represents the failure to start the AFW pumps from the control room when automatic initiation has failed. E-0, Step 10 has operators manually start pumps as required. Timing for this event is the same as for AFHFDSAFWX.	1.00E-01		Use same screening value.	1.00E-01

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AFHFDSUPPL	OPERATORS FAIL TO SUPPLY ALTERNATE SOURCES OF WATER TO AFW. This event represents the failure of operators to provide alternate sources of water to the suction of the AFW pumps after the CST inventory is exhausted. One CST provides sufficient volume for a minimum of 2 hrs of decay heat removal. Assuming that two tanks are available , four hours would be available prior to exhausting inventory in the CSTs. Annunciator H-13, CONDENSATE STORAGE TANK HI-LO LEVEL ALARM sounds at 18' 4". Alarm response procedure AR-H-13 directs the operators on receipt of a low level alarm to "Check Hotwell Level Controller LC-107 is operating properly, and start transferring water in." EOPs have continuous actions to verify CST level (see E-0 foldout page). Procedure ER-AFW.1 provides directions for operators to transfer water in or to provide alternate sources of water to the AFW pumps. This event specifically includes the options available in steps 4.1, 4.4, 4.7, and 4.8. Steps 4.2 and 4.3 were assumed to be unavailable and steps 4.5 and 4.6 are included in the event for the operators failing to align SAFW (AFHFDSAFWX, above).	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to operators (e.g., ER-FIRE.1, Step 4.4.6 and 4.4.7). Given the time available to perform this activity, no change is required.	1.00E-03
AFHFDTDAFW	OPERATORS FAIL TO MANUALLY OPEN STEAM VALVES TO TDAFW PUMP (NO FIRE). This event represents the failure of operators to manually start a TDAFW pump during a non-fire event when the start signal to the pump fails. Procedure ECA-0.0, Step 4 requires operators to verify that the TDAFW pump is running. Timing for this action is the same as for AFHFDSAFWX.	1.00E-01		Use same screening value.	1.00E-01
AXHFDCITYW	OPERATORS FAIL TO USE CITY FIRE WATER FOR SAFW PER ER-AFW.1. This event represents the failure of operators to align the SAFW system to take suction from the city water supply using a hydrant connection. Directions are provided per Step 4.6 of ER-AFW. The timing for this step is the same as for AFHFDSAFWX. Cues would also be from FR-H.1 or any other EOP step which verifies AFW flow and CST level (note - these are continuous actions - see E-0 foldout page).	1.00E-01	FIDG1B10	If operators use EOPs, then same procedure steps apply and no change is necessary. All important fire scenarios involve successful suppression so assume no impact of fire on ex-control room actions. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.5E-02

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AXHFDSAFWX	OPERATORS FAIL TO CORRECTLY ALIGN SAFW. This event represents the failure of operators to align and start the SAFW system for events which result in a loss of all three AFW trains and MFW (e.g., HELB or SLB events). SAFW must be aligned prior to steam generator dryout which occurs at 45 minutes following a loss of MFW event. Procedure FR-H.1, Step 7, directs operators to align the SAFW system for operation per Attachment SAFW.	1.00E-01	FI00RR5 FI000AVT FI00ABB03 FI0RC2-1 FI00TYW3 FI0TB1FP FI0TYE2 FI0RC2-2 FIDG1B10	If operators use EOPs, then same procedure steps apply and no change is necessary. Normally, no ex-control room actions required. If ER-FIRE procedures are used, value was increased to 1.00E-02 to account for need to perform these actions outside the control room (event FSAZCORR02).	5.19E-03
CCHFD738AB	OPERATORS FAIL TO MANUALLY OPEN MOV 738A/B WHEN ELECTRICAL FAILURE OCCURS. This event represents the failure to locally open the CCW isolation valves to the RHR heat exchangers when no power is available. ES-1.3, Step 5 has operators verify that MOV 738A and 738B are open and dispatches an Auxiliary Operator to locally open these valves if not. Timing for this action is the same as for event RRHFDRECR*.	1.00E-01		Use same screening value.	1.00E-01
CCHFDCCWAB	OPERATORS FAIL TO START STANDBY CCW PUMP IF AUTO START FAILS. This event represents failure to start the standby CCW pump given that the running pump fails and the auto start signal on low header pressure fails. This event is used for seal LOCA modeling only, not for CCW failure in recirculation sequences. Operators would have 1 hour to start the standby pump prior to long-term RCP seal failure. Operators have the following cues to indicate the need for starting the standby CCW pump: Annunciators A-17, and A-31. AR-A-17 directs the operators to procedure AP-CCW.2, while AR-A-31 instructs the operators to insure a CCW pump is running and also refers them to procedure AP-CCW.2. Both these procedures direct operators to start the standby pump. Also, ES-0.1 Step 4 verifies the status of CCW pumps and instructs the operators to manually start a pump as required following an UV.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to operators to manually start CCW pumps as necessary for long-term RHR support (e.g., ER-FIRE.1, Step 4.4.11). No change required.	7.0E-03
CCHFDSTART	OPERATORS FAIL TO START A CCW PUMP FOLLOWING AN EVENT WITH BOTH A LOOP AND SI. This event occurs during a loss of offsite power coincident with an SI signal which trips the CCW pumps such that they must be manually restarted. This event is used for seal LOCA modeling only (i.e. not for CCW failure for recirculation). Operators would have 1 hour to start the standby pump prior to long-term RCP seal failure. Procedure E-0, step 13 directs operators to verify that at least one CCW pump is running, and if not, to start a pump.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to operators to manually start CCW pumps as necessary for long-term RHR support (e.g., ER-FIRE.1, Step 4.4.11). No change required.	7.0E-03

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CCHFDSTARX	OPERATORS FAIL TO START A CCW PUMP FOLLOWING LOSS OF DC CONTROL POWER. This event represents the failure of operators to locally close the CCW pump breaker when DC power is lost. Timing and procedural steps are the same as for CCHFDSTART.	1.00E-01		Use same screening value.	1.00E-01
CTHFDCNMTXX	OPERATORS FAIL TO MANUALLY INITIATE SI MASTER RELAY LOGIC OR ISOLATE CNMT FOR FIRE OR FLOOD (EX CR). This event represents the failure of operators to locally isolate containment isolation valves in the event that DC power to the master relays fails during a fire (i.e., control room is evacuated). Timing and cues are the same as for CTHFDCNMTXZ.	1.00E-01		See Description of Human Event.	1.00E-01
CTHFDCNMTXZ	OPERATORS FAIL TO MANUALLY INITIATE SI MASTER RELAY LOGIC OR ISOLATE CNMT FOR FIRE OR FLOOD (CR ACT). This event represents the failure of operators to manually isolate containment isolation valves from the control room in the event that DC power to the master relays fail. Operators would have several hours to accomplish this task (i.e., after core damage and release of radioactivity from the core). Procedure E-0, Step 12 has the operators verify that all containment isolation valves status lights are bright. CIVs can be closed from the control room or locally in the field as directed by the EOP Attachment.	1.00E-01		See Description of Human Event.	1.00E-01
CTHFDFIREX	OPERATORS FAIL TO RECOVER ISOLATED COMPONENTS POST FIRE OR FLOOD. This event represents the failure of operators to unisolate or re-energize components following a fire that leads to core damage. The ER-FIRE procedures have operators intentionally isolate components electrically to prevent a hot short from resulting in equipment failures. However, once core damage has occurred, several items of equipment must be re-energized to prevent containment failure. Timing for this event is estimated to be at least 1 hour following core damage. Operators would be directed to use this equipment by entering the EOPs following core damage.	1.00E-01		See Description of Human Event.	1.00E-01
CTHFDLOCAL	OPERATORS FAIL TO LOCALLY CLOSE EQUIPMENT BREAKERS FOR CNMT HEAT REMOVAL FUNCTIONS. This event is similar to CTHFDFIREX but refers specifically to containment heat removal functions. Timing and procedural steps are the same.	1.00E-01		See Description of Human Event.	1.00E-01
CTHFDNEWCAB	OPERATORS FAIL TO RUN NEW CABLING, ETC FOR CNMT HEAT REMOVAL FUNCTIONS. This event is similar to CTHFDFIREX but refers specifically to running new cables to the containment fan coolers. Timing for this event would be several hours following core damage. Plant personnel are directed to perform this action by the ER-FIRE procedures.	1.00E-01		See Description of Human Event.	1.00E-01

