# Zone 99-M PSA Analysis for Operator Action SDP

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**Purpose**:

The purpose of this write up is to document the calculation of the conditional core damage probability (CCDP) for the ANO-1 model given a fire in zone 99-M.

The CCDP can then be used in combination with the fire ignition frequency to provide a total CDF for a fire in zone 99-M.

The secondary purpose of this write up is to provide the NRC review staff with the information they requested to perform their phase 3 of the Significance Determination Process (SDP) (Reference 3).

The NRC has requested the following CCDP values for zone 99-M:
1. The CCDP with current assumed cable failures given NO operator action
2. The CCDP with red cables wrapped given NO operator action
3. The CCDP with green cables wrapped given NO operator action

**References**:
1. ANO Calculation 95-E-0066-02,Rev. 1, "ANO-1 IPEEE Fire P2 Values".
2. ANO Calculation 98-E-0039-04,Rev. 0, "ANO-1 HUMAN RELIABILITY ANALYSIS WORK PACKAGE FOR THE ANO1 PSA MODEL REVISION 2":
3. ANO Condition Report: CR-ANO-1-2001-0723 Corrective Action 8.

**Assumptions:**
1. The ANO-1 IPEEE fire model was used for this evaluation. This model was taken from Reference 1. The method of quantification used in the IPEEE fire evaluation was adhered to for this evaluation. It is important to note that this method does vary from the current PSA practices seen in the base PSA model. For example: the fire model has HRA values directly in the fault tree with their nominal values. The fire model also conservatively takes no credit for the station blackout diesel. The only deviation from the IPEEE fire method was the truncation value. The new technology will allow truncation at 1E-09 instead of the previous value of 1E-07. The lower truncation was used to ensure greater completeness of the cutset results.
2. The fire protection engineers provided the failures in the zone listed in Attachment 1. For most valves and breakers, no attempt was made to establish failure mode. Rather, all components listed by fire protection were failed in all of their failure modes unless specifically stated otherwise in the fire protection component listing.
3. Based on Reference 1, the main feedwater system was assumed to fail as a result of a fire in zone 99-M. However, the PSA model requires an operator action to prevent overfill by main feedwater. Since the main feedwater system is assumed to fail, this failure mode was eliminated from the PSA model for fire zone 99M. This was accomplished by setting the following events to FALSE: EXCESSMFWA, EXCESSMFWB, XSMFWTOA, XSMFWTOB, and SGOFREC.

4. An operator action is placed in the model to manually stop overfill of the steam generators due to EFW. The recovery only appears with the P-7A pump. Since the P-7A pump will ONLY be operated and controlled with a local manual action, the operator action includes the requirement to prevent overfill and a secondary recovery is unnecessary. This was accomplished by setting the event SGOFREC2 to FALSE.
5. The EFW system has solenoid control valves that are normally open and are energized to close valves. Cables for the P-7B side control valves (CV-2646 and CV-2648) pass through zone 99-M. Based on the cables going through the zone, the fire could cause the either of the cables to short and cause it associated valve to go closed. The probability of this hotshort is considered higher than a typical hotshort probability for MOVs (6.8E-02, based on NUREG/CR-2258). A value of 0.25 has been used in this evaluation based on Attachment 6.
6. The NRC has requested an evaluation assuming green train cables are wrapped. However, the zone in question contains green train equipment. Since wrapping the green train cable would not protect the actual components in the zone, the components in the zone are considered failed when the green train raceways are wrapped.
7. It is assumed that the NRC request for the CCDP without operator action refers to operator action OUTSIDE of the control room. This assumption is based on the fact that the available staff for ex-control room action will be diminished due to the fire brigade manpower requirements. Therefore, only operator actions outside of the control room will be set to TRUE in the no operator action analyses.
8. With the exception of the post-initiator operator recovery events QHFPWRSHT (Operator Fails to deenergize CV-2646 and 2648), XHF1MEDXXX (OPERATOR FAILS TO BEGIN HPR FOLLOWING M-LOCA), and XHF1SMALLX (OPERATOR FAILS TO BEGIN HPR FOLLOWING S-LOCA), post-initiator operator recoveries were credited only if the recoveries were also credited in the ANO-1 IPEEE fire analysis, Reference 1. Recovery QHFPWRSHT is described in the Analysis Section, below; XHF1MEDXXX and XHF1SMALLX are in-control room responses that are not affected by the fire.

Analysis:

Fire Protection provided the list of components either in 99-M or with cables in 99-M. This list is provided as Attachment 1. Attachment 1 shows the components are separated into 5 categories.

- Blue (blank in Column 1) – fire modeling has shown the cable will not be affected by a fire so the component does not need to be failed even though it has a cable in the zone.
- Black (B in Column 1) – This component will fail regardless of which conduits are wrapped.
- Red (R in Column 1) – These components are considered protected when the red train cables are wrapped in the zone
- Green (G in Column 1) – These components are considered protected when the green train cables are wrapped in the zone.
- Orange (O in Column 1) – These are swing components. They typically have redundant power supply or control cables and are considered protected with either red or green train wrapped cables.

Consistent with the NRC request specified in the Purpose, three scenarios will be evaluated:

1. All current failures: components coded Black, Red, Green and Orange will be failed
2. Red train wrapped: components coded Black and Green will be failed
3. Green train wrapped: components coded Black and Red will be failed (plus Green equipment located in the zone)

Once these three lists of components were created, the associated lists of basic events were created. The mapping file from Reference 1 (betaga1.dbf) was used to create the list of basic events affected by a fire in zone 99-M. This mapping file relates a component with every basic event it affects in the model. Since the fire fault tree model also contains module events and since their constituent basic events have been pruned from the model, these module events are also listed in the mapping file. Attachments 2 through 4 list the basic events (including module events) which will be set to TRUE in the fault tree model for each of the above scenarios.

Prior to using them, each of the mapping files were reviewed for appropriateness. Three errors in the Reference 1 tag file were found as part of this process. The following maps were removed from Attachment 2, 3 and 4 map files for the reason given.

- DMM1Y11IAC to B5141B, because breaker B5141B is actually a spare breaker with no function
- SMV13641XK to CV3641, because CV-3641 has been changed to a manual valve
- QMM1P7BTRF to CV2869, because valve CV-2888 is in the recirculation path for P-7B and failure of CV-2869 alone would not cause flow diversion and fail the pump.

Attachment 2 –4 list the final basic event lists provided for each scenario.

For each scenario, a set of equivalence gates was created using the basic events in each basic event list. In this process, each basic event was set equal to ".T." in an equivalence gate. Each set of equivalence gates was then input into the Reference 1 ANO-1 fire fault tree model to create three versions of the fault tree model, one for each scenario. The model is then reviewed for possible recoveries or problems with the failed events.