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CVHFD00313	OPERATORS FAIL TO MANUALLY ISOLATE MOV 313 (SEAL RETURN LINE). This event represents the failure of operators to manually isolate containment isolation MOV 313 given that it fails to close upon a CI signal following a LBLOCA. This action is necessary to prevent a potential ISLOCA event. This event is applicable to sump recirculation sequences, and must be completed prior to going on recirc. Therefore, the timing of this event is different for the different LOCA sequences. Procedure E-0, Step 12 instructs operators to verify all containment isolation valve status lights are lit. If not, they are directed to locally close alternate isolation valves per Attachment CI/CVI.	1.00E-01	LILBLOCA	LBLOCA accident sequences are not credible for fire and flood events; no change required.	1.3E-02
CVHFD00313-M	OPERATORS FAIL TO MANUALLY ISOLATE MOV 313 (SEAL RETURN LINE) - MBLOCA. Same as CVHFD00313 but timing is for Medium LOCA.	1.00E-01	LIMBLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.2E-03
CVHFD00313-S	OPERATORS FAIL TO MANUALLY ISOLATE MOV 313 (SEAL RETURN LINE) - SLOCA. Same as CVHFD00313 but timing is for Small LOCA.	1.00E-01	LIOSLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.2E-03
CVHFD00313-SS	OPERATORS FAIL TO MANUALLY ISOLATE MOV 313 (SEAL RETURN LINE) - SSLOCA. Same as CVHFD00313 but timing is for Small-Small LOCA.	1.00E-01	LISSLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.2E-03
CVHFD00371	OPERATORS FAIL TO MANUALLY ISOLATE AOV 371 (LETDOWN LINE). This event represents the failure of operators to manually isolate containment isolation AOV 371 given that it fails to close upon a CI signal. This event is applicable to sump recirculation sequences, and must be completed prior to going on recirc. Therefore, the timing of this event is different for the different LOCA sequences. Procedure E-0, step 12 instructs operators to verify all containment isolation valve status lights are lit. If not, they are directed to locally close alternate isolation valves per Attachment CI/CVI.	1.00E-01	LILBLOCA	LBLOCA accident sequences are not credible for fire and flood events; no change required.	1.3E-02

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CVHFD00371-M	OPERATORS FAIL TO MANUALLY ISOLATE AOV 371 (LETDOWN LINE) - MBLOCA. Same as CVHFD00371 but timing is for Medium LOCA.	1.00E-01	LIMBLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	5.3E-03
CVHFD00371-S	OPERATORS FAIL TO MANUALLY ISOLATE AOV 371 (LETDOWN LINE) - SBLOCA. Same as CVHFD00371 but timing is for Small LOCA.	1.00E-01	LIOSLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.2E-03
CVHFD00371-SS	OPERATORS FAIL TO MANUALLY ISOLATE AOV 371 (LETDOWN LINE) - SSLOCA. Same as CVHFD00371 but timing is for Small-Small LOCA.	1.00E-01	LISSLOCA	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedure guidance so a probability of 1.0 is used.	1.2E-03
CVHFD01BAF	OPERATORS FAIL TO START SI/CHARGING PUMPS FOR INVENTORY MAKEUP TO REACH CSD. This event represents the need to manually start a charging or SI pump for RCS inventory control when needed to achieve CSD (i.e., go to RHR conditions). This event is only used for non-control room evacuation sequences. Timing for this event depends on RCS leakage, but would be expected to be several hours under normal leakage and cooldown conditions (> 3 hours). If RCS leakage is excessive, operators would be receive cue via continuous actions for SI initiation contained in all EOPs where SI is not running (e.g., ES-0.1 foldout page). For normal RCS leakage considerations, EOPs establish charging as a normal course in terminating SI or stabilizing the plant (e.g., E-0, Step 38). See event CVHFDMPST.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then these provide specific guidance (e.g., ER-FIRE.1, Step 4.3.1.3) and separate human actions are modeled.	1.5E-03
CVHFD350OP	OPERATORS FAIL TO OPEN MOV 350 LOCALLY OR USE BYPASS. This event represents the failure of operators to manually open MOV 350 (or its bypass) to provide a boron injection path. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01

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CVHFDDBORAT	OPERATORS FAIL TO IMPLEMENT EMERGENCY BORATION. This event represents failure of operators to provide emergency boration to the RCS during an ATWS event within 10 minutes . Failure to do so results in a failure to achieve long-term shutdown reactivity margin. Final value taken from WCAP-11993, page B-25. Operators are directed to initiate emergency boration per FR-S.1, Step 4 from E-0 Step 1.	1.00E-01		ATWS is only addressed in FR-S.1 and would be used for all external events. FR-S.1 provides both in-control room and ex-control room options. No change required.	1.00E-02
CVHFDMPMPST	OPERATORS FAIL TO MANUALLY LOAD CHARGING PUMP. This event represents failure of operators to manually start charging pumps following an undervoltage signal or an SI signal, since the pumps are shed from the bus on either signal. Operators have 1 hour to start a charging pump prior to long-term RCP seal failure. Procedures E-0, Step 38 (for SI conditions) and ES-0.1, Step 7 (for non-SI conditions) provide the necessary operator direction.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance for starting pumps (e.g., ER-FIRE.1, Step 4.3.1.3). Due to available time, no change required.	1.0E-03
CVHFDSDINJ	OPERATORS FAIL TO INITIATE CHARGING. This event represents the failure of operators to initiate charging during a shutdown dilution event. Timing for this event depends on the volume of water in the RCS cavity and the rate of the dilution event.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	5.00E-03
CVHFDSTARX	OPERATOR FAILS TO START A CHARGING PUMP FOLLOWING LOSS OF DC CONTROL POWER. This event represents failure of operators to locally start a charging pump when no DC power is available. Timing and procedural direction are the same as for CVHFD01BAF.	1.00E-01		Use same screening value.	1.00E-01
CVHFDSTOPP	OPERATORS FAIL TO REDUCE CHARGING TO PREVENT PORV LIFT. This event represents the failure of operators to terminate charging following a loss of RHR event to prevent a PORV lift as the RCS pressurizes. Timing for this event is estimated to be < 15 minutes with procedural actions driven by AP-RHR.1.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	5.00E-02
CVHFD SUCTN	OPERATORS FAIL TO MANUALLY OPEN SUCTION LINE TO CHARGING PUMPS UPON LOSS OF IA. This event represents the failure of operators to open the alternate suction valve to the RWST, and to isolate the VCT, upon a loss of support systems for the normal valves, which would cause them to go closed (i.e. loss of IA or DC power). Operators would have 30 minutes to complete the task prior to the VCT draining down to the point where there could be air entrainment in the charging pumps, failing the pumps. Procedures E-0, Step 38 (for SI conditions) and ES-0.1, Step 6 RNO, provides directions for operators to locally open manual charging pump suction valve to the RWST and close the isolation valve to the VCT.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance for starting pumps (ER-FIRE.1, Attach 4). Due to available time, no change required.	2.4E-02

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
DGHFDCITYW	OPERATORS FAIL TO CONNECT CITY WATER TO DG COOLING PER ER-DG. This event represents the failure of operators to provide city water cooling to the DGs in the event that SW is lost. Timing for this event is based on the operators tripping the DG before damage would occur (at least 10 minutes for loaded DG; 20 minutes for unloaded) and implementing ER-D/G.2. This procedure must be implemented prior to core damage (minimum of 1 hour depending on RCS leakage). Cues to the loss of SW would be DG high temperature alarms on the MCB, ES-0.1, Step 5, and E-0, Step 11 (Verify at least 2 SW pumps running). ER-D/G.2 would be implemented from ECA-0.0, Step 5.	1.00E-01	FI0TB1-5	<i>See Description of Human Event.</i>	3.5E-02
FSHFD03996	OPERATORS FAIL TO RECOVER TDAFW MOV 3996 FOLLOWING HOT SHORT. This event represents the failure of operators to manually open the discharge MOV from TDAFW pump if it were to fail closed following a fire. Timing for this event is dependent on the time at which the valve went closed but as a minimum is the same as for event AFHFDSAFWX. Cues would be available from EOP continuous action steps which verify AFW flow and from local operator verification of flow during ER-FIRE procedures.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFD850XX	OPERATORS FAIL TO ISOLATE 850A/B LOCALLY AFTER HOT SHORT. This event represents the failure of operators to locally isolate MOV 850A and 850B during a fire event to prevent draining the RWST into containment. ER-FIRE.1 Attachment 4 instructs operators to open the breakers for MOV 850A/B and verify that 856 is closed as part of plant recovery. Timing is based on when hot short occurs and the rate of RWST draindown via a 8" line.	1.00E-01	FI0CR3-1	<i>See Description of Human Event.</i>	6.4E-03
FSHFDAFW1A	FAILURE TO LOCALLY START AND CONTROL MDAFW PUMP 1A. This event addresses scenarios where the MDAFW Pump receives no automatic start signal and operations personnel would have to locally start the pump. Timing for this event is the same as for AFHFDSAFWX. Cues would be available from E-0, Step 15 and EOP continuous action steps which verify AFW flow, and from local operator verification of flow during ER-FIRE procedures.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDAFWXX	HCO FAILS TO LOCALLY OPEN MOV 3996 AND MOV 3505A PER ATTACHMENT 3 OF ER-FIRE. This event represents the failure of the HCO to perform required actions following a fire in the control/relay room, cable tunnel, or Auxiliary Building. These actions are contained in Attachment 3 to ER-FIRE.1, .2, and .3. Timing for this event would be same as for AFHFDSAFWX.	1.00E-01	FI0CR3-1 FI000RR3	<i>See Description of Human Event.</i>	2.6E-02

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDARVXX	FAILURE TO DEPRESSURIZE SG A USING ARV 3411. This event represents failure to depressurize SG A using ARV 3411. These actions are addressed in Step 4.4.10.6 in ER-FIRE.1, .2, .3; Step 4.4.3.4 in ER-FIRE.4 and .5. Timing for this event is several hours since the plant can remain stabilized at HSD for long periods of time if AFW is available.	1.00E-01	FI0CR3-1	<i>See Description of Human Event.</i>	6.4E-03
FSHFDAUXBB	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN AUX BLDG. BASEMENT. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to DC power failures. However, Bus 17 power is available such that operators could manually close the breaker in the Screenhouse to start pump if necessary. Can also use city water and extinguishers. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FI00ABB3	<i>See Description of Human Event.</i>	1.8E-02
FSHFDAUXBM	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN AUX BLDG. INTERMEDIATE LEVEL. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to DC power failures. However, Bus 17 power is available such that operators could manually close the breaker in the Screenhouse to start pump if necessary. Can also use city water and extinguishers. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDBR1A3	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN BATTERY ZONE BR1A-3. No automatic suppression in zone. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FIBR1A-3	<i>See Description of Human Event.</i>	1.8E-02
FSHFDBR1B3	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN BATTERY ZONE BR1B-3. No automatic suppression in zone. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FIBR1B-3	<i>See Description of Human Event.</i>	1.8E-02
FSHFDCABTN	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN CABLE TUNNEL. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to DC power failures. However, Bus 17 power is available such that operators could manually close the breaker in the Screenhouse to start pump if necessary. Can also use city water and extinguishers. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FI00CT1	<i>See Description of Human Event.</i>	1.8E-02
FSHFDCHG1A	CO FAILS TO LINE UP ALTERNATE DC TO CHG PUMP A AND START PER ATTACHMENT TO ER-FIRE. This event represents failure of the CO to use the alternate DC supply to the Charging Pumps. Attachment 4 to ER-FIRE.1, .2, and .3 provide the necessary actions. Timing for this event is similar to CVHFDMPST.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDCCL313	OPERATORS FAIL TO CLOSE MOV 313 FOLLOWING A FIRE USING E-0. This event is similar to CTHFDCNMTXZ but pertains specifically to the need to isolate MOV 313 to avoid a LOCA outside containment via seal return.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDCR-3-X	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN CONTROL ROOM. No automatic suppression in zone. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FI0CR3-1	<i>See Description of Human Event.</i>	1.8E-02
FSHFDCRAHR	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN AIR HANDLING ROOM. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to DC power failures. However, Bus 17 power is available such that operators could manually close the breaker to start to pump if necessary. Can also use city water and extinguishers. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FI00AHR1	<i>See Description of Human Event.</i>	1.8E-02
FSHFDCROM1	OPS FAIL TO USE ALTERNATE NATURAL CIRC INSTRUMENTATION WHEN CONTROL ROOM INDICATION LOST. This event represents the failure to use ex-control room indications for natural circulation when control board indications for T _{hot} ; subcooling monitor + (p _{zr} pressure or CETs fail); and T _{cold} + SG Pressure fail. This is for non ER-FIRE procedures. EOPs have operators continuously verifying natural circulation via fold out pages, typically by the STA. Action would be taken as necessary to use alternate indication (e.g., local operating stations). Timing is dependent upon equipment availability. That is, if have degraded secondary heat sink then must verify quickly to ensure adequate natural circulation. If everything is operable then only need to verify as part of long-term actions since have only lost positive verification of natural circulation, not the capability to perform.	1.00E-01	FIIBN1-3 FI000RR6	<i>See Description of Human Event.</i>	4.00E-03
FSHFDCROM2	OPS FAIL TO USE ALTERNATE AFW/SG INSTRUMENTATION WHEN CONTROL ROOM INDICATION LOST. This event represents the failure to use ex-control room indicators for AFW/SG instrumentation when control board indications for SG level and AFW flow fail to both SGs. This is for non ER-FIRE procedures. EOPs have operators continuously verify SG level and AFW flow via foldout page for SI termination. Action would be taken as necessary to use alternate indication (e.g., AFW local operating station). Timing is dependent upon AFW availability. That is, if AFW is lost, then need indication immediately in order to initiate recovery actions. However, there would be other control room indications available (CETs, AFW pump breaker status, etc). If AFW is available, then need indication to ensure no SG dryout or overfill. Again, other control room indications provide supporting information (CETs, SG pressure).	1.00E-01	FI0CR3-1 FI0RC2-2 FI000RR6 FIIBN1-3 FI0TB1-5 FI0TB2-1 FI0TB2-3 FI000RR3 FI000RC3 FI00AB01 FIDG1B11 FIDG1B10	<i>See Description of Human Event.</i>	6.7E-03

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDCROM3	OPS FAIL TO USE ALTERNATE PZR INSTRUMENTATION WHEN CONTROL ROOM INDICATION LOST. This event represents the failure to use ex-control room indicators for Pressurizer pressure or level instrumentation when control board indications fail. This is for non ER-FIRE procedures. EOPs have operators continuously verify Pzr level and pressure for SI re-initiation. Action would be taken as necessary to use alternate indication (Aux Bldg local operation station). Timing is dependent upon RCS conditions. That is, if normal RCS leakage is occurring, then 20-30 minutes should be available. If significant RCS leakage is occurring, then there is a more immediate need. However, alternate indications exist (natural circulation, SI/Charging flow).	1.00E-01		<i>See Description of Human Event.</i>	3.2E-02
FSHFDCVCSX	OPERATORS FAIL TO ALIGN TSC DIESEL TO SUPPLY EITHER CHARGING PUMP B OR C WITH AC POWER. This event represents the failure of operators to locally connect the TSC Diesel to supply Charging Pump B or C with power. Actions are driven by ER-ELEC via ER-D/G.1. Timing for this event is similar to CVHFDSTART.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDDCPWR	FAILURE TO ALIGN TSC DC SUPPLY TO BATTERY B FOR TDAFW PUMP PER ATTACHMENT 8 OF ER-FIRE. This event represents the failure of operators to provide a long-term source of DC power for the TDAFW pump. Timing for this event is 10 hours based on 6-8 hour battery life and time before core uncover. Actions are provided in Attachment 8 to ER-FIRE.1, .2, .3, .4, and .5.	1.00E-01	FI000RR3 FI0CR3-1 FIBR1A-3	<i>See Description of Human Event.</i>	1.3E-03
FSHFDDGAXX	STA FAILS TO START DG A PER ATTACHMENT 2 TO ER-FIRE. This event represents the failure of the STA to locally start DG A following a control/relay room or Battery Room B fire. Attachment 2 to ER-FIRE.1 and .5 provide the necessary actions. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01	FIBR1B-3	<i>See Description of Human Event.</i>	6.4E-03
FSHFDDGAXY	CRF FAILS TO STRIP BUS 18 LOADS AND MANUALLY CLOSE BREAKER TO DG A PER ATTACHMENT 1 TO ER-FIRE. This event represents the failure of the CRF to strip Bus 18 loads and manually close the breaker for DG A for fires in the control/relay room, cable tunnel, and Battery Room B. Attachment 1 to ER-FIRE.1, .2, and .5 provide the necessary actions. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01	FIBR1B-3 FI0CR3-1	<i>See Description of Human Event.</i>	3.9E-03

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDDGAXZ	CO FAILS TO STRIP BUS 14 LOADS AND MANUALLY CLOSE BREAKER TO DG A / SW A PER ATTACHMENT 4 TO ER-FIRE. This event represents the failure of the CO to strip Bus 14 loads and manually close DG A and SW Pump A breakers for fires in the control/relay room, cable tunnel, Auxiliary Bldg, and Battery Room B. Attachment 4 to ER-FIRE.1, .2, .3, and .5 provide the necessary actions. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01		<i>See Description of Human Event.</i>	3.9E-03
FSHFDDGBXX	STA FAILS TO START DG B AND SW PUMP PER ER-FIRE.4. This event represents the failure of the STA to start DG B and a SW Pump for fires in Battery Room A. Attachment 2 to ER-FIRE.4 provides the necessary actions. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDIBLDG	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN INTERMEDIATE BLDG. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to an SI signal. However, Bus 17 power is available such that operators could manually reset SI and close the breaker to start to pump if necessary. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDLOSPX	OPERATORS FAIL TO RESTORE OFFSITE POWER FOLLOWING HOT SHORT. This event represents the failure of the operators to recover offsite power when a fire in the switchyard (initiators FI00TYE1, FI00TYE3, or FI00TYW2) causes the event. While no specific recovery procedure was modeled, EOPs and plant shutdown procedures instruct operators to attempt to restore offsite power as time permits. Event assumed to be required within 1 hour for RCP seals.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDNORCV	OPERATORS FAIL TO RECOVER HOT SHORT EVENT IN UV SYSTEM. This generic event was applied to all hot short failures in the UV system. This event is equivalent to FSHFDUVLOG but only applies to hot short failures. E-0, Step 3 has operators check that at least one train of AC power is available or attempt a manual start of the DG. Subsequent local actions would be based on ECA-0.0 and ER-D/G.1. The ER-FIRE procedures specifically instruct the operators to manually place loads on the DG. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDOPENC	OPERATORS FAIL TO OPEN CIRCUIT FROM HOT SHORT FAILURES (GENERIC). This generic event was applied to operators failing to manually recover any hot short event. Events for which this was potentially important were separated out (e.g., FSHFD03996). No specific procedure actions exist to perform these actions except as operators verify each EOP step and discover valves closed, etc. Timing would be based on the component that is affected.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDOPENV	OPERATORS FAIL TO RECOVER HOT SHORT EVENT AFFECTING SW ISOLATION VALVES. This event represents the failure of operators to manually open the SW isolation valves following a hot short which caused them to fail closed. EOPs have the operators verify that the SW isolation valves are open prior to starting equipment that would be cooled by these isolation valves (e.g., E-0, Step 33). Timing would be based on the component affected and would typically be longer term (e.g., IA compressors, CCW, SAFW).	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDOVDFP	FAILURE TO RECOVER DIESEL FIRE PUMP AFTER AUTO INITIATION FAILS. This event represents the failure of operators to manually initiate the diesel fire pump from the control room following notification that a fire exists. Cues for this event would be control room notification of fire or smoke from plant personnel, or smoke detectors alarming in the control room. Timing would be based on the severity of the fire (i.e., a severe fire would provide rapid control room notification versus a smaller fire which might require more time for discovery).	1.00E-01		<i>See Description of Human Event.</i>	3.2E-02
FSHFDPFP02	OPERATORS FAILS TO MANUALLY START MOTOR-DRIVEN FIRE SERVICE WATER PUMP. This event represents the failure of operators to manually start the motor-driven fire pump from the control room when the automatic start logic failed. Timing for this event is dependent upon the fire severity but would generally be within 5 minutes. Cues to start the pump would be fire alarms within the control room and the response of the fire brigade to these alarms.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDPORVS	OPERATORS/I&C FAIL TO PERFORM ER-FIRE.1 ATTACHMENT 9 (PORV LOCAL OPERATION). This event represents the failure of operators to manually depressurize the primary system using pressurizer PORV 430 for any fire requiring ex-control room shutdown capability. Attachment 9 to ER-FIRE.1, .2, .3, .4, and .5 provides the necessary instructions for operators. Timing for this event is long-term (e.g., 10 hours) since the plant can remain at HSD for extended periods of time.	1.00E-01	FI000RR3 FI0CR3-1	<i>See Description of Human Event.</i>	2.6E-03