In zone 99-M, the two P-7B control valves are affected as discussed in Assumption 5. However for the B side generator the only failure of module QMM1SGBP7B is CV-2648. Since this valve is not a definite failure and will require a hotshort to go closed, the model will be changed to account for this and provide a more realistic risk estimate. Attachment 5 shows the exact model changes made. Basically, a new gate CNTVLVFAILS was added to the "OR" gate above QMM1SGBP7B. This gate is an "AND" gate of two events. Event HSCV2648 is the hotshort of CV-2648 set to 0.25 and event QHFPWRSHT is the failure of operations to de-energize the valve and cause it to fail open. Operations Procedure OP-1106.006 provides discussion of these valves and instructs the operations staff on which panel provides the capability to de-energize and open the valves. An operator action was created for this event using the spreadsheet method discussed in Reference 2. A printout of the HRA spreadsheet output for QHFPWRSHT is provided in Attachment 8. The value provided from the spreadsheet is 2.26E-1.

In addition to the above modeling changes, initiating event T1 (REACTOR/TURBINE TRIP) was set to TRUE, since the fire in assumed to produce a reactor trip. This is consistent with the Reference 1 fire modeling.

Once these changes were made, all ".T." events were set to TRUE and each of the three trees were compressed. The PRAQuant software was then used to quantify the TOP gate in each scenario model at a truncation of 1E-9. The resulting cutsets then went through a short set of manipulations before the final answer was reached. The mutually exclusive file was then DELTermed from each of these cutsets. Then, all of the events discussed in Assumptions 3 and 4 were set to FALSE (i.e., EXCESSMFWA, EXCESSMFWB, XSMFWTOA, XSMFWTOB, SGOFREC, SGOFREC2). The post –initiator recoveries not credited in the IPEEE were also set to TRUE in the cutsets. The complete list of these recoveries is located in Attachment 7.

The process followed was similar for all three scenarios discussed above. However, for the red train wrapped scenario, no model changes were needed, since the additional fire wrapping will protect the valves from fire damage.

To generate the CCDP without credit for ex-Control Room operator recoveries, the recovery events listed in Attachment 7 were set to TRUE in three cutsets and each of the cutsets were subsumed.

**Results**:

The following table shows the final results from the analysis of zone 99-M and the associated cutset file.

**Zone 99-M**

| | CCDP with ex-control room recoveries True | ANO CCDP value with recoveries applied | |
|---|---|---|---|
| ALL Current Failures | 5.76E-02 | 1.27E-03 | 5.63E-2↑ |
| RED train protected | 7.96E-03 | 8.32E-04 | 9.5E-4↑ |
| Green train protected | 5.76E-02 | 1.26E-03 | 5.6E-2↑ |

## Electronic Files:

The following electronic files are included with this document.

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| Zone99MSDP.zip | n/a | 03/01/02 | n/a | WINZip file containing electronic files associated with this calculation |

This WINZip file contains the following files

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| 21299MG.CAF | 128,449 | 02/21/02 | 03:43p | 99M Green wrapped CAFTA fault tree file before trues compressed (Scenario 3) |
| 21299MGC.CAF | 60,421 | 02/21/02 | 03:43p | 99M Green wrapped CAFTA fault tree file after trues compressed (Scenario 3) |
| 21299MR.CAF | 127,845 | 02/21/02 | 03:00p | 99M Red wrapped CAFTA fault tree file before trues compressed (Scenario 2) |
| 21299MRC.CAF | 63,089 | 02/21/02 | 03:01p | 99M Red wrapped CAFTA fault tree file after trues compressed (Scenario 2) |
| 99-M FAILED components (colorcoded 215) (2).xls | 31,232 | 02/28/02 | 09:17p | List from Fire protection for Zone 99-M |
| 99M Changes made.xls | 37,376 | 02/25/02 | 09:47a | List of fault tree changes made in 99-M |
| 99m SDP Write UP.doc | n/a | 03/01/02 | n/a | WORD document of this calculation |
| 99M.QNT | 5,036 | 03/01/02 | 08:59a | PRAQuant file used to quantify for this write up |
| 99mbase.CUT | 1,069,446 | 03/01/02 | 08:54a | 99M Baseline cutset file (Scenario 1) |
| 99MGR.cut | 1,060,286 | 03/01/02 | 09:00a | 99M Green wrapped cutset file (Scenario 2) |
| 99MRED.cut | 832,230 | 03/01/02 | 08:56a | 99M Red wrapped cutset file (Scenario 3) |
| ANO1FIRE.BE | 531,456 | 03/01/02 | 08:47a | Basic Event file with new hotshort components and recoveries |
| ANO1FIRE.GT | 1,110,016 | 11/26/01 | 08:53a | Original ANO-1 Fire IPEEE gt file |
| ANO1FIRE.TC | 108,544 | 12/20/95 | 06:34p | Original ANO-1 Fire PEEE tc file |
| APPRC.CAF | 60,713 | 02/25/02 | 09:47a | 99M Baseline CAFTA fault tree file after trues compressed (Scenario 1) |
| APPRONLY.CAF | 129,077 | 02/21/02 | 02:53p | 99M Baseline CAFTA fault tree file before trues compressed (Scenario 1) |
| QHFPWROFF_99m.XLS | 34,304 | 02/25/02 | 09:13a | HRA spreadsheet for recovery QHFPWRSHT |
| MODEL.ZIP | 265,707 | 11/07/01 | 03:25p | Original set of files from ANO-1 Fire IPEEE Calculation |

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| MODEL.ZIP | 265,707 | 11/07/01 | 03:25p | Original set of files from ANO-1 Fire IPEEE Calculation (see listing below) |
| DATABASE.ZIP | 272,273 | 11/07/01 | 03:25p | Original set of files from ANO-1 Fire IPEEE Calculation (see listing below) |

This WINZip file contains the following files

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| ANO1FIRE.CAF | 131,355 | 03/05/96 | 12:45p | Original file from ANO-1 Fire IPEEE |

| | | | | |
|---|---|---|---|---|
| | | | | Calculation |
| ANO1FIRE.BE | 531,456 | 03/05/96 | 09:29a | Original file from ANO-1 Fire IPEEE Calculation |
| ANO1FIRE.GT | 1,110,016 | 03/05/96 | 09:30a | Original file from ANO-1 Fire IPEEE Calculation |
| ANO1FIRE.TC | 108,544 | 12/20/95 | 06:34p | Original file from ANO-1 Fire IPEEE Calculation |
| MUTEXC | 7,795 | 11/09/92 | 09:29a | Original file from ANO-1 Fire IPEEE Calculation |
| MUTEXC.CUT | 14,114 | 08/29/95 | 05:41p | Original file from ANO-1 Fire IPEEE Calculation |

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| DATABASE.ZIP | 272,273 | 11/07/01 | 03:25p | Original set of files from ANO-1 Fire IPEEE Calculation |