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDPWRAX	OPERATORS FAIL TO RECOVER OFFSITE POWER/DG TO BUS 14/18 AFTER FIRE. This event addresses the failure of operations personnel to recover either DG A or offsite power to Buses 14 and 18 after a fire causes isolation of a bus. The fire is <u>not</u> in the area of the buses but causes undervoltage or overcurrent logic to strip the buses and prevent them from being used. Timing for this event is based on equipment that is available (e.g., TDAFW pump) - worst case would be 1 hour. Procedure ECA-0.0, Step 7 has operators determine if offsite power is available under SBO conditions; several other EOPs direct this activity for non-SBO conditions. The ER-FIRE procedures have instructions for verifying AC power availability which would provide early indication to operators to begin recovery action.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDR2-2	FIRE BRIGADE FAILS TO MANUALLY SUPPRESS FIRE IN CNMT ZONE RC-2-2. No automatic suppression system in zone. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training. There is also a limited oxygen supply within CNMT due to its design.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDR3	FAILURE TO FIND ALTERNATIVE COOLDOWN PATHS (TDAFW STEAM LINES). This event represents the failure of operators to use alternative paths to cooldown and depressurize the secondary side in the event that no ARVs are available. FR-H.4 provides the necessary actions. Timing for this event would be long-term since the plant can remain at HSD for long-periods of time assuming normal RCS leakage.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDRPORV	OPERATOR FAILS TO DE-ENERGIZE PORV CONTROL CIRCUIT. This event represents the failure of operators to de-energize a PORV that is stuck open due to a hot short failure. This must occur within 3 minutes to prevent the need for SI/RHR (see RCHFDPLOCA). EOPs instruct the operators to verify PORV status (E-0, Step 21), while AP-CR.1, Step 3 provides the necessary actions prior to entry into the ER-FIRE procedures.	1.00E-01		<i>See Description of Human Event.</i>	6.4E-03
FSHFDRROOM	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN RELAY ROOM. This event represents the failure to manually extinguish a fire in the relay room following failure of the halon system. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01	FI000RR3	<i>See Description of Human Event.</i>	1.8E-02
FSHFDSAFWX	OPERATOR FAILS TO COMPLETE WATER SOLID SG OPERATION POST FIRE. For Aux Bldg. fire recovery events, the plant achieves cold shutdown via filling the SGs to a water solid condition. This human action represents an operator error to achieve these conditions using SAFW. ER-FIRE.3 Attachment 10 provides the necessary operator actions. Timing is a long-term event since the plant can stay at HSD for long periods of time assuming normal RCS leakage.	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFDSH2-1	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN SCREENHOUSE ZONE SH-2-1. No automatic suppression system in zone. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDSHBAS	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN SCREENHOUSE BASEMENT. Both the diesel and motor driven fire pump are assumed failed due to the fire such that only city water and extinguishers are available. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDSTADG	STA FAILS TO START DG FROM CONTROL ROOM PER ATTACHMENT 2 TO ER-FIRE.2. This event represents the failure of the STA to start DG A from the control room in the event of a fire in the cable tunnel. ER-FIRE.2 and .3, Attachment 2 provides the necessary actions. Timing for this event is based on RCS leakage considerations (< 1 hour for not requiring RHR, up to 10 hours to prevent core damage).	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01
FSHFDTBLDI	FIRE BRIGADE FAILS TO MANUALLY EXTINGUISH FIRE IN TURBINE BLDG. INTERMEDIATE LEVEL. The diesel fire pump is assumed to independently fail with the motor-driven pump failing due to DC power failures. However, Bus 17 power is available such that operators could manually close the breaker in the Screenhouse to start the pump if necessary. Also, city water and extinguishers can be used. Timing for this event is based on the severity of the fire. Actions are based on fire brigade training.	3.00E-01		<i>See Description of Human Event.</i>	1.8E-02
FSHFDTDAFW	HUMAN FAILURE TO RECOVER SPURIOUSLY OPEN TDAFW STEAM ADMISSION VALVE DUE TO HOT SHORT. This event addresses the failure of operators to manually close the steam admission valves for SG isolation purposes after a hot short causes the valve to open. EOPs instruct the operators to verify all steam paths are closed under SI conditions (E-2, Step 4). Timing is based on the need for SG isolation.	1.00E-01		<i>See Description of Human Event.</i>	1.3E-03
FSHFDTSCDG	FAILURE TO REMOVE FAULTED TSC BATTERY AND CONNECT DIRECTLY TO TSC DG. This event represents the failure of operators to remove a fault associated with the TSC battery and connect the TSC DG and associated battery charger directly to the plant battery B. This action is not proceduralized; however, the action was performed during the on-line replacement of the TSC batteries in 1999 and is relatively simple to perform. Timing is approximately 8 hours (capacity of Battery B without charging).	1.00E-01		<i>See Description of Human Event.</i>	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
FSHFUVLOG	OPERATORS FAIL TO RECOVER LOCKIN OF BUS UV LOGIC FOR DG BREAKER. The UV logic for the 480V safeguards buses have installed fuses which if there were to open, would cause an UV signal to be locked into the bus. In these instances, the DG feeder breaker would close onto the bus, but all other loads would be prevented from loading (e.g., pumps). Plant personnel would then have to replace the fuse to allow the breakers to close. ECA-0.0, Step 5 directs operators to ER-D/G.1 which provides necessary actions (Step 4.4). Event assumed to be required within 1 hour.	1.00E-01	FIBRIB-3	See Description of Human Event.	1.3E-02
HVHFDSAFWB	OPERATORS FAIL TO RECOVER COOLING TO SAFW ROOM FOR LONG-TERM PROTECTION OF PUMPS. This event represents the failure of operators to implement cooling of the SAFW room for long-term protection of the SAFW pump motors. There is no direct procedural steps for this action. Auxiliary Operators would be performing frequent rounds of the SAFW room if this equipment was being used as the source of feedwater. There is a large wall thermometer available in the room. Timing would be at least 1 day since the motors could tolerate short durations of extreme temperatures.	1.00E-01		See Description of Human Event.	1.6E-03
HVHFD_CTMT	OPERATORS FAIL TO RE-START CONTAINMENT COOLING. This event represents the failure of operators to re-start Containment Recirculation Fan Coolers (CRFCs). The CRFCs combined with the containment spray system work to limit post accident pressure and temperature. If the CRFCs fail to start due to ESFAS signal failure and less than 2 CRFCs are initially running, operators must restart containment fan coolers to prevent exceeding the ultimate containment pressure of ~140 psig. Operators are directed to start or verify CRFCs are running when required by E-0, Step 6.	1.00E-01		Use same screening value.	1.00E-01
IAHFDCSA03	OPERATORS FAIL TO PLACE CNMT BREATHING AIR COMPRESSOR IN SERVICE. The containment breathing air compressor provides manual backup to the IA compressors. This event represents failure to place this portable air compressor into service when needed as backup to the IA compressors (e.g., attempt to use IA supply to PORVs). On receipt of annunciator H-8 or other indication of loss of IA, operators are directed to go to AP-IA.1 which directs the portable air compressors be started per procedure T-2F. In addition, EOPs provide this alternative (e.g., E-0, Step 33 and ES-0.1, Step 6).	1.00E-01		Use same screening value.	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
IAHFDCSA04	OPERATORS FAIL TO PLACE THE DIESEL AIR COMPRESSOR IN SERVICE. The diesel air compressor provides manual backup to the IA compressors. This event represents failure to place the portable air compressor into service when needed as backup to the IA compressors (e.g., attempt to use IA supply to PORVs). On receipt of annunciator H-8 or other indication of loss of IA, operators are directed to go to AP-IA.1 which directs the portable air compressors be started per procedure T-2F. In addition, EOPs provide this alternative (e.g., E-0, Step 33 and ES-0.1, Step 6).	1.00E-01		Use same screening value.	1.00E-01
IFHFDABISOL	FAILURE TO ISOLATE AUX BLDG. FLOOD PRIOR TO SUBMERGENCE OF CHARGING SYSTEM. This event represents the failure of operators to isolate a flood in the Auxiliary Bldg basement prior to flooding the charging system. There are no specific procedures to perform this activity, but there are numerous alarms available to the control room to indicate a flood (e.g., sump actuations, low flow/level in the ruptured system). Timing of this event is based on the size of the leak.	1.00E-01		<i>See Description of Human Event</i>	1.00E-01
IFHFDACPWR	FAILURE TO ALIGN SECURITY DIESEL TO OPERATE SHROUD FAN. This event represents the failure of operators to use the security DG to provide AC power for the Shroud Fans to support natural circulation following a long-term SBO. ER-ELEC.5 provides the necessary instructions as driven by ER-D/G.1 and ECA-0.0. Timing is 6 hours based on ITS LCO 3.4.10.	1.00E-01		<i>See Description of Human Event</i>	1.3E-03
IFHFDAFW1A	FAILURE TO LOCALLY START AND CONTROL AFW PUMP 1A (CR EVAC - FLOOD). This is similar to FSHFDAFW1A except it applies to floods.	1.00E-01		<i>See Description of Human Event</i>	1.00E-01
IFHFDAFWSW	FAILURE TO LOCALLY ALIGN SW TO TDAFW AND SAFW SUCTION FOLLOWING CR EVAC FOR FLOOD. This is similar to AFHFDSUPPL except it applies to floods.	1.00E-01		<i>See Description of Human Event</i>	1.5E-02
IFHFDAFWXX	HCO FAILS TO LOCALLY OPEN MOV 3996 AND MOV 3505A PER ATTACHMENT 3 OF ER-FIRE. This is similar to FSHFDAFWXX except it applies to floods.	1.00E-01		<i>See Description of Human Event</i>	2.6E-02
IFHFDBRISLL	FAILURE TO ISOLATE LARGE SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER. This event represents the failure of operators to isolate a large flood in the Battery Rooms prior to flooding both rooms and failing all DC power. Spray from the flood is assumed to not fail equipment until it is submerged (i.e., no warning provided by spray effects). There are no specific procedures to perform this activity, but there are alarms available to the control room to indicate a flood (e.g., sump actuations). Timing of this event is 17 minutes.	1.00E+00		<i>See Description of Human Event</i>	9.1E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
IFHFDBRISLS	FAILURE TO ISOLATE SMALL SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER (SUMP PUMP FAILS). This event is similar to IFHFDBRISLL but assumes spray effects will provide a warning while the sump pump is failed. There are no specific procedures to perform this activity. This event also assumes the sump pump has failed such that the only control room indication would be equipment failures. Timing of this event is 13 minutes.	1.00E+00		<i>See Description of Human Event</i>	9.4E-01
IFHFDBRISNS	FAILURE TO ISOLATE SMALL SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER (SUMP FAILS). This event represents the failure of operators to isolate a small flood in the Battery Rooms prior to flooding both rooms and failing all DC power. There are no specific procedures to perform this activity. This event assumes the sump pump fails such that the only control room indication would be equipment failures. Timing of this event is approximately 60 minutes.	1.00E-01		<i>See Description of Human Event</i>	2.9E-03
IFHFDBRISOL	FAILURE TO ISOLATE LARGE SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER. This event is similar to IFHFDBRISLL but assumes spray effects and the sump pump will provide warnings. There are no specific procedures to perform this activity, but there are numerous alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment effects). Timing of this event is 17 minutes.	1.00E+00		<i>See Description of Human Event</i>	4.4E-01
IFHFDBRISOLS	FAILURE TO ISOLATE SMALL SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER. This event is similar to IFHFDBRISNS except the sump pump is not failed. There are no specific procedures to perform this activity, but there are numerous alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment effects). Timing of this event is approximately 60 minutes.	1.00E-01		<i>See Description of Human Event</i>	6.6E-03
IFHFDCHG1A	CO FAILS TO LINE UP ALTERNATE DC TO CHG PUMP A AND START PER ATTACHMENT 8 TO ER-FIRE. This is the same event as FSHFDCHG1A except it applies to floods.	1.00E-01		<i>See Description of Human Event</i>	1.00E-01
IFHFDRCIRCW	OPERATORS FAIL TO TRIP CIRC WATER PUMPS UPON INDICATION OF FLOOD WITH NO AUTOMATIC ISOLATION. This event represents the failure of operators to manually trip the circulating water pumps upon indication of a large flood in the turbine building and failure of the automatic trip logic. There are no specific procedural actions for this event. Operators would be aware of significant flood in Turbine Bldg via sump alarms and spraying effect on equipment. Pump trips could be performed from control room, at Bus11A/B on Intermediate Level of Turbine Bldg, or locally in Screenhouse.	1.00E-01		<i>See Description of Human Event</i>	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
IFHFDCVCSX	OPERATORS FAIL TO ALIGN TSC DIESEL TO SUPPLY EITHER CHARGING PUMP B OR C. This is similar to FSHFDCVCSX except for floods.	1.00E-01		See Description of Human Event	2.1E-02
IFHFDDCPWR	FAILURE TO ALIGN TSC DC SUPPLY TO BATTERY B FOR TDAFW PUMP. This is similar to FSHFDDCPWR except for floods.	1.00E-01		See Description of Human Event	1.3E-03
IFHFDDGAXX	STA FAILS TO START DG PER ATTACHMENT 2 TO ER-FIRE.1. This is similar to FSHFDDGAXX except during floods.	1.00E-01		See Description of Human Event	6.4E-03
IFHFDDGAXY	CRF FAILS TO STRIP BUS 18 LOADS AND MANUALLY CLOSE BREAKER FOR DG A PER ATTACHMENT TO ER-FIRE. This is similar to FSHFDDGAXY except during floods.	1.00E-01		See Description of Human Event	3.9E-03
IFHFDDGAXZ	CO FAILS TO STRIP BUS 14 LOADS AND MANUALLY CLOSE BREAKER FOR DG A / SW A PER ATTACHMENT 8 TO ER-FIRE. This is similar to FSHFDDGAXZ except during floods.	1.00E-01		See Description of Human Event	3.9E-03
IFHFDEVACR	OPERATORS FAIL TO USE ER-FIRE.1 FOLLOWING RELAY ROOM FLOOD THAT REQUIRES CONTROL ROOM EVAC. This event represents the failure of operators to enter ER-FIRE.1 for a significant flood in the relay room. ER-FIRE.1, Step 1 contains the entry conditions including flooding events in the relay room. Timing would be approximately 10 minutes based on need for DG cooling; however, ECA-0.0 would provide additional time (1 hour) if this procedure were used first .	1.00E-01		See Description of Human Event	1.6E-03
IFHFDIBISOL	FAILURE TO ISOLATE INTERMEDIATE BLDG. FLOOD PRIOR TO DAMAGE OF ALL IB EQUIPMENT. This event represents the failure of operators to isolate a flood in the Intermediate Bldg. prior to failing all equipment. There are no specific procedures to perform this activity, but there are alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment failures). Timing of this event is based on size of flood.	1.00E-01		See Description of Human Event	1.00E-01
IFHFDLOSP1	FAILURE TO RECONNECT OFFSITE POWER DURING CR EVAC IF DG UNAVAILABLE. This is the same event as FSHFDPWRAX except it applies to floods.	1.00E-01		See Description of Human Event	1.00E-01
IFHFDRWSTX	OPERATORS FAIL TO LOCALLY VERIFY RWST LEVEL FOR CASES WHERE INDICATION IS LOST. This event represents the failure of operators to verify RWST level when using ER-FIRE.1 for long-term cooldown. There is no specific guidance in ER-FIRE.1, but given the RWST volume (300,000 gal) and expected charging rate (15 gpm), this would take days to draindown.	1.00E-01		See Description of Human Event.	5.00E-02

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<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
IFHFDSAFWY	FAILURE TO CONTROL SAFW PUMP LOCALLY. This is similar to AXHFDSAFWX except that it applies to floods where local control of SAFW must be used.	5.00E-01		<i>See Description of Human Event</i>	1.5E-02
IFHFDSISOL	SH FLOOD ISOLATED PRIOR TO SUBMERGENCE OF SH EQUIPMENT. This event represents successful isolation of a screenhouse flood prior to the submergence of required equipment (e.g., SW pumps). This is the complement of IFHFDSLISOL for a large flood.	5.00E-01		<i>See Description of Human Event</i>	5.00E-01
IFHFDSLISOL	FAILURE TO ISOLATE LARGE SH FLOOD. This event represents the failure of operators to isolate a large flood in the Screenhouse prior to failing all equipment. There are no specific procedures to perform this activity, but there are alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment failures). Timing of this event is based on size of flood.	1.00E+00		<i>See Description of Human Event</i>	5.00E-01
IFHFSSISOL	FAILURE TO ISOLATE SMALL SH FLOOD. This event represents the failure of operators to isolate a small flood in the Screenhouse prior to failing all equipment. There are no specific procedures to perform this activity, but there are alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment failures). Timing of this event is based on size of flood.	1.00E-01		<i>See Description of Human Event</i>	6.6E-03
IFHFDTBISOL	FAILURE TO ISOLATE LARGE TB FLOOD. This event represents the failure of operators to isolate a large flood in the Turbine Bldg. (e.g., MFW, MS) prior to failing all equipment. There are no specific procedures to perform this activity, but there are alarms available to the control room to indicate a flood (e.g., sump actuations, sprayed equipment failures). Timing of this event is based on size of flood.	1.00E-01		<i>See Description of Human Event</i>	1.6E-03
MFHFDMF100	OPERATORS FAIL TO REESTABLISH MFW FLOW. This event represents failure of the operators to reinitiate MFW flow post reactor trip, given that AFW cannot be established or is insufficient (<200 gpm). MFW must be established prior to steam generator dryout which occurs at 45 minutes following a loss of MFW. E-0 Step 14 directs the operators to FR-H.1 on loss of AFW. After trying to establish AFW flow, FR-H-1 directs operators to try and establish MFW flow to at least one steam generator. Two values are generated due to the complexity of resetting a SI signal.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, value was increased to 1.00 since no procedure guidance.	1.2E-02 (SI) 9.3E-3 - noSI