This WINZip file contains the following files

| File Name | File Size (KB) | File Date | File Time | Description |
|---|---|---|---|---|
| BETAGA1.DBF | 625,301 | 03/05/96 | 03:44p | Original file from ANO-1 Fire IPEEE Calculation |
| BETAGA1.MDX | 95,232 | 03/05/96 | 03:45p | Original file from ANO-1 Fire IPEEE Calculation |
| CRIT.DBF | 2,226 | 03/04/96 | 06:24p | Original file from ANO-1 Fire IPEEE Calculation |
| CRIT.TXT | 700 | 03/29/95 | 09:36p | Original file from ANO-1 Fire IPEEE Calculation |
| FINAL.DBF | 15,236 | 03/05/96 | 05:00p | Original file from ANO-1 Fire IPEEE Calculation |
| LOCA1.DBF | 1,662,014 | 03/05/96 | 03:43p | Original file from ANO-1 Fire IPEEE Calculation |
| LOCA1.MDX | 460,800 | 03/05/96 | 03:44p | Original file from ANO-1 Fire IPEEE Calculation |
| LOCA197X.DBF | 1,662,014 | 03/04/96 | 03:33p | Original file from ANO-1 Fire IPEEE Calculation |
| LOCA197X.MDX | 460,800 | 03/04/96 | 03:33p | Original file from ANO-1 Fire IPEEE Calculation |
| SCEN.DBF | 27,902 | 03/05/96 | 07:02p | Original file from ANO-1 Fire IPEEE Calculation |
| SCEN.MDX | 7,168 | 03/05/96 | 07:02p | Original file from ANO-1 Fire IPEEE Calculation |

# Attachment 1

## Initial List of Components Affected by the Fire from Fire Protection Sorted into 5 Color Categories with Fire Protection Comments

Red = Red train Appendix R component; Green = Green train Appendix R component
Orange = Swing component that would be available for either train.
Black = BOP equipment; Blue = equipment that will be available for any credible fire scenario
Components were extracted from FIVE (cables.xls) and PDMS (Fire Zone impact report for 99-M). In addition, some Black components were assumed to have cables in the zone.
In addition, some Black components were assumed to have cables in the zone.
Note: RTDs and related indicators were not compiled.

| | | |
|---|---|---|
| B | A104 | |
| | A111 | Listed cables do not affect operation of A111 |
| | A112 | Listed cables do not affect operation of A112 |
| B | A211 | |
| B | A212 | |
| | A3 | RCD1104A provides control power to A3. Fire models determined that realistic fires would not impact the cable. |
| | A302 | Listed cables do not impact operation of breaker |
| B | A304 | |
| | A305 | Listed cable does not affect operation of A305 |
| | A306 | Fire models determined that realistic fires would not impact the associated cables. |
| R | A307 | |
| R | A308 | |
| R | A310 | |
| | A311 | Same cable as for P7B. Will not affect start of pump from control room. |
| G | A4 | Component in zone. |
| G | A401 | Component in zone. |
| G | A402 | Component in zone. |
| G | A403 | Component in zone. |
| B | A404 | Component in zone. |
| G | A405 | Component in zone. |
| G | A406 | Component in zone. |
| G | A407 | Component in zone. |
| G | A408 | Component in zone. |
| G | A409 | Component in zone. |
| G | A410 | Component in zone. |
| O | A601 | |
| B | B15 | |
| | B24 | Listed cable does not affect operation of component |
| | B25 | Listed cable does not affect operation of component |
| B | B31 | |
| B | B41 | |
| B | B43 | |
| B | B44 | |
| | B5 | Fire models determined that realistic fires would not impact the associated cables. |
| | B512 | Fire models determined that realistic fires would not impact the associated cables. |
| | B5122 | Listed cable does not affect operation of breaker |
| B | B55 | Swing appendix R component, but it is located in the zone. |

| | | |
|---|---|---|
| B | B56 | Swing appendix R component, but it is located in the zone. |
| B | B5622B | |
| B | B5653 | |
| B | B57 | |
| G | B6 | Component in zone. |
| G | B61 | |
| G | B612 | Component in zone. |
| B | B6123 | |
| G | B614 | Component in zone. |
| G | B6145A | |
| B | B6145B | |
| G | B62 | |
| G | B621 | Component in zone. |
| G | B622 | Component in zone. |
| B | B623 | Component in zone. |
| G | B63 | |
| B | B633 | Component in zone. |
| G | B634 | Component in zone. |
| B | B64 | |
| G | B65 | Component in zone. |
| B | B7 | |
| B | B712 | |
| B | B72 | |
| B | C187 | |
| | C539 | Component is listed due to loss of power source. However, source is RS1, which is unaffected for a fire in this zone. |
| G | C540 | |
| G | CV1000 | Component is listed due to loss of power source (B61). Valve will fail in normally open position. |
| B | CV1009 | |
| B | CV1206 | |
| G | CV1221 | Component is listed due to loss of power source (B61). Valve will fail in normally open position. |
| G | CV1227 | Component is listed due to loss of power source (B61). Valve will fail in normally closed position. |
| G | CV1228 | Component is listed due to loss of power source (B61). Valve will fail in normally closed position. |
| G | CV1274 | Component is listed due to loss of power source (B61). Valve will fail in normally open position. |
| G | CV1400 | Component is listed due to loss of power source (B61). Valve will fail in normally closed position. |
| 0 | CV1404 | |
| G | CV1406 | Component is listed due to loss of power source (B61). Valve will fail in normally closed position. |
| G | CV1408 | Component is listed due to loss of power source (B61). Valve will fail in normally closed position. |
| G | CV1410 | Component is listed due to loss of power source (B62). Valve will fail in normally closed position. |
| B | CV1416 | |
| G | CV1435 | |
| G | CV1437 | |
| B | CV2235 | |
| | CV2613 | Valve listed due to loss of power (D25). D25 is not affected by a fire in this zone. |
| B | CV2617 | |
| G | CV2618 | Cable listed does not impact valve operation. However, power to the valve (i.e. via RS2) is lost. |
| G | CV2619 | Valve listed due to loss of power. If ADVs are not needed then valve is in correct position. |
| G | CV2620 | This valve is powered from a red source (D15) but is classified green because it is associated with P7A. |
| B | CV2625 | |

| | | |
|---|---|---|
| | CV2626 | Valve listed due to loss of power. Valve is normally open. Therefore, loss of power causes valve to fail in proper position. |
| G | CV2627 | This valve is powered from a red source (D15) but is classified green because it is associated with P7A. |
| B | CV2630 | |
| | CV2645 | Valve listed due to loss of power. Loss of power causes valve to fail in proper position. |
| R | CV2646 | |
| | CV2647 | Valve listed due to loss of power. Loss of power causes valve to fail in proper position. |
| R | CV2648 | |
| R | CV2663 | |
| R | CV2667 | |
| R | CV2668 | |
| | CV2670 | Valve listed due to loss of power. Valve is normally open. Therefore, loss of power causes valve to fail in proper position. |
| B | CV2674 | |
| B | CV2680 | |
| G | CV2692 | |
| | CV2800 | Fire models determined that realistic fires would not impact the associated cables. |
| R | CV2802 | |
| R | CV2803 | |
| R | CV2806 | |
| | CV2869 | Fire models determined that realistic fires would not impact the associated cables. |
| | CV2870 | Valve listed due to loss of power (D25). Valve is normally closed. Therefore, loss of power causes valve to fail in proper position. |
| B | CV3640 | |
| | CV3641 | Changed to a manual valve. Will not fail |
| G | CV3642 | |
| B | CV3643 | |
| G | CV3644 | |
| G | CV3807 | Component is listed due to loss of power source (B62). Valve will fail in the closed position. |
| G | CV3821 | |
| | CV3840 | Valve listed due to apparent loss of power. However, power is from RS1, which is not affected in this zone. |
| G | CV3841 | |
| R | CV3850 | |
| R | CV3851 | |
| B | CV5611 | |
| B | CV7472 | |
| B | CV7473 | |
| B | D05 | |
| | D1104 | Same cable for A3 |
| | D1109 | This is the control power for B5 which was survived fire modeling |
| R | D15 | |
| | D21 | Component is listed due to loss of power source (D02). D02 is not affected by a fire in this zone. |
| G | D2104 | |
| G | D2109 | |
| | D25 | Component is listed due to loss of power source (D02). D02 is not affected by a fire in this zone. |
| | K4A | Fire models determined that realistic fires would not impact the associated cables. |
| G | K4B | |
| G | LT1002 | |
| B | LT2617 | |