**TABLE F-4
Human Error Events - Post Initiators**

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MSHFDISOLA	OPERATORS FAIL TO ISOLATE A RUPTURED SG GIVEN A FAILURE OF NORMAL ISOLATION VALVES. This event represents the failure of the operators to use an alternate method to isolate the ruptured SG given that normal isolation valve fails to close. E-0 step 25 has operators verify that SG tubes are intact. Procedure E-3, Steps 3, 4 and 5, and Attachment RUPTURED S/G, give specific guidance as to how ruptured SG is to be isolated. The RNO section for these steps gives alternate means to isolate. Based on MAAP runs, operators have 45 minutes to complete this task.	1.00E-01		SGTR event not credible during flood or fire event; no change required.	1.00E-01
MSHFDISOLR	OPERATORS FAIL TO ISOLATE A RUPTURED SG. This event represents operator failure to isolate feedwater flow to, and steam flow from, a ruptured SG during a steam generator tube rupture event. E-0 step 25 has operators verify that SG tubes are intact. If SG primary side is not intact, then operators are directed to go to procedure E-3. E-3 (including Attachment RUPTURED SG), give specific guidance as to how ruptured SG is to be isolated. Based on MAAP runs, operators have 45 minutes to complete this task.	1.00E-01		SGTR event not credible during flood or fire event; no change required.	7.24E-03
MSHFDISOLRN	OPERATORS SUCCESSFULLY ISOLATE RUPTURED SG. This event is the complement of MSHFDISOLR.	1.00		SGTR event not credible during flood or fire event; no change required.	9.9E-01
MSHFDMSIVX	OPERATORS FAIL TO CLOSE MSIVS. This event represents the failure of the operators to close the MSIV on the faulted SG. E-0, Step 2 verifies that turbine stop valves have closed and if not, requires closure of MISVs. Procedure E-2, step 1, instructs the operators to check that the MSIV on the faulted SG is closed. If it is not closed, they are directed to manually close the MSIV. This event is only applicable if it is an instrumentation failure (i.e. MSIV must remain capable of closing from the control room). Timing is assumed to be a few minutes (1-2).	1.00E-01		Main steam line break not credible during flood or fire event; no change required.	1.00E-01
RCHFD00MRI	OPERATORS FAIL TO MANUALLY INSERT RODS. This event represents the failure of the operators to manually insert the control rods given that they have failed to insert due to non-mechanical failures (i.e. failure of the trip signal but the rods are still capable of being inserted). The value is based on WCAP-11993, page B-7. Procedural action is based on E-0, Step 1 and FR-S.1.	1.00E-02		ATWS is only addressed in EOPs and would be used for all external events. Each ER-FIRE procedure has guidance to manually trip reactor from control room or locally (e.g., ER-FIRE.1, Step 4.1.1). No change required.	1.00E-02

**TABLE F-4
Human Error Events - Post Initiators**

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RCHFD00RCP	OPERATORS FAIL TO TRIP RCPs AFTER LOSS OF SUPPORT SYSTEMS. This event represents failure of the operators to trip the RCPs after cooling is lost to the RCP seals. Operators have 2 minutes to trip the RCPs prior to seal failure. Operators are directed by procedure E-0, Step 18 to verify CCW flow to the RCP thermal barriers or stop the affected RCPs. For non-SI events, RCP trip criteria is recognized by operators for entry into AP-RCP.1.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide guidance to trip the RCPs very early in procedure (e.g., ER-FIRE.1, Step 4.1.1.3). No change required.	1.61E-02
RCHFD01BAF	OPERATORS FAIL TO MANUALLY START SI PUMPS (BLEED AND FEED). This event represents failure of the operators to recognize or initiate bleed and feed of the RCS for decay heat removal. Bleed and Feed must be initiated within 45 minutes per Section 4.2.2.4. Operators are directed by failure to achieve adequate AFW flow (≥ 200gpm) and SG level (E-0, Step 15. FR-H.1 provides guidance to the operators in performing bleed and feed of the RCS. Different values are provided for multiple human events in same cutset and for SI versus non-SI events.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, then there is no procedural guidance so a probability of 1.0 is used. No change required.	5.3E-2, SI 4.07E-1,SI 2.9E-2, noSI 6.2E-2,noSI
RCHFD01RCP	OPERATORS FAIL TO RESTORE RCP SEAL COOLING WITHIN ONE HOUR. This event represents failure of the operators to restore seal cooling to the RCPs within one hour per Section 4.2.2.3.2. This is a tagging event and as such, remains a probability of 1.0.	1.00E+00		Use same value.	1.00E+00
RCHFDCD0SS	OPERATORS FAIL TO COOLDOWN TO RHR AFTER SI FAILS - SSLOCA. This event represents failure of the operators to take actions to rapidly cooldown the RCS to RHR conditions in the event that core cooling is inadequate following a small break LOCA. This must be initiated within 45 minutes per Section 4.2.2.3.3. In this scenario, SI flow fails or is inadequate to provide core cooling such that CSFST (F-0.2) Core Cooling Path is Red. Operators are then directed to FR-C.1 to cool down the RCS to RHR conditions using the ARVs.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, value was increased to 1.00 since no procedure guidance.	3.7E-02
RCHFDCDDPR	OPERATORS FAIL TO COOLDOWN AND DEPRESSURIZE RCS DURING SGTR PRIOR TO SG OVERFILL. This event represents failure of the operators to take actions to cooldown and depressurize the RCS and then terminate SI following a SGTR. Using the ARVs and PORVs, operators are instructed to perform these activities by E-3, Steps 14 and 22. The accident analysis assumes that the ARVs will be opened within 20 minutes of isolating the ruptured SG (or 30 minutes total) with the PORVs opened 2 minutes later and SI terminated thereafter (see Section 4.2.2.3.3). MAAP runs suggest that opening the ARV could be delayed 45 to 60 minutes.	1.00E-01		SGTR event not credible during flood or fire event; no change required.	9.61E-03

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<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
RCHFDCDTR2	OPERATOR FAILS TO COOLDOWN TO RHR AFTER SI FAILS DURING SGTR. This event represents failure of the operators to take actions to rapidly cooldown the RCS to RHR conditions in the event that SI fails following a SGTR. This must be initiated within 45 minutes per Section 3.2.2.3.3. In this scenario, SI flow fails or is inadequate to provide core cooling such that CSFST (F-0.2) Core Cooling Path is Red. Operators are then directed to FR-C.1 to cool down the RCS to RHR conditions using the ARVs.	1.00E-01		SGTR event not credible during flood or fire event; no change required.	3.07E-02
RCHFDCOOLD	OPERATORS FAIL TO RAPIDLY COOLDOWN TO RHR AFTER ARV STICKS OPEN OR OVERFILL OCCURS. This event represents failure of the operators to cooldown to RHR conditions in the event that the ARV sticks open preventing the capability to terminate the SGTR break flow. In this scenario, the ARV fails such that an overcooling event occurs requiring entry into RHR conditions. Operators are directed by procedure ECA-3.1 to perform the depressurization from E-3, Step 12. This is assumed to be initiated within 45 minutes per Section 4.2.2.3.3.	1.00E-01		SGTR event not credible during flood or fire event; no change required.	3.07E-02
RCHFDHEATR	OPERATORS FAIL TO LOAD PRESSURIZER HEATERS FOLLOWING A LOOP OR SI SIGNAL. This event represents operator failure to re-energize pressurizer heaters following a loss of offsite power or a safety injection signal. Failing to re-energize heaters could result in a loss of primary plant pressure control and subcooling margin necessary for natural circulation. For non-SI events, either procedure ES-0, Step 7, or ECA-0.1, Step 20, instructs operators to reset the heaters. For SI events, after the SI is terminated, operators are directed by ES-1.1, Step 3 or E-0, Step 39 to reset the heaters. Required within 6 hours per Section 4.2.2.2.2.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, specific guidance given (e.g., ER-FIRE.1, Attach 5). Due to time involved, no change required.	3.1E-04
RCHFDPLOCA	OPERATORS FAIL TO CLOSE PORV BLOCK VALVE (515/516) TO TERMINATE LOCA WITHIN 3 MIN. This event represents operator failure to close the PORV block valves assuming a PORV lifts and cannot be closed. Procedural guidance is given by E-0, Step 21 and E-1 Step 5. The operators are directed to manually close the open PORV. If this fails, they are directed to manually close its associated block valve. Operators have approximately 3 minutes to perform this action before a small break LOCA results. (Note - this was done in 3 minutes following 1982 SGTR)	1.00E-01		Use same value. Event FSHFDRPORV addresses PORV LOCAs due to hot shorts.	5.00E-02
RCHFDRHSB	OPERATORS FAIL TO RAPIDLY DEPRESSURIZE TO RHR (OR USE AFW LONG-TERM). This event represents the failure of operators to depressurize the primary system down to RHR conditions or continue to use AFW following restoration of power after an SBO event. This is part of the normal activities per ECA-0.1 and ECA-0.2 which transfer to E-1 and ES-1.1.	1.00E-01	FI0TB2-3 FI00AB01 FI0TB2-1	If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, specific guidance given (e.g., ER-FIRE.1, Step 4.4.9). Due to time involved, no change required.	5.00E-03

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RCHFDSRAM	OPERATORS FAIL TO TRIP ROD DRIVE MG SETS DURING ATWS. This event represents operator failure to trip the reactor by deenergizing the rod drive motor generator sets during an ATWS event. Deenergizing the motor generator sets would cause the control rod assemblies to drop, shutting down the reactor. Once an ATWS event is identified by the operators (E-0, Step 1), procedure FR-S.1 is used. FR-S.1, Step 5 directs that an auxiliary operator be dispatched to trip the rod drive motor generator sets. Failure probability based on WCAP-11993, page B-7.	1.00E-02		ATWS is only addressed in FR-S.1 and would be used for all external events. No change required.	1.00E-02
RHHFDRHRE1	OPERATORS FAIL TO RECOVERY RHR SYSTEM BEFORE ONSET OF BOILING (CAVITY NOT FLOODED). This event represents the failure of operators to recover the loss of RHR when shutdown. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E+00		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-02
RHHFDRHRE2	OPERATORS FAIL TO RECOVERY RHR SYSTEM BEFORE ONSET OF BOILING (REDUCED INVENTORY - NO SI). This event represents the failure of operators to recover the loss of RHR when shutdown. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E+00		Fire and flood not currently evaluated for shutdown conditions; no change required.	5.00E-01
RHHFDRHRE3	OPERATORS FAIL TO RECOVER RHR SYSTEM BEFORE ONSET OF BOILING (REDUCED INVENTORY - SI). This event represents the failure of operators to recover the loss of RHR when shutdown. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
RHHFDRHREC	OPERATORS FAIL TO RECOVERY RHR SYSTEM BEFORE ONSET OF BOILING (CAVITY FLOODED). This event represents the failure of operators to recover the loss of RHR when shutdown. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E+00		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-02
RRHFD850AB	OPERATORS FAIL TO MANUALLY OPEN MOV 850A/B WHEN ELECTRICAL FAILURE OCCURS. This event represents operator failure to locally open 850A/B in order to get to containment sump recirculation. Timing for this event is similar to RRHFDRECR and the other LOCA recirculation events.	1.00E-01		Use sane screening value.	1.00E-01
RRHFDCLXH2	OPERATORS FAIL TO COOLDOWN & DEPRESSURIZE RCS FOLLOWING SMALL LOCA USING ES-1.2. This represents the failure of operators to implement ES-1.2 based on the procedural requirements of E-1 with respect to RWST level. Timing of this event would depend on the RWST level when the procedural step was reached in E-1 but would be expected to be > 30 minutes for this size LOCA.	1.00E-01		If operators use EOPs, then same procedural steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to the operators.	1.00E-02

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RRHFDcoolX	FAILURE TO RECOVER LONG-TERM RHR. This event represents the failure of operators to recover a failure within the RHR system while on decay heat removal. Timing for this event is based on the decay heat levels. Procedural guidance is provided in AP-RHR.1.	1.00E-01		If operators use EOPs, then same procedural steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance to the operators.	1.00E-01
RRHFDGRAVF	OPERATOR FAILS TO ALIGN GRAVITY FEED TO RCS. This event represents the failure of operators to recover the loss of RHR when shutdown. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01
RRHFDRECR	OPERATOR FAILS TO CORRECTLY SHIFT THE RHR SYSTEM TO RECIRCULATION AND ISOL CS. This event represents operator failure to shift the RHR system to the recirculation mode prior to the RWST level dropping below 15%, including necessary manipulations within RHR, CCW, and SW systems. Decision point to transfer to recirculation is found in E-1, Step 22, and is based on the level in the RWST reaching 28%. E-1 Step 21 directs that the shift to recirculation be made per ES-1.3, steps 1-9. Table F-1 provides timing information where RHR is shutoff at 28% RWST level. Since the time available is different for each of the LOCA initiators, different values are used. Note that steps 10-12 of procedure ES-1.3 are included in event SRHFDRECR and are not considered here.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, a probability of 1.0 was used since no specific guidance given.	1.3E-02
RRHFDRECR-M	OPERATOR FAILS TO CORRECTLY SHIFT THE RHR SYSTEM TO RECIRCULATION AND ISOL CS - MBLOCA. Same as RRHFDRECR but timing for MBLOCA.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, a probability of 1.0 was used since no specific guidance given.	5.3E-03
RRHFDRECR-S	OPERATOR FAILS TO CORRECTLY SHIFT THE RHR SYSTEM TO RECIRCULATION AND ISOL CS - SBLOCA. Same as RRHFDRECR but timing for SBLOCA.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, a probability of 1.0 was used since no specific guidance given.	1.2E-03

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
RRHFDRECR-SS	OPERATOR FAILS TO CORRECTLY SHIFT THE RHR SYSTEM TO RECIRCULATION AND ISOL CS - SMALL-SMALL LOCA. Same as RRHFDRECR but timing for Small-Small LOCA.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, a probability of 1.0 was used since no specific guidance given.	1.2E-03
RRHFDSEALX	OPERATORS FAIL TO SHUT DOWN AN RHR PUMP GIVEN THAT THE PUMP SEAL HAS FAILED. This event represents the failure of the operators to shut down a running RHR pump, given that its seal has failed. Failure to shut down the pump would eventually flood the RHR pit, failing both pumps. Annunciators L-9 (Aux Bldg Sump Hi Level) and L-10 (Aux Bldg Sump Pump Auto Start), would give operators indications of pump seal failure. Alarm response procedures AR-L-9 and AR-L-10 direct operators to check for leakage in the RHR pit upon a high level alarm or repeated sump pump starts. There are also rad monitors that would alarm requiring operator response. Worst case scenario of no sump pump operation would require operators to shut down the running pump within 2 hours (UFSAR Section 5.4.5.3.5).	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, operators would be roving within the Auxiliary Bldg monitoring the status of pumps. There are also local radiation alarms. No change required.	1.00E-01
RRHFD SUCTN	OPERATORS FAIL TO MANUALLY OPEN RHR SUCTION VALVES. This event represents the failure of operators to manually open the RHR suction valves from the RCS loop "A" hot leg for long-term recirculation in the event that they are prevented from opening automatically due to a failure of instrumentation. Since these valves are inside containment, operators would have to potentially jumper the control circuit at the MCB and open the valves. This is a long-term event with no specific procedural guidance.	1.00E-01		Use same screening value.	1.00E-01
SFHFD00782	OPERATORS FAIL TO OPEN MANUAL VALVE 782 AND START SFP B / SFP A RUNNING. This event represents the failure of operators to open manual valve 782 and start SFP B / SFP A running. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-03
SFHFD86RSI	OPERATORS FAIL TO RESET SI AND MCC PROTECTIVE RELAY 86/MCCC. This event represents the failure of operators to reset SI and MCC protective relay 86/MCCC. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	5.00E-02
SFHFD LOOPA	OPERATORS FAIL TO PROPERLY ALIGN FIRE SERVICE WATER TO LOOP A AFTER SW FAILS. This event represents the failure of operators to properly align fire service water to Loop A after SW fails. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-01

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
SFHFD PAC03	OPERATORS FAIL TO START SFP STANDBY LOOP RECIRCULATION PUMP (PAC03). This event represents the failure of operators to start SFP standby loop recirculation pump (PAC03). Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-03
SFHFD PAC7A	OPERATORS FAIL TO (RE)START SFP RECIRCULATION PUMP A (PAC07A). This event represents the failure of operators to (re)start SFP recirculation pump A (PAC07A). Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	3.00E-03
SFHFD PAC7B	OPERATORS FAIL TO (RE)START SFP LOOP B RECIRCULATION PUMP (PAC07B). This event represents the failure of operators to (re)start SFP loop B recirculation pump (PAC07B). Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	3.00E-03
SFHFD REC01	LOSS OF SFP COOLING RECOVERY FACTOR. This event represents the failure of operators of loss of SFP cooling recovery factor. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-02
SIHFDSIINJ	OPERATORS FAIL TO INITIATE COLD LEG INJECTION. This event represents the failure of operators to initiate cold leg injection. Timing is based on equipment that is available before boiloff within the cavity. Assumed to be 1 hour or more.	1.00E-01		Fire and flood not currently evaluated for shutdown conditions; no change required.	1.00E-02
SIHFDS TRTP	OPERATORS FAIL TO MANUALLY START SI PUMP RECOVERY. This event represents the failure of the operators to start an SI pump or RHR pump, given that the pump has not received a start signal due to a failure of relays in the ESFAS circuitry. Procedure E-0, Step 5 instructs the operators to verify that all SI pumps, and both RHR pumps are running. If not, they are instructed to manually start the pumps.	1.00E-01		Use same screening value.	1.00E-01
SRHFD RECRC	OPERATORS FAIL TO SHIFT SI SYSTEM TO HIGH HEAD RECIRCULATION. This event represents operator failure to identify, align and initiate high head recirculation using the SI pumps. This is failure to complete steps 9 through 12 of ES-1.3. Event assumes that operators have successfully aligned the RHR system for sump recirculation (see event RRHFD RECRC). Timing information is provided in Table F-2.	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, a probability of 1.0 was used since no specific guidance given.	1.30E-03