| | | |
|---|---|---|
| | LT2618 | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| | LT2620 | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| | LT2622 | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| | LT2624 | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| | LT2667 | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| B | LT2668 | |
| | LT2669 | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| | LT2671 | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| | LT2673 | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| B | M55A | |
| G | P16B | Component is listed due to loss of power source (B61) |
| G | P34B | |
| | P36A | Fire models determined that realistic fires would not impact the associated cables. |
| O | P36B | |
| G | P36C | |
| | P4A | Listed cables do not prevent remote operation. |
| | P4B | Red train of pump would always be available. |
| G | P4C | |
| R | P64A | |
| O | P64B | |
| G | P64C | |
| G | P7A | |
| | P7B | Failure of cable does not prevent starting of pump from control room. |
| B | PT2617A | |
| | PT2618A | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| | PT2618B | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| | PT2667A | Component listed due to loss of power source (RS1). However, RS1 is unaffected in this zone. |
| | PT2667B | Component listed due to loss of power source (Y28). However, Y28 is unaffected in this zone. |
| B | PT2668A | |
| | RA2 | Component is listed due to loss of power source (D02). D02 is not affected by a fire in this zone. |
| G | RS2 | |
| G | RS4 | |
| | SG2 | Valve is normally open. Affected cables cannot cause spurious operation. |
| G | SG4 | |
| G | SG6 | |
| G | SG7 | |
| | SV1072 | Component is listed due to loss of power source (D21) |
| | SV1074 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1082 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1084 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1092 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1094 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1270 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1271 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1272 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV1273 | Component is listed due to loss of power source (D21). D21 is not affected by a fire in this zone. |
| | SV2613 | Valve listed due to loss of power (D25). D25 is not affected by a fire in this zone. |
| B | SV3805 | |

| | | |
|---|---|---|
| B | SV3815 | |
| G | SV3841 | |
| B | SV5237 | |
| B | SV5239 | |
| B | TE1002 A | |
| G | TV7902 A | Component is listed due to loss of power source (B61) |
| G | TV7902 B | Component is listed due to loss of power source (B61) |
| G | VEF24C | Component is listed due to loss of power source (B61) |
| G | VEF24D | Component is listed due to loss of power source (B61) |
| B | VSF1C | |
| B | VSF1D | |
| B | VUC1D | |
| B | VUC7B | |
| | X03 | Annunciator cables have no effect on component |
| G | X6 | Component in zone. |
| G | Y22 | Component in zone. |
| G | Y24 | Component in zone. |
| G | Y25 | Component in zone. This is a new component that is probably not in the IPEEE model |
| G | Y28 | |

# Attachment 2

List of affect events for Scenario 1

| Component | BE_NAME |
|---|---|
| P36B | ARE11P36BE |
| RS2 | DB4100RS2F |
| D2104 | DCD12104XR |
| D05 | DMM1000D05 |
| B5622B | DMM1000D05 |
| D05 | DMM1000D05 |
| D15 | DMM1000D15 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IDC |
| Y22 | DMM1Y22IDC |
| Y22 | DSI100Y22F |
| Y22 | DSI100Y22X |
| A409 | ECB1A409XR |
| K4B | EDG1A4XXXO |
| K4B | EDG1DG2XXA |
| K4B | EDG1DG2XXF |
| TV7902A | EMC17902AN |
| TV7902B | EMC17902BN |
| A4 | EMM1A4XXXX |
| A4 | EMM1A4XXXX |
| B55 | EMM1B55B56 |
| B56 | EMM1B55B56 |
| B622 | EMM1B55B56 |
| B56 | EMM1B55B56 |
| B55 | EMM1B55B56 |
| B61 | EMM1B61XXX |
| B621 | EMM1B61XXX |
| B61 | EMM1B61XXX |
| B614 | EMM1B62XXX |
| B62 | EMM1B62XXX |
| B62 | EMM1B62XXX |
| B63 | EMM1B63XXX |

| | |
|---|---|
| B63 | EMM1B63XXX |
| A401 | EMM1B6XXXX |
| B6 | EMM1B6XXXX |
| B6 | EMM1B6XXXX |
| B612 | EMM1B6XXXX |
| X6 | EMM1B6XXXX |
| A211 | EMM1CB211X |
| A211 | EMM1CB211X |
| A212 | EMM1CB212X |
| A212 | EMM1CB212X |
| A308 | EMM1CB308X |
| A308 | EMM1CB308X |
| A408 | EMM1CB408X |
| A408 | EMM1CB408X |
| P16B | EMM1DG2FXA |
| P16B | EMM1DG2FXF |
| SV5237 | EMM1DG2SAC |
| SV5239 | EMM1DG2SAD |
| CV3807 | EMM1DG2SWC |
| CV3807 | EMM1DG2SWC |
| TV7902A | EMM1RMCLCA |
| TV7902A | EMM1RMCLCF |
| B6123 | EMM1RMCLDA |
| TV7902B | EMM1RMCLDA |
| TV7902B | EMM1RMCLDF |
| A211 | ERE1211SRR |
| A4 | ERE1A4LXXK |
| A4 | ERE1A4X1UE |
| A4 | ERE1A4X2UE |
| B6 | ERE1B6XUXE |
| B6 | ERE1B6XUXK |
| K4B | ERE1DG2LXK |
| K4B | ERE1DG2UXK |
| CV2625 | FMM1CV2625 |
| CV2625 | FMM1CV2625 |
| CV2674 | FMM1CV2674 |
| CV2674 | FMM1CV2674 |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| CV2680 | FMM1SGABVC |
| CV2680 | FMM1SGABVC |
| CV2630 | FMM1SGBBVC |
| CV2630 | FMM1SGBBVC |
| SV3815 | GMM1TRAN2M |
| SV3815 | GMM1TRAN2M |