**TABLE F-4
Human Error Events - Post Initiators**

<i>Event Name</i>	<i>Description Of Human Event</i>	<i>Screening Value</i>	<i>Important Scenarios⁽¹⁾</i>	<i>External Event Evaluation</i>	<i>Final Value</i>
SWHFDSTART	OPERATORS FAIL TO START A SERVICE WATER PUMP. This event represents the failure of the operators to start a service water pump if two pumps are not running. This event is used for cases where pumps have tripped due to undervoltage on the bus and have not received a start signal either due to failure of the signal or because they are not aligned in standby. Procedure E-0, Step 1 (SI conditions), and procedure ES-0.1, Step 5 (no SI conditions), direct operators to verify that two service water pumps are running. If not they are instructed to start the pumps. Event includes hardware faults	1.00E-01		If operators use EOPs, then same procedure steps apply and no change is necessary. If ER-FIRE procedures are used, these provide specific guidance for manually starting the SW pumps (e.g., ER-FIRE.1, Attach 1). No change required.	5.00E-03
TLHFDPN110	OPERATOR FAILS TO RECOVER ISLOCA THROUGH PENETRATION 110. See Section 8.2.4. See E-0, Step 34 and ECA-1.2.	1.00E-01		ISLOCA evaluated separately; no change required.	1.00E-01
TLHFDPN111	OPERATOR FAILS TO RECOVER ISLOCA THROUGH PENETRATION 111. See Section 8.2.4. See E-0, Step 34 and ECA-1.2.	1.00E-01		ISLOCA evaluated separately; no change required.	1.00E-01
TLHFDPN140	OPERATOR FAILS TO RECOVER ISLOCA THROUGH PENETRATION 140. See Section 8.2.4. See E-0, Step 34 and ECA-1.2.	1.00E-01		ISLOCA evaluated separately; no change required.	1.00E-01

NOTES

(1) Considered important scenario when screening value being used and cutset > 5.0E-07 is generated.

Attachment II

Sample of Operator Action Detailed Evaluations

Human Error Event: IFHFDACPWR, FAILURE TO ALIGN SECURITY DIESEL TO OPERATE SHROUD FAN

Governing Procedure: This event represents the failure of operators to use the security DG to provide AC power for the Shroud Fans to support natural circulation following a long-term SBO. ER-ELEC.5 provides the necessary instructions as driven by ER-D/G.1 and ECA-0.0.

Important Scenarios: None (screening value 1.00E-01)

Compelling Signal

This action is a procedural step. No required signal or diagnosis applies.

Instrumentation Needed to Diagnose

This action is a procedural step. No required signal or diagnosis applies.

Initial Conditions / Assumptions

Operators enter ER-ELEC.5 as directed by ER-D/G.1 and ECA-0.0.

Event Timing

Timing is 6 hours based on ITS LCO 3.4.10.

Sequence of Events

Operators to use the security DG to provide AC power for the Shroud Fans to support natural circulation following a long-term SBO.

Diagnosis HEP

This action is a procedural step. No required signal or diagnosis applies.

Post-diagnosis HEP

0.02 EF 5 (perform a critical action as part of a step-by-step task done under moderately high stress).

Operator "B" fails to recover 0.2 EF 5 (verify the correctness of a critical action as part of a step-by-step task under moderately high stress)

Shift supervisor fails to call for action 0.2 EF 5

The multiplication factor for error factor 5 is 1.61

Mean post-diagnosis HEP = $0.02 * 0.2 * 0.2 * 1.61 = 1.29E-3$

Total HEP = 1.3E-3

Human Error Event: IFHFDBRISLL, FAILURE TO ISOLATE LARGE SW LEAK IN BATTERY ROOM PRIOR TO FAILING ALL DC POWER

Governing Procedure: Failure to isolate large SW leak in battery room prior to disabling DC Trains A and B; sump pump operation is successful; spray does not damage equipment installed in the room; isolation is performed from the control room. Spray from the flood is assumed to not fail equipment until it is submerged (i.e., no warning provided by spray effects). There are no specific procedures to perform this activity.

Important Scenarios: None (screening value 1.00E+00)

Compelling Signal

No compelling signal is assumed to be available in the control room.

Instrumentation Needed to Diagnose

No compelling signal is assumed to be available in the control room.

Initial Conditions / Assumptions

See explanation below for development of diagnosis HEP.

Event Timing

Isolation must occur within 17 minutes from the onset of the leak prior to equipment damage of both DC trains.

Sequence of Events

Flood is detected by security personnel, and operators are alerted.

Diagnosis HEP

No flood detection equipment is installed in the rooms. Therefore, discovery of a leak would occur only if security personnel note the leak in sufficient time during hourly plant walk-throughs. The failure probability for leak detection assumed is 0.84 based on a postulated ten minute time window available during which the leak would need to be detected $((60-10)/60)$. If detection is a success, the diagnosis HEP for operators to isolate the SW leak is as follows. Seven minutes are available for leak isolation, assuming ten minutes are required to detect the leak. Within the seven minute time window, two minutes are assumed to be necessary to alert operators of the leak, and one minute is necessary to perform the isolation, therefore, four minutes are available for diagnosis.

2.5E-1 EF 5 diagnosis error probability (median diagnosis HEP with four minutes available)

Conversion factor for EF 5 is 1.61

Mean diagnosis HEP = $2.5E-1 * 1.61 = 4.03E-1$

Post-diagnosis HEP

0.02 EF 5 (perform a critical action as part of a step-by-step task done under moderately high stress).

No credit for recovery is given due to relatively short time available.

The multiplication factor for error factor 5 is 1.61

Mean post-diagnosis HEP = $0.02 * 1.61 = 3.22E-2$

Total HEP = $4.4E-1$

Taking into account the complementary probability for successful detection (0.16), the HEP is equal to $0.84 + 0.16 * 0.44 = \underline{9.1E-01}$.

Human Error Event: IFHFDEVACR, OPERATORS FAIL TO USE ER-FIRE.1 FOLLOWING RELAY ROOM FLOOD THAT REQUIRES CONTROL ROOM EVAC

Governing Procedure: This event represents the failure of operators to enter ER-FIRE.1 for a significant flood in the relay room. ER-FIRE.1, Step 1 contains the entry conditions including flooding events in the relay room.

Important Scenarios: None (screening value 1.00E-01)

Compelling Signal

Flooding occurring in relay room causes equipment impacts which are later investigated by operators

Instrumentation Needed to Diagnose

Flooding occurring in relay room causes equipment impacts which are later investigated by operators

Initial Conditions / Assumptions

Impacts from the flood may result in diesel generator initiation and may also result in an unavailability of diesel generator cooling. It is assumed that operators will trip the diesel generators if diesel generator cooling is unavailable since operators are well trained to do so.

Event Timing

Timing would be approximately 10 minutes based on need for DG cooling; however, ECA-0.0 would provide additional time (1 hour) if this procedure were used first. It is assumed that one hour is available.

Sequence of Events

Flooding occurring in relay room causes equipment impacts which are later investigated by operators, resulting in flood detection.

Diagnosis HEP

Twenty minutes are assumed available for diagnosis, (following 20 minutes for leak detection and a remaining 20 minutes available for operators to initiate ER-FIRE.1)

1E-3 EF 10 (lower bound HEP with 20 minutes available for diagnosis)

Conversion factor for EF 10 is 2.66

Mean diagnosis HEP = $1E-3 * 2.66 = 2.66E-3$

Post-diagnosis HEP

Not applicable

Total Mean HEP 2.7E-3

Human Error Event: IFHFDSAFWY, FAILURE TO CONTROL SAFW PUMP LOCALLY

Governing Procedure: This event represents the failure of operators to align the SAFW system to take suction from the city water supply using a hydrant connection. Directions are provided per Step 4.6 of ER-AFW.

Important Scenarios: None (screening value 1.00E-01)

Compelling Signal

Cues would also be from FR-H.1 or any other EOP step which verifies AFW flow and CST level (note - these are continuous actions - see E-0 foldout page).

Instrumentation Needed to Diagnose

1. AFW flow indication
2. CST level indication
3. SG level indication

Initial Conditions / Assumptions

Following loss of AFW, 45 minutes are available to align SAFW.

Event Timing

It is assumed that 10 minutes elapse following loss of AFW prior to receipt of compelling indication in the control room. Fifteen minutes are assumed to be required to perform the actions necessary to align city water. Twenty minutes are therefore available for diagnosis.

Sequence of Events

1. Feedwater to steam generators is discovered to be unavailable
2. Operators initiate ER-AFW.1 and proceed to SAFW pump room to align pump suction
3. SAFW pumps are started to supply feedwater to steam generators

Diagnosis HEP

Twenty minutes are available for diagnosis

1E-3 EF 10 (lower bound HEP with 20 minutes available for diagnosis)

Conversion factor for EF 10 is 2.66

Mean diagnosis HEP = $1E-3 * 2.66 = 2.66E-3$

Post-diagnosis HEP

Two critical actions are performed: 1) alignment of SAFW valves and 2) starting the SAFW pumps

2 * 0.02 EF 5 (perform two critical actions as part of a step-by-step task done under moderately high stress)

Recovery 0.2 EF 5 (verify the correctness of a critical action as part of a step-by-step task under moderately high stress).

Result: $2 * 0.02 * 0.2 = 8E-3$ EF 5

The multiplication factor for EF 5 is 1.61.

Mean post-diagnosis HEP = $8E-3 * 1.61 = 1.29E-2$.

Total mean HEP: 1.6E-2