| | |
|---|---|
| VSF1C | GMM1VSF1CM |
| B623 | GMM1VSF1CM |
| CV7472 | GMM1VSF1CM |
| VSF1C | GMM1VSF1CM |
| VSF1D | GMM1VSF1DM |
| B633 | GMM1VSF1DM |
| CV7473 | GMM1VSF1DM |
| VSF1D | GMM1VSF1DM |
| CV1206 | HMM1CV1206 |
| CV1227 | HMM1MU1214 |
| CV1227 | HMM1MU1214 |
| CV1228 | HMM1MU1215 |
| CV1228 | HMM1MU1215 |
| P36B | HMM1P36BFR |
| A307 | HMM1P36BFR |
| P36B | HMM1P36BFS |
| A307 | HMM1P36BFS |
| A406 | HMM1P36CFR |
| P36C | HMM1P36CFR |
| P36C | HMM1P36CFS |
| A406 | HMM1P36CFS |
| CV1406 | LMM1CV1406 |
| CV1406 | LMM1CV1406 |
| CV1408 | LMM1CV1408 |
| CV1408 | LMM1CV1408 |
| P34B | LMM1MPP34B |
| A405 | LMM1MPP34B |
| P34B | LMM1MPP34B |
| A405 | LMM1MPP34B |
| CV1437 | LMV101437K |
| CV2618 | QAV102618C |
| CV2668 | QAV102668C |
| C187 | QBI1L2618N |
| C187 | QBI1L2622N |
| C187 | QBI1L2667N |
| C187 | QBI1L2671N |
| C187 | QLC1INAPXD |
| C187 | QLC1INAXXD |
| C187 | QLC1INBPXD |
| C187 | QLC1INBXXD |
| C187 | QLC1INCPXD |
| C187 | QLC1INCXXD |
| C187 | QLC1INDPXD |
| C187 | QLC1INDXXD |
| C187 | QMM12645OA |
| C187 | QMM12645OA |
| C187 | QMM12647OA |

| | |
|---|---|
| C187 | QMM12647OA |
| C187 | QMM1L2617H |
| C187 | QMM1L2617H |
| LT2617 | QMM1L2617H |
| C187 | QMM1L2618H |
| C187 | QMM1L2620H |
| C187 | QMM1L2621H |
| C187 | QMM1L2621H |
| C187 | QMM1L2622H |
| C187 | QMM1L2624H |
| C187 | QMM1L2668H |
| LT2668 | QMM1L2668H |
| C187 | QMM1L2668H |
| C187 | QMM1L2669H |
| C187 | QMM1L2672H |
| C187 | QMM1L2672H |
| C187 | QMM1L2673H |
| C187 | QMM1MSAATP |
| C187 | QMM1MSABTP |
| C187 | QMM1MSBATP |
| C187 | QMM1MSBBTP |
| CV2680 | QMM1MSLIAA |
| CV2680 | QMM1MSLIAF |
| CV2630 | QMM1MSLIBA |
| CV2630 | QMM1MSLIBF |
| PT2617A | QMM1P2617A |
| C187 | QMM1P2617A |
| C187 | QMM1P2617A |
| C187 | QMM1P2617B |
| C187 | QMM1P2617B |
| C187 | QMM1P2618A |
| C187 | QMM1P2618A |
| C187 | QMM1P2618B |
| C187 | QMM1P2618B |
| C187 | QMM1P2667A |
| C187 | QMM1P2667A |
| C187 | QMM1P2667B |
| C187 | QMM1P2667B |
| PT2668A | QMM1P2668A |
| C187 | QMM1P2668A |
| C187 | QMM1P2668A |
| C187 | QMM1P2668B |
| C187 | QMM1P2668B |
| P7A | QMM1P7ATRA |
| CV2802 | QMM1P7ATRA |
| P7A | QMM1P7ATRF |
| CV2627 | QMM1SGAP7A |

| | |
|---|---|
| CV2627 | QMM1SGAP7A |
| CV2646 | QMM1SGAP7B |
| CV2667 | QMM1SGASTM |
| CV2620 | QMM1SGBP7A |
| CV2620 | QMM1SGBP7A |
| CV2648 | QMM1SGBP7B |
| CV2617 | QMM1SGBSTM |
| CV2663 | QMM1TASADM |
| CV2663 | QMM1TASADM |
| C187 | QMM1TMAEFW |
| C187 | QMM1TMAEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1VMAORD |
| C187 | QMM1VMAORD |
| C187 | QMM1VMBORC |
| C187 | QMM1VMBORC |
| CV2663 | QSV102663N |
| CV2663 | QTD1C2663F |
| CV1000 | RMM1B1000C |
| CV1000 | RMM1B1000C |
| CV1000 | RMM1CV1000 |
| CV1000 | RMM1CV1000 |
| A403 | SCB1A403XR |
| A601 | SCB1A601XR |
| CV3644 | SMM123AXXX |
| CV3640 | SMM123BXXX |
| CV3642 | SMM123BXXX |
| CV3643 | SMM1AUXCLG |
| CV3643 | SMM1AUXCLG |
| B5653 | SMM1AUXCLG |
| CV3841 | SMM1AV3841 |
| SV3841 | SMM1AV3841 |
| CV3841 | SMM1AV3841 |
| SV3841 | SMM1AV3841 |
| CV3821 | SMM1E35BSW |
| CV3821 | SMM1E35BSW |
| A403 | SMM1P4BXXA |
| CV3643 | SMV13643XK |
| CV3644 | SMV13644XR |
| SG4 | SSG1SG4XXK |

# Attachment 3

List of Basic Events for Scenario 2 (Red Train Wrapped)

| Field2 | BE_NAME |
|---|---|
| RS2 | DB4100RS2F |
| D2104 | DCD12104XR |
| B5622B | DMM1000D05 |
| D05 | DMM1000D05 |
| D05 | DMM1000D05 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IDC |
| Y22 | DMM1Y22IDC |
| Y22 | DSI100Y22F |
| Y22 | DSI100Y22X |
| A409 | ECB1A409XR |
| K4B | EDG1A4XXXO |
| K4B | EDG1DG2XXA |
| K4B | EDG1DG2XXF |
| TV7902A | EMC17902AN |
| TV7902B | EMC17902BN |
| A4 | EMM1A4XXXX |
| A4 | EMM1A4XXXX |
| B56 | EMM1B55B56 |
| B56 | EMM1B55B56 |
| B55 | EMM1B55B56 |
| B622 | EMM1B55B56 |
| B55 | EMM1B55B56 |
| B621 | EMM1B61XXX |
| B61 | EMM1B61XXX |
| B61 | EMM1B61XXX |
| B614 | EMM1B62XXX |
| B62 | EMM1B62XXX |
| B62 | EMM1B62XXX |
| B63 | EMM1B63XXX |
| B63 | EMM1B63XXX |
| A401 | EMM1B6XXXX |

| | |
|---|---|
| B612 | EMM1B6XXXX |
| B6 | EMM1B6XXXX |
| B6 | EMM1B6XXXX |
| X6 | EMM1B6XXXX |
| A211 | EMM1CB211X |
| A211 | EMM1CB211X |
| A212 | EMM1CB212X |
| A212 | EMM1CB212X |
| A408 | EMM1CB408X |
| A408 | EMM1CB408X |
| P16B | EMM1DG2FXA |
| P16B | EMM1DG2FXF |
| SV5237 | EMM1DG2SAC |
| SV5239 | EMM1DG2SAD |
| CV3807 | EMM1DG2SWC |
| CV3807 | EMM1DG2SWC |
| TV7902A | EMM1RMCLCA |
| TV7902A | EMM1RMCLCF |
| TV7902B | EMM1RMCLDA |
| B6123 | EMM1RMCLDA |
| TV7902B | EMM1RMCLDF |
| A211 | ERE1211SRR |
| A4 | ERE1A4LXXK |
| A4 | ERE1A4X1UE |
| A4 | ERE1A4X2UE |
| B6 | ERE1B6XUXE |
| B6 | ERE1B6XUXK |
| K4B | ERE1DG2LXK |
| K4B | ERE1DG2UXK |
| CV2625 | FMM1CV2625 |
| CV2625 | FMM1CV2625 |
| CV2674 | FMM1CV2674 |
| CV2674 | FMM1CV2674 |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| RS4 | FMM1NNIYPO |
| CV2680 | FMM1SGABVC |
| CV2680 | FMM1SGABVC |
| CV2630 | FMM1SGBBVC |
| CV2630 | FMM1SGBBVC |
| SV3815 | GMM1TRAN2M |
| SV3815 | GMM1TRAN2M |
| CV7472 | GMM1VSF1CM |
| VSF1C | GMM1VSF1CM |
| B623 | GMM1VSF1CM |
| VSF1C | GMM1VSF1CM |

| | |
|---|---|
| VSF1D | GMM1VSF1DM |
| B633 | GMM1VSF1DM |
| CV7473 | GMM1VSF1DM |
| VSF1D | GMM1VSF1DM |
| CV1206 | HMM1CV1206 |
| CV1227 | HMM1MU1214 |
| CV1227 | HMM1MU1214 |
| CV1228 | HMM1MU1215 |
| CV1228 | HMM1MU1215 |
| A406 | HMM1P36CFR |
| P36C | HMM1P36CFR |
| A406 | HMM1P36CFS |
| P36C | HMM1P36CFS |
| CV1406 | LMM1CV1406 |
| CV1406 | LMM1CV1406 |
| CV1408 | LMM1CV1408 |
| CV1408 | LMM1CV1408 |
| P34B | LMM1MPP34B |
| P34B | LMM1MPP34B |
| A405 | LMM1MPP34B |
| A405 | LMM1MPP34B |
| CV1437 | LMV101437K |
| CV2618 | QAV102618C |
| C187 | QBI1L2618N |
| C187 | QBI1L2622N |
| C187 | QBI1L2667N |
| C187 | QBI1L2671N |
| C187 | QLC1INAPXD |
| C187 | QLC1INAXXD |
| C187 | QLC1INBPXD |
| C187 | QLC1INBXXD |
| C187 | QLC1INCPXD |
| C187 | QLC1INCXXD |
| C187 | QLC1INDPXD |
| C187 | QLC1INDXXD |
| C187 | QMM12645OA |
| C187 | QMM12645OA |
| C187 | QMM12647OA |
| C187 | QMM12647OA |
| LT2617 | QMM1L2617H |
| C187 | QMM1L2617H |
| C187 | QMM1L2617H |
| C187 | QMM1L2618H |
| C187 | QMM1L2620H |
| C187 | QMM1L2621H |
| C187 | QMM1L2621H |
| C187 | QMM1L2622H |

| | |
|---|---|
| C187 | QMM1L2624H |
| LT2668 | QMM1L2668H |
| C187 | QMM1L2668H |
| C187 | QMM1L2668H |
| C187 | QMM1L2669H |
| C187 | QMM1L2672H |
| C187 | QMM1L2672H |
| C187 | QMM1L2673H |
| C187 | QMM1MSAATP |
| C187 | QMM1MSABTP |
| C187 | QMM1MSBATP |
| C187 | QMM1MSBBTP |
| CV2680 | QMM1MSLIAA |
| CV2680 | QMM1MSLIAF |
| CV2630 | QMM1MSLIBA |
| CV2630 | QMM1MSLIBF |
| C187 | QMM1P2617A |
| C187 | QMM1P2617A |
| PT2617A | QMM1P2617A |
| C187 | QMM1P2617B |
| C187 | QMM1P2617B |
| C187 | QMM1P2618A |
| C187 | QMM1P2618A |
| C187 | QMM1P2618B |
| C187 | QMM1P2618B |
| C187 | QMM1P2667A |
| C187 | QMM1P2667A |
| C187 | QMM1P2667B |
| C187 | QMM1P2667B |
| PT2668A | QMM1P2668A |
| C187 | QMM1P2668A |
| C187 | QMM1P2668A |
| C187 | QMM1P2668B |
| C187 | QMM1P2668B |
| P7A | QMM1P7ATRA |
| P7A | QMM1P7ATRF |
| CV2627 | QMM1SGAP7A |
| CV2627 | QMM1SGAP7A |
| CV2620 | QMM1SGBP7A |
| CV2620 | QMM1SGBP7A |
| CV2617 | QMM1SGBSTM |
| C187 | QMM1TMAEFW |
| C187 | QMM1TMAEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMBEFW |

| | |
|---|---|
| C187 | QMM1VMAORD |
| C187 | QMM1VMAORD |
| C187 | QMM1VMBORC |
| C187 | QMM1VMBORC |
| CV1000 | RMM1B1000C |
| CV1000 | RMM1B1000C |
| CV1000 | RMM1CV1000 |
| CV1000 | RMM1CV1000 |
| A403 | SCB1A403XR |
| CV3644 | SMM123AXXX |
| CV3640 | SMM123BXXX |
| CV3642 | SMM123BXXX |
| CV3643 | SMM1AUXCLG |
| B5653 | SMM1AUXCLG |
| CV3643 | SMM1AUXCLG |
| CV3841 | SMM1AV3841 |
| CV3841 | SMM1AV3841 |
| SV3841 | SMM1AV3841 |
| SV3841 | SMM1AV3841 |
| CV3821 | SMM1E35BSW |
| CV3821 | SMM1E35BSW |
| A403 | SMM1P4BXXA |
| CV3643 | SMV13643XK |
| CV3644 | SMV13644XR |
| SG4 | SSG1SG4XXK |

# Attachment 4

List of Basic Events for Scenario 3 ( Green Train Wrapped)

| Component | BE_NAME |
|---|---|
| A211 | ERE1211SRR |
| A211 | EMM1CB211X |
| A211 | EMM1CB211X |
| A212 | EMM1CB212X |
| A212 | EMM1CB212X |
| A307 | HMM1P36BFS |
| A307 | HMM1P36BFR |
| A308 | EMM1CB308X |
| A308 | EMM1CB308X |
| A4 | EMM1A4XXXX |
| A4 | ERE1A4X2UE |
| A4 | ERE1A4X1UE |
| A4 | EMM1A4XXXX |
| A4 | ERE1A4LXXK |
| A401 | EMM1B6XXXX |
| A403 | SCB1A403XR |
| A403 | SMM1P4BXXA |
| A405 | LMM1MPP34B |
| A405 | LMM1MPP34B |
| A406 | HMM1P36CFR |
| A406 | HMM1P36CFS |
| A408 | EMM1CB408X |
| A408 | EMM1CB408X |
| A409 | ECB1A409XR |
| B55 | EMM1B55B56 |
| B55 | EMM1B55B56 |
| B56 | EMM1B55B56 |
| B56 | EMM1B55B56 |
| B5622B | DMM1000D05 |
| B5653 | SMM1AUXCLG |
| B6 | EMM1B6XXXX |
| B6 | EMM1B6XXXX |
| B6 | ERE1B6XUXE |
| B6 | ERE1B6XUXK |
| B612 | EMM1B6XXXX |
| B6123 | EMM1RMCLDA |
| B614 | EMM1B62XXX |
| B621 | EMM1B61XXX |
| B622 | EMM1B55B56 |
| B623 | GMM1VSF1CM |
| B633 | GMM1VSF1DM |
| C187 | QLC1INDPXD |
| C187 | QLC1INCXXD |

| | |
|---|---|
| C187 | QMM1L2620H |
| C187 | QMM12647OA |
| C187 | QMM1L2618H |
| C187 | QMM1L2617H |
| C187 | QMM1L2617H |
| C187 | QMM1VMBORC |
| C187 | QMM12647OA |
| C187 | QMM1VMBORC |
| C187 | QMM1TMBEFW |
| C187 | QMM1VMAORD |
| C187 | QMM1TMBEFW |
| C187 | QMM12645OA |
| C187 | QMM1TMBEFW |
| C187 | QMM1TMAEFW |
| C187 | QMM1TMAEFW |
| C187 | QMM12645OA |
| C187 | QMM1TMBEFW |
| C187 | QLC1INDXXD |
| C187 | QMM1VMAORD |
| C187 | QMM1L2621H |
| C187 | QMM1L2622H |
| C187 | QMM1L2668H |
| C187 | QMM1MSBBTP |
| C187 | QLC1INCPXD |
| C187 | QMM1L2668H |
| C187 | QMM1P2617A |
| C187 | QBI1L2671N |
| C187 | QBI1L2667N |
| C187 | QMM1P2617A |
| C187 | QMM1MSBATP |
| C187 | QMM1P2617B |
| C187 | QMM1MSABTP |
| C187 | QMM1L2624H |
| C187 | QMM1L2669H |
| C187 | QMM1MSAATP |
| C187 | QMM1L2672H |
| C187 | QMM1L2672H |
| C187 | QMM1L2673H |
| C187 | QMM1L2621H |
| C187 | QBI1L2622N |
| C187 | QMM1P2667B |
| C187 | QLC1INBXXD |
| C187 | QLC1INBPXD |
| C187 | QMM1P2668B |
| C187 | QLC1INAXXD |
| C187 | QMM1P2668B |
| C187 | QMM1P2668A |

| | |
|---|---|
| C187 | QBI1L2618N |
| C187 | QLC1INAPXD |
| C187 | QMM1P2667B |
| C187 | QMM1P2667A |
| C187 | QMM1P2667A |
| C187 | QMM1P2618B |
| C187 | QMM1P2618B |
| C187 | QMM1P2618A |
| C187 | QMM1P2618A |
| C187 | QMM1P2617B |
| C187 | QMM1P2668A |
| CV1206 | HMM1CV1206 |
| CV2617 | QMM1SGBSTM |
| CV2625 | FMM1CV2625 |
| CV2625 | FMM1CV2625 |
| CV2630 | QMM1MSLIBF |
| CV2630 | FMM1SGBBVC |
| CV2630 | FMM1SGBBVC |
| CV2630 | QMM1MSLIBA |
| CV2646 | QMM1SGAP7B |
| CV2648 | QMM1SGBP7B |
| CV2663 | QSV102663N |
| CV2663 | QMM1TASADM |
| CV2663 | QMM1TASADM |
| CV2663 | QTD1C2663F |
| CV2667 | QMM1SGASTM |
| CV2668 | QAV102668C |
| CV2674 | FMM1CV2674 |
| CV2674 | FMM1CV2674 |
| CV2680 | QMM1MSLIAF |
| CV2680 | QMM1MSLIAA |
| CV2680 | FMM1SGABVC |
| CV2680 | FMM1SGABVC |
| CV2802 | QMM1P7ATRA |
| CV3640 | SMM123BXXX |
| CV3643 | SMV13643XK |
| CV3643 | SMM1AUXCLG |
| CV3643 | SMM1AUXCLG |
| CV7472 | GMM1VSF1CM |
| CV7473 | GMM1VSF1DM |
| D05 | DMM1000D05 |
| D05 | DMM1000D05 |
| D15 | DMM1000D15 |
| LT2617 | QMM1L2617H |
| LT2668 | QMM1L2668H |
| PT2617A | QMM1P2617A |
| PT2668A | QMM1P2668A |

| | |
|---|---|
| SV3815 | GMM1TRAN2M |
| SV3815 | GMM1TRAN2M |
| SV5237 | EMM1DG2SAC |
| SV5239 | EMM1DG2SAD |
| VSF1C | GMM1VSF1CM |
| VSF1C | GMM1VSF1CM |
| VSF1D | GMM1VSF1DM |
| VSF1D | GMM1VSF1DM |
| X6 | EMM1B6XXXX |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IAC |
| Y22 | DMM1Y22IDC |
| Y22 | DSI100Y22F |
| Y22 | DSI100Y22X |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1Y22AAC |
| Y22 | DMM1000Y22 |
| Y22 | DMM1000Y22 |
| Y22 | DMM1Y22IDC |

# Attachment 5

Super C listing of PSA Fault tree Changes

**Logic Changes:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3Q090 | OR | 3Q092F | 3Q110 | QCV1FW56BN | 3QP7B-BMAN | | DELETED(OLD) |
| 3Q090 | OR | 3Q092F | 3Q110 | QCV1FW56BN | 3QP7B-BMAN | CNTVLVFAILS | INSERT(NEW) |
| CNTVLVFAILS | AND | QHFPWRSHT | HSCV2648 | | | | INSERT(NEW) |

# Attachment 6

Estimation of the Probability that a Hotshort will Close CV-2646 or CV-2648

CV-2646 and CV-2648 are both normally-open solenoid-operated valves (SOVs). The inadvertent closure of either valve will cause the loss of flow from one EFW pump to one Steam Generator. The control power cables for CV-2646 and CV-2648 both run through zone 99-M. The motive power cables for these valves are conservatively assumed to be unaffected by the fire, since loss of its motive power will cause these valves to fail open. The control cable for each valve contains two conductors (F1 and F2). The two conductors form a current loop through the valve controller. The current flow in the loop modulates the valve position. When the current is 4 ma or less, the valve is fully open; when the current is between 4 ma and 20 ma, the valve is partially open; and, when the current is 20 ma, the valve is fully closed.

The fire is assumed to independently affect the cables and, as such, they are treated separately. In addition, it is assumed that one outcome is possible as a net effect of the fire. Given this, there are six possible outcomes of the fire on the conductors of a given valve.

1. [F1 and F2 are not in contact] and [F1 is not grounded (i.e., normally energized) and F2 is not grounded (i.e., normally energized)]. For this case, the fire has no effect on the conductors and the valve remains fully open.
2. [F1 and F2 are not in contact] and [F1 is grounded and F2 is not grounded (i.e., normally energized)]. For this case, the valve closes.
3. [F1 and F2 are not in contact] and [F1 is not grounded and F2 is grounded]. For this case, the valve remains fully open or opens, if closed or partially closed.
4. [F1 and F2 are not in contact] and [F1 is grounded and F2 is grounded]. For this case, the valve remains fully open or opens, if closed or partially closed.
5. [F1 and F2 are in contact] and [F1 is not grounded and F2 is not grounded]. For this case, the valve remains fully open or opens, if closed or partially closed.
6. [F1 and F2 are in contact] and [F1 is grounded and F2 is grounded]. For this case, the valve remains fully open or opens, if closed or partially closed.

Given that the probability associated with each case is not known, it is assumed that each is equally likely. Since only Case 2 results in the valve going closed due to the fire, the probability that the valve will close is estimated to be 1 in 6 (i.e., 0.167). This value is rounded up to 0.25 for conservatism. It is noted that the assumption that only one outcome is possible as a net effect of the fire is conservative, since most states drive the valve to an open state.

# Attachment 7

Recoveries

The following recoveries were used in the original IPEEE analysis:

| | | |
|---|---|---|
| ICWCLGISO | | OPERATOR FAILS TO ISOLATE ICW AFTER AUTO SW ISO. FAILS ON ES; |
| P7AMANREC | | OPERATOR FAILS TO START AND CONTROL P7A MANUALLY WHEN OFFSITE POWER IS AVAIL. |
| QP7BMANREC | | OPERATOR FAILS TO START AND CONTROL P7B MANUALLLY DURING FIRE |
| MANDREC | | OPERATOR FAILS TO OPEN BRKR LOCALLY AT A1 FROM UAT (A212 OR A211) |
| MANEDGREC | | OPERATOR FAILS TO MANUALLY CLOSE BREAKER 152-308 OR 152-408 |
| MANEFWSTRT | | OPERATOR FAILS TO OVERRID FALSE EFW SIGNAL AND MANUALLY OPEN P7B ISO VLVS |
| SGOFREC | | OPERATOR FAILS TO PREVENT SG OVERFILL DUE TO EXCESSIVE MAIN FEEDWATER FLOW |
| SGOFREC2 | | OPERATOR FAILS TO PREVENT SG OVERFILL DUE TO EXCESSIVE EFW |
| SWECPREC | | OPERATOR FAILS TO ALIGN SW PUMPS TO ECP UPON LOSS OF SW SUCTION FLOW |
| QHF1HPITR1 | | OPERATOR FAILS TO THROTTLE HPI TO PREVENT RCS PRESSURE RELIEF |
| QHF1HPITRD | | OPERATOR FAILS TO THROTTLE HPI TO PREVENT SRV LIQUID RELEASE |
| QHF1RCPTRP | | OPERATOR FAILS TO TRIP RCPS ON 30 MINUTES |
| UHF1THPIAD | | OPERATOR FAILS TO ATTEMPT HPI COOLING |

Note that Section 4.6 of Reference 1 listed only some of these recoveries; the others were located in the cutset file associated with zone 99-M.

The following post-initiator recoveries were not used in the original IPEEE model and were set to true in our analysis as well.

| | |
|---|---|
| OPER-13H | OPERS FAIL TO RE-ENERGIZE H1/H2 FROM ST2 GIVEN TRANS EVENT |
| OPER-F1 | OPERATOR FAILS TO CLOSE SW CROSSOVER VALVES TO PREVENT FLOW DIVERSION |
| RHF1B1000X | OPERATOR FAILS TO OPEN CV-1000 |
| OPER-15 | OPER DOES NOT XFER TO D01 BACKUP CHRGR (D03) W/ENERGIZED SRC |
| OPER-16 | OPER DOES NOT XFER TO D02 BACKUP CHRGR (D05) W/ENERGIZED SRC |
| SWEDGMOV | OPERATOR FAILS TO MANUALLY OPEN SW CLG JKT VALVES UPON AN MOV SIGNAL FAILURE |
| AFWFEEDREC | OPERATOR FAILS TO START AND ALIGN AFW PUMP P75 AFTER LOSS OF EFW |
| MANESSTART | OPERATOR FAILS TO START ES UPON ACTUATION AT PROPER SETPOINT. |
| OPER-13 | OPERS FAIL TO RE-ENERGIZE A1/A2 FROM ST2 GIVEN TRANS EVENT |
| RHF1BLOCKD | OPERATOR FAILS TO CLOSE BLOCK VALVE AFTER PRESS. RELIEF |
| SWSWINGREC | OPERATOR FAILS TO START AND ALIGN OP SW PUMP INCLUDING AVAILABLE POWER SOURCE |

As discussed in assumption 8 of the calculation the following post initiator recoveries were credited in our assessment but not in the original IPEEE analysis.

| | |
|---|---|
| XHF1MEDXXX | OPERATOR FAILS TO BEGIN HPR FOLLOWING M-LOCA |
| XHF1SMALLX | OPERATOR FAILS TO BEGIN HPR FOLLOWING S-LOCA |
| QHFPWRSHT | Operator Fails to deenergize CV-2646 and 2648 |

Of the recoveries listed above the following are ex-control room recoveries and were set to true in order to provide the numbers needed for the NRC reviewer.

ICWCLGISO
P7AMANREC
QP7BMANREC
MANDREC
MANEDGREC
QHFPWRSHT

# Attachment 8
HRA Spreadsheet for QHFPWRSHT

Ex-Control Room Model

| | | |
|---|---|---|
| 1. EVENT | QHFPWROFF99m | |
| 2. EVENT IDENTIFICATION | | |
| 2.1 Descriptor | Operator fails to switch power off to CV-2646 and CV-2648 | |
| 2.2 Comment | 1106.006 discussion section | |
| 3. EVENT CATEGORIZATION | | |
| 3.1 Event type | post-initiator recovery | |
| 3.2 Location of action(s) | ex-control room | |
| 3.3 Failure mode | mistake | |
| 4. METHOD USED | SAIC TRC system | |
| 5. INPUT PARAMETERS | | |
| 5.1 Mean response time (min), m1 | no default | 10 |
| 5.2 Additions to response time | default is 0 | 5 |
| 5.3 Model error factor, f1 | generic is 4.3905 | default |
| 5.4 Adjustments to error factor | default is 0 | 1 |
| 5.5 Model uncertainty error factor, fU | generic is 1.68 | default |
| 5.6 Available time (min), t | no default | 36 |
| 6. CALCULATED PARAMETERS | | |
| 6.1 Adjusted mean response time, mean | | 15.0 |
| 6.2 Adjusted error factor, fR | | 6.332 |
| 6.3 Median response time, m | | 14.3 |
| 7. EVENT OCCURENCE PROBABILISTIC ESTIMATES | | |
| 7.1 Mean (explicitly includes associated equipment failures) | | 2.3E-01 |
| 7.2 95th percentile | | 3.6E-01 |
| 7.3 5th percentile | | 1.1E-01 |
| 7.4 Error Factor | | 1.84 |
| 8. ASSOCIATED EQUIPMENT RELIABILITY TREATMENT | | |
| 8.1 Human reliability event mean failure probability | | 2.3E-01 |
| 8.2 Associated equipment reliability limited (1=yes,0=no) | | 1 |
| 8.3 Associated equipment failure probability (see E49) | | |
| 8.4 Combined human and equipment failure probability | | 2.26E-01 